

## Study regulations of the Master's course

# **Data Science & Intelligent Analytics**

To obtain the academic degree

Master of Science in Engineering,  
abbreviated MSc

as an appendix to the statutes of the  
HOK | University of Applied Sciences Kufstein Tirol

**Organizational form:** full-time & part-time

**Duration:** 4 semesters

**Scope:** 120 ECTS

**Places for beginners per academic year:** 33 full-time  
25 part-time

Version 1

Adopted by the Faculty on June 24, 2026  
Program starts WS 2027/28

## Table of Contents

|          |                                     |           |
|----------|-------------------------------------|-----------|
| <b>1</b> | <b>Occupational Profiles.....</b>   | <b>3</b>  |
| 1.1      | <i>Career opportunities.....</i>    | 3         |
| 1.2      | <i>Qualification profile .....</i>  | 5         |
| <b>2</b> | <b>Curriculum .....</b>             | <b>13</b> |
| 2.1      | <i>Curriculum data .....</i>        | 13        |
| 2.2      | <i>Curriculum matrix.....</i>       | 14        |
| 2.2.1    | Curriculum matrix full-time .....   | 14        |
| 2.2.2    | Curriculum matrix part-time .....   | 17        |
| 2.3      | <i>Modularization.....</i>          | 21        |
| 2.3.1    | Module descriptions full-time ..... | 21        |
| 2.3.2    | Module descriptions part-time ..... | 45        |
| <b>3</b> | <b>Admission requirements.....</b>  | <b>76</b> |

# 1 OCCUPATIONAL PROFILES

## 1.1 Career opportunities

Graduates of the Master's program in Data Science & Intelligent Analytics can generally work in any industry involved in data collection, data storage, data analysis, and data utilization. However, thanks to their broad education, graduates are in particularly high demand as employees and leaders in the following core fields:

- IT in the field of data analysis and utilization
- IT consulting in the field of data analysis and utilization
- Predictive analytics in various fields, including, among others
  - Consumer- and process-oriented data processing in companies
  - Data processing in the field of sensor data (e.g., Internet of Things)
  - Analysis of data in the context of scientific topics
- Preparation and presentation of data and analysis results
- Development of strategic options for data utilization
- Designing data analysis and utilization with regard to ethics, compliance, and legal considerations

Due to the growing importance of data in the age of digitalization and the resulting increase in demand for professionals skilled in collecting, storing, analyzing, and utilizing data, graduates can pursue careers in a wide variety of institutions and types of organizations. These include both large corporations operating nationally and internationally, as well as small and medium-sized enterprises and organizations in the government and NGO sectors.

Key characteristics of these professional fields include:

1. A **deep understanding of the technical foundations, methods, and tools** of data analysis, which can be highly complex.
2. A **high degree of flexibility in applying these methods and tools** in different organizational contexts, achieved through broad-based knowledge in both the technical and applied contexts.

After a training period, graduates of this program are not only capable of performing operational tasks but are also able to assume leadership roles in the areas of data collection, storage, analysis, and utilization. Below are some examples of typical career profiles. These profiles deliberately cover a very broad spectrum to illustrate that graduates of the master's program can establish themselves in very different fields depending on their specialization and prior experience. The master's program itself provides a solid education focused on the activities described throughout the data lifecycle.

In line with common practice in the field of data science and IT-related domains, the job profiles are listed using English job titles.

### **Data Application Developer**

Data Application Developers are proficient in developing data-driven systems, create corresponding toolchains, and understand how they function. The focus here is on practical development work. In their work, these professionals typically build upon predefined software interfaces and concentrate on the data pipeline between the output and input interfaces of the relevant software systems. This allows them to focus on the performance and scalability of these applications. They work primarily at the operational level and are generally not tied to specific application domains. In some cases, however, they may specialize in specific methods or techniques of data analysis.

This job description includes the following tasks:

- Developing data-driven systems
- Developing toolchains
- Developing data-driven components for existing systems
- Developing analysis pipelines based on existing interfaces (APIs)

### **Data Engineer**

Data engineers are experts in software engineering—that is, the design of software—in the field of data-driven systems, and they design architectures for data processing, such as toolchains and storage systems. In doing so, they focus not only on the architecture but also on the scalability of applications for processing large volumes of data. The focus of their work is on implementing methods and techniques for the holistic integration of data and its use within the system landscape. In doing so, these professionals work primarily at the operational level and often independently of a specific subject matter domain. However, they may specialize in certain methods or techniques of data analysis.

This job description includes the following tasks:

- Designing strategies for data integration within an organization
- Designing strategies for implementing data analysis in systems
- Designing scalable analytics systems and system landscapes
- Supporting data-driven applications in the areas of requirements management (change control) and operations

### **Big Data & Business Intelligence Consultant**

Big Data & Business Intelligence Consultants provide consulting services that focus specifically on the collection, storage, analysis, and/or use of data. These professionals typically operate at the middle and upper (strategic) management levels. They possess extensive knowledge of tools and methods, as well as a solid understanding of common data science practices.

This job description includes the following responsibilities:

- Advising clients on the design of data-driven strategies
- Supporting clients in the implementation of data-driven strategies
- Advising clients on the purchase of new systems
- Advising clients on the development of data-driven business models
- Conducting an initial analysis in the form of a "Data Value Check"

### **Senior Data Scientist**

Senior Data Scientists work within a company on tasks related to data analysis, business intelligence, and data-driven applications, including, among other things, the collection, storage, analysis, and/or use of data. In this role, these individuals have a strong connection to the specific application domain in which they operate. As a result, they achieve a higher level of technical expertise in their work than, for example, traditional data application developers or data engineers. Their core responsibilities lie at the operational and management levels. They also prepare data-related decisions for strategic-level decision-makers. In this context, these professionals possess a very broad range of knowledge in the field of data-driven applications. Additionally, they serve as technology scouts in the field of data-driven applications, thereby driving the topic forward within their company.

This job description includes the following responsibilities:

- Prepare strategic decisions and develop strategic options
- Developing data-driven business models with a focus on the application domain
- Analyze company data for various departments
- Advise business units on how to handle data
- Conduct technology and methodology scouting
- Advise business units on the compliance of products and projects, including with regard to data protection

### **Data Science Team Manager**

Managers of data science teams coordinate company-wide projects or organizational units focused on the collection, storage, analysis, and/or use of data. Their daily work centers on combining technical expertise in data science with management and leadership skills. In this role, they primarily work at the management and strategic levels and often serve as the interface with other departments. Some of the tasks require skills that can be developed after appropriate training.

This job description includes the following responsibilities:

- Perform management tasks in the execution of data-driven projects
- Performing management tasks in the operation of data-driven products
- Leading employees within the context of specialized teams
- Designing the strategic use of data analysis
- Hiring professionals in the field of data science
- Serve as the liaison to other departments
- Conduct effort estimates for project resources
- Assess the compliance of products/projects, including with regard to data protection

## **1.2 Qualification profile**

The qualification objectives and learning outcomes of the master's program [Topic] align with both academic and professional requirements and correspond to ISCED level 0688 (International Standard Classification of Education). The curriculum equips graduates for the professional fields described in previous chapters.

The intended learning outcomes include the ability to develop and implement data-driven products and solutions. This is achieved through a practice-oriented education with a focus on data collection and storage, data analysis, data utilization, and the fundamentals of business administration.

As part of the program, students acquire competencies across the entire data lifecycle, from data collection to data utilization (see **Fehler! Verweisquelle konnte nicht gefunden werden.** ). Phases A through E of the lifecycle represent the actual processing phases in their typical sequence and are supported by the cross-functional phases F and G.

The modules of the Data Science & Intelligent Analytics master's program focus on developing competencies across the entire data lifecycle. The following table illustrates the relationship between the job profile, the key competencies required for it, and the corresponding modules. In this context, various modules—some of which overlap—develop the necessary competencies across the data lifecycle.

| Professional Field Title | Task                                        | Competency Description                                                                                                                                                                                  | Competency Mapping                | Curriculum Modules                             |
|--------------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------------------------------------------------|
| Big Data & BI Consultant | Advise clients in the field of data science | Students have gained initial practical experience with the platforms presented.                                                                                                                         | Technical/Scientific Competencies | WPF - Elective Course                          |
|                          |                                             | Students are familiar with basic concepts and methods from the fields of Systematic Innovative Thinking, Systemic Management, and Innovation Management.                                                | Technical/Scientific Competence   | MDS - Management for Data Science              |
|                          |                                             | Students understand how basic algorithms in the field of data science work.                                                                                                                             | Technical/Scientific Competence   | MLAL - Machine Learning & Algorithms           |
|                          |                                             | Students understand how advanced algorithms in the field of data science work.                                                                                                                          | Technical/Scientific Competence   | MLAL - Machine Learning & Algorithms           |
|                          |                                             | Students are familiar with the common tools used in software development within the field of data science.                                                                                              | Technical/Scientific Competence   | SDDE - Software Development & Data Engineering |
|                          |                                             | Students are familiar with the fundamental concepts of software development (e.g., object-oriented programming, functional programming, etc.) that are frequently applied in the field of data science. | Technical/Scientific Competence   | SDDE - Software Development & Data Engineering |
|                          |                                             | Students are familiar with the data structures, runtime characteristics, and complexity classes required by the algorithms covered.                                                                     | Technical/Scientific Competence   | MLAL - Machine Learning & Algorithms           |
|                          |                                             | Students have a basic understanding of data visualization and visual communication.                                                                                                                     | Technical/Scientific Competence   | WPF - Elective Course                          |
|                          |                                             | Students are familiar with various strategies for implementing artificial intelligence systems.                                                                                                         | Technical/Scientific Competence   | DPR - Data Processing                          |
|                          |                                             | Students are familiar with various application-oriented analysis platforms.                                                                                                                             | Technical/Scientific Competence   | WPF - Elective Course                          |
|                          |                                             | Students are familiar with advanced ethical and legal requirements for data processing.                                                                                                                 | Personal/Social Competence        | ETHR - Ethics & Law                            |
|                          |                                             | Students are familiar with advanced concepts in software development (e.g., pipelines, testing, etc.) that are frequently applied in the field of data science.                                         | Technical/Scientific Competence   | SDDE - Software Development & Data Engineering |
|                          |                                             | Students are familiar with advanced methods and tools for project management and the management of data-driven products.                                                                                | Personal/Social Competence        | MDS - Management for Data Science              |
|                          |                                             | Students are familiar with tools (e.g., libraries, cloud platforms, or software tools) that can be used to support machine learning.                                                                    | Technical/Scientific Competence   | MLAL - Machine Learning & Algorithms           |
|                          |                                             | Students are able to work with various visualization tools and libraries to present data and analysis results in a meaningful way.                                                                      | Technical/Scientific Competence   | WPF - Elective Course                          |
|                          |                                             | Students can apply the algorithms covered in isolated problem scenarios.                                                                                                                                | Technical/Scientific Competence   | SDDE - Software Development & Data Engineering |
|                          |                                             | Students can compare the project management methods and tools covered in terms of their suitability for specific projects.                                                                              | Personal/Social Competence        | MDS - Management for Data Science              |
|                          |                                             | Students can compare the tools they have developed in terms of their suitability for specific problems.                                                                                                 | Technical/Scientific Competence   | MLAL - Machine Learning & Algorithms           |
|                          |                                             | Students can independently apply the tools they have developed in the context of a specific project.                                                                                                    | Technical/Scientific Competence   | MLAL - Machine Learning & Algorithms           |
|                          |                                             | Students can compare the analysis platforms they have learned about in terms of their suitability for a specific use case.                                                                              | Technical/Scientific Competence   | WPF - Elective Course                          |
|                          |                                             | Students can apply project management methods and tools in projects.                                                                                                                                    | Personal/Social Competence        | MDS - Management for Data Science              |
|                          |                                             | Students can apply these advanced requirements to data-driven projects.                                                                                                                                 | Technical/Scientific Competence   | ETHR - Ethics & Law                            |
|                          |                                             | Students can structure and manage a data-centric project.                                                                                                                                               | Technical/Scientific Competence   | MDS - Management for Data Science              |
|                          |                                             | Students can design end-to-end machine learning projects.                                                                                                                                               | Technical/Scientific Competence   | MLAL - Machine Learning & Algorithms           |
|                          |                                             | Students can independently carry out end-to-end machine learning projects.                                                                                                                              | Technical/Scientific Competence   | MLAL - Machine Learning & Algorithms           |
|                          |                                             | Students are able to independently develop and apply appropriate solutions to specific problems.                                                                                                        | Personal/Social Skills            | DPR - Data Processing                          |
|                          |                                             | Students can configure basic data science algorithms for                                                                                                                                                | Technical                         | SDDE - Software                                |

| Professional Field Title       | Task                        | Competency Description                                                                                                                                                                                  | Competency Mapping              | Curriculum Modules                             |
|--------------------------------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|------------------------------------------------|
|                                |                             | specific purposes.                                                                                                                                                                                      | cal/Scientific Competence       | Development & Data Engineering                 |
|                                |                             | Students can apply basic data science algorithms in practice.                                                                                                                                           | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                                |                             | Students can develop basic application concepts and translate them into an implementable form.                                                                                                          | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                                |                             | Students can independently implement basic application concepts.                                                                                                                                        | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                                |                             | Students can design basic applications to automate fundamental functionalities.                                                                                                                         | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                                |                             | Students can independently develop visualizations and use them for communication purposes.                                                                                                              | Technical/Scientific Competence | WPF - Elective Course                          |
|                                |                             | Students can develop strategies for designing artificial intelligence systems for practical application.                                                                                                | Technical/Scientific Competence | DPR - Data Processing                          |
|                                |                             | Students can configure advanced data science algorithms for specific applications.                                                                                                                      | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                                |                             | Students can gain a practical understanding of advanced data science algorithms.                                                                                                                        | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                                |                             | Students can develop advanced application concepts and translate them into an implementable form.                                                                                                       | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                                |                             | Students can independently implement advanced application concepts.                                                                                                                                     | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                                |                             | Students can design advanced applications to automate basic functionalities.                                                                                                                            | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                                |                             | Students are able to apply specific creative techniques to generate innovations.                                                                                                                        | Technical/Scientific Competence | MDS - Management for Data Science              |
|                                |                             | Students are able to analyze the use of large amounts of data and strategies for utilizing it within the context of ethical and legal frameworks, and to develop approaches based on this analysis.     | Technical/Scientific Competence | ETHR - Ethics & Law                            |
|                                |                             | Students are able to select appropriate algorithms for given problems.                                                                                                                                  | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                                |                             | Students are familiar with applying the concepts they have learned in commonly used software development environments in the field of data analysis (e.g., Python, MATLAB, or R).                       | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                                |                             | Students understand the statistical concepts and methodologies behind the algorithms covered.                                                                                                           | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                                |                             | Students understand the advantages and disadvantages of the strategies developed and are aware of the challenges they present.                                                                          | Technical/Scientific Competence | DPR - Data Processing                          |
| Big Data Application Developer | Develop data-driven systems | Students have gained initial practical experience with the platforms presented.                                                                                                                         | Technical/Scientific Competence | WPF - Elective Course                          |
|                                |                             | Students are familiar with the specific challenges that arise when storing and processing large volumes of data (V-Model: Volume, Variety, Velocity, Veracity).                                         | Technical/Scientific Competence | DPR - Data Processing                          |
|                                |                             | Students understand how basic algorithms in the field of data science work.                                                                                                                             | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                                |                             | Students are familiar with the common tools used in software development within the field of data science.                                                                                              | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                                |                             | Students are familiar with the fundamental concepts of software development (e.g., object-oriented programming, functional programming, etc.) that are frequently applied in the field of data science. | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                                |                             | Students are familiar with the data structures, runtime characteristics, and complexity classes required by the algorithms covered.                                                                     | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                                |                             | Students are familiar with the data structures, runtime characteristics, and complexity classes required by the algorithms covered.                                                                     | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                                |                             | Students have a basic understanding of data visualization and                                                                                                                                           | Technical/Scientific Competence | WPF - Elective                                 |

| Professional Field Title | Task | Competency Description                                                                                                                                                                                        | Competency Mapping              | Curriculum Modules                             |
|--------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|------------------------------------------------|
|                          |      | visual communication.                                                                                                                                                                                         | cal/Scientific Competence       | Course                                         |
|                          |      | Students learn about ways to address these challenges (systems from the respective areas of the V-model are discussed as examples).                                                                           | Technical/Scientific Competence | DPR - Data Processing                          |
|                          |      | Students are familiar with various strategies for implementing artificial intelligence systems.                                                                                                               | Technical/Scientific Competence | DPR - Data Processing                          |
|                          |      | Students are familiar with various application-oriented analysis platforms.                                                                                                                                   | Technical/Scientific Competence | WPF - Elective Course                          |
|                          |      | Students are familiar with various advanced data storage concepts (e.g., NoSQL databases, distributed databases, etc.).                                                                                       | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students are familiar with advanced ethical and legal requirements for data processing.                                                                                                                       | Personal/Social Competence      | ETHR - Ethics & Law                            |
|                          |      | Students are familiar with advanced concepts in software development (e.g., pipelines, testing, etc.) that are frequently applied in the field of data science.                                               | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students are familiar with tools (e.g., libraries, cloud platforms, or software tools) that can be used to support machine learning.                                                                          | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |      | Students are able to work with various visualization tools and libraries to present data and analysis results in a meaningful way.                                                                            | Technical/Scientific Competence | WPF - Elective Course                          |
|                          |      | Students can compare and select data storage concepts based on their suitability for projects.                                                                                                                | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students can apply the algorithms covered in isolated problem scenarios.                                                                                                                                      | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students can compare the tools they have developed in terms of their suitability for specific problems.                                                                                                       | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |      | Students can compare the analysis platforms they have learned about in terms of their suitability for a specific use case.                                                                                    | Technical/Scientific Competence | WPF - Elective Course                          |
|                          |      | Students can apply these advanced requirements to data-driven projects.                                                                                                                                       | Technical/Scientific Competence | ETHR - Ethics & Law                            |
|                          |      | Students can carry out end-to-end machine learning projects.                                                                                                                                                  | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |      | Students can design end-to-end machine learning projects.                                                                                                                                                     | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |      | Students can independently carry out end-to-end machine learning projects.                                                                                                                                    | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |      | Students can configure basic data science algorithms for specific applications.                                                                                                                               | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students can apply basic data science algorithms in practice.                                                                                                                                                 | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students can design basic applications to automate fundamental functions.                                                                                                                                     | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students can independently implement storage concepts in the context of a specific problem.                                                                                                                   | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students can independently develop visualizations and use them for communication purposes.                                                                                                                    | Technical/Scientific Competence | WPF - Elective Course                          |
|                          |      | Students can configure advanced data science algorithms for specific applications.                                                                                                                            | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |      | Students can gain a practical understanding of advanced data science algorithms.                                                                                                                              | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |      | Students can design advanced applications to automate basic functionalities.                                                                                                                                  | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students are able to analyze the use of large amounts of data and data utilization strategies within the context of ethical and legal frameworks and, based on this analysis, develop appropriate approaches. | Technical/Scientific Competence | ETHR - Ethics & Law                            |
|                          |      | Students are able to select appropriate algorithms for given                                                                                                                                                  | Techni-                         | MLAL - Machine                                 |

| Professional Field Title | Task                                                | Competency Description                                                                                                                                                                                  | Competency Mapping              | Curriculum Modules                             |
|--------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|------------------------------------------------|
|                          |                                                     | problems.                                                                                                                                                                                               | cal/Scientific Competence       | Learning & Algorithms                          |
|                          |                                                     | Students are able to select appropriate algorithms for given problems.                                                                                                                                  | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |                                                     | Students are familiar with applying the concepts they have learned in commonly used software development environments in the field of data analysis (e.g., Python, MATLAB, or R).                       | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |                                                     | Students are also able to design the implementation of these systems with an eye toward scalability and operational requirements.                                                                       | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |                                                     | Students understand the specific requirements for data storage that arise from the use of very large amounts of data (big data).                                                                        | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |                                                     | Students understand the statistical concepts and methodologies behind the algorithms covered.                                                                                                           | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |                                                     |                                                                                                                                                                                                         |                                 |                                                |
| Data Engineer            | Develop data models and integration strategies      | Students are familiar with the specific challenges that arise when storing and processing large amounts of data (V-model: Volume, Variety, Velocity, Veracity).                                         | Technical/Scientific Competence | DPR - Data Processing                          |
|                          |                                                     | Students are familiar with ways to address these challenges (, and systems from the respective areas of the V-Model are discussed as examples).                                                         | Technical/Scientific Competence | DPR - Data Processing                          |
|                          |                                                     | Students are familiar with various advanced data storage concepts (e.g., NoSQL databases, distributed databases, etc.).                                                                                 | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |                                                     | Students are familiar with advanced ethical and legal requirements for data processing.                                                                                                                 | Personal/Social Competence      | ETHR - Ethics & Law                            |
|                          |                                                     | Students can compare and select data storage concepts based on their suitability for projects.                                                                                                          | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |                                                     | Students can independently implement storage concepts in the context of a specific problem.                                                                                                             | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |                                                     | Students are able to analyze the use of large amounts of data and data utilization strategies based on these ethical and legal frameworks and, building on this, develop approaches.                    | Technical/Scientific Competence | ETHR - Ethics & Law                            |
|                          |                                                     | Students are also able to design the implementation of these systems with an eye toward scalability and operational requirements.                                                                       | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |                                                     | Students understand the specific requirements for data storage that arise from the use of very large amounts of data (big data).                                                                        | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |                                                     |                                                                                                                                                                                                         |                                 |                                                |
| Data Scientist           | Addresses data-driven challenges within the company | Students have gained initial hands-on experience with the platforms presented.                                                                                                                          | Technical/Scientific Competence | WPF - Elective Course                          |
|                          |                                                     | Students are familiar with the specific challenges that arise when storing and processing large volumes of data (V-model: Volume, Variety, Velocity, Veracity).                                         | Technical/Scientific Competence | DPR - Data Processing                          |
|                          |                                                     | Students understand how basic algorithms in the field of data science work.                                                                                                                             | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |                                                     | Students understand how advanced algorithms in the field of data science work.                                                                                                                          | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |                                                     | Students are familiar with the common tools used in software development within the field of data science.                                                                                              | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |                                                     | Students are familiar with the fundamental concepts of software development (e.g., object-oriented programming, functional programming, etc.) that are frequently applied in the field of data science. | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |                                                     | Students are familiar with the data structures, runtime characteristics, and complexity classes required by the algorithms covered.                                                                     | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |                                                     | Students are familiar with the data structures, runtime characteristics, and complexity classes required by the algorithms covered.                                                                     | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |                                                     | Students have a basic understanding of data visualization and visual communication.                                                                                                                     | Technical/Scientific Competence | WPF - Elective Course                          |
|                          |                                                     | Students are familiar with ways to address these challenges (systems from the respective areas of the V-model are discussed as examples).                                                               | Technical/Scientific Competence | DPR - Data Processing                          |
|                          |                                                     | Students are familiar with various strategies for implementing artificial intelligence systems.                                                                                                         | Technical/Scientific Competence | DPR - Data Processing                          |

| Professional Field Title | Task | Competency Description                                                                                                                                          | Competency Mapping              | Curriculum Modules                             |
|--------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|------------------------------------------------|
|                          |      | Students are familiar with various application-oriented analysis platforms.                                                                                     | Technical/Scientific Competence | WPF - Elective Course                          |
|                          |      | Students are familiar with various advanced data storage concepts (e.g., NoSQL databases, distributed databases, etc.).                                         | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students are familiar with advanced ethical and legal requirements for data processing.                                                                         | Personal/Social Competence      | ETHR - Ethics & Law                            |
|                          |      | Students are familiar with advanced concepts in software development (e.g., pipelines, testing, etc.) that are frequently applied in the field of data science. | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students are familiar with tools (e.g., libraries, cloud platforms, or software tools) that can be used to support machine learning.                            | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |      | Students are able to work with various visualization tools and libraries to present data and analysis results in a meaningful way.                              | Technical/Scientific Competence | WPF - Elective Course                          |
|                          |      | Students can compare and select data storage concepts based on their suitability for projects.                                                                  | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students can apply the algorithms covered in isolated problem scenarios.                                                                                        | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |      | Students can apply the algorithms covered to isolated problems.                                                                                                 | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students can compare the tools they have developed in terms of their suitability for specific problems.                                                         | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |      | Students can independently apply the tools they have developed in the context of a specific project.                                                            | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |      | Students can compare the analysis platforms they have learned about in terms of their suitability for a specific use case.                                      | Technical/Scientific Competence | WPF - Elective Course                          |
|                          |      | Students can apply these advanced requirements to data-driven projects.                                                                                         | Technical/Scientific Competence | ETHR - Ethics & Law                            |
|                          |      | Students can carry out end-to-end machine learning projects.                                                                                                    | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |      | Students can design end-to-end machine learning projects.                                                                                                       | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |      | Students can independently carry out end-to-end machine learning projects                                                                                       | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |      | Students can independently develop and implement appropriate solutions for specific problems.                                                                   | Personal/Social Competence      | DPR - Data Processing                          |
|                          |      | Students can configure basic data science algorithms for specific applications.                                                                                 | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students can apply basic data science algorithms in practice.                                                                                                   | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students can develop basic application concepts and translate them into an implementable form.                                                                  | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students can independently implement basic application concepts.                                                                                                | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students can design basic applications to automate fundamental functionalities.                                                                                 | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students can independently implement storage concepts in the context of a specific problem.                                                                     | Technical/Scientific Competence | SDDE - Software Development & Data Engineering |
|                          |      | Students can independently develop visualizations and use them for communication purposes.                                                                      | Technical/Scientific Competence | WPF - Elective Course                          |
|                          |      | Students can develop strategies for designing artificial intelligence systems for practical application.                                                        | Technical/Scientific Competence | DPR - Data Processing                          |
|                          |      | Students can configure advanced data science algorithms for specific applications.                                                                              | Technical/Scientific Competence | MLAL - Machine Learning & Algorithms           |
|                          |      | Students can gain a practical understanding of advanced data science algorithms.                                                                                | Technical/Scientific            | MLAL - Machine Learning & Algo-                |

| Professional Field Title       | Task                 | Competency Description                                                                                                                                                                      | Competency Mapping                            | Curriculum Modules                                       |
|--------------------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|----------------------------------------------------------|
|                                |                      | Students can develop advanced application concepts and translate them into an implementable form.                                                                                           | Competence<br>Technical/Scientific Competence | rithms<br>SDDE - Software Development & Data Engineering |
|                                |                      | Students can independently implement advanced application concepts.                                                                                                                         | Technical/Scientific Competence               | SDDE - Software Development & Data Engineering           |
|                                |                      | Students can design advanced applications to automate basic functionalities.                                                                                                                | Technical/Scientific Competence               | SDDE - Software Development & Data Engineering           |
|                                |                      | Students are able to analyze the use of large amounts of data and data utilization strategies based on these ethical and legal frameworks and, building on this, develop approaches.        | Technical/Scientific Competence               | ETHR - Ethics & Law                                      |
|                                |                      | Students are able to select appropriate algorithms for given problems.                                                                                                                      | Technical/Scientific Competence               | MLAL - Machine Learning & Algorithms                     |
|                                |                      | Students are able to select appropriate algorithms for given problems.                                                                                                                      | Technical/Scientific Competence               | MLAL - Machine Learning & Algorithms                     |
|                                |                      | Students are familiar with applying the concepts they have learned in commonly used software development environments in the field of data analysis (e.g., Python, MATLAB, or R).           | Technical/Scientific Expertise                | SDDE - Software Development & Data Engineering           |
|                                |                      | Students are familiar with applying the concepts they have learned in commonly used software development environments in the field of data analysis (e.g., Python, MATLAB, or R).           | Technical/Scientific Competence               | SDDE - Software Development & Data Engineering           |
|                                |                      | Students are also able to design the implementation of these systems with an eye toward scalability and operational requirements.                                                           | Technical/Scientific Competence               | SDDE - Software Development & Data Engineering           |
|                                |                      | Students understand the specific requirements for data storage that arise from the use of very large amounts of data (big data).                                                            | Technical/Scientific Competence               | SDDE - Software Development & Data Engineering           |
|                                |                      | Students understand the statistical concepts and methodologies underlying the algorithms covered.                                                                                           | Technical/Scientific Competence               | MLAL - Machine Learning & Algorithms                     |
|                                |                      | Students understand the statistical concepts and methods underlying the algorithms covered.                                                                                                 | Technical/Scientific Competence               | MLAL - Machine Learning & Algorithms                     |
|                                |                      | Students understand the advantages and disadvantages of the strategies developed and are aware of the challenges they present.                                                              | Technical/Scientific Competence               | DPR - Data Processing                                    |
| Managers of Data Science Teams | Lead Data Scientists | Students are familiar with current practical issues in the field of data science.                                                                                                           | Technical/Scientific Competence               | WPF - Elective Course                                    |
|                                |                      | Students are familiar with current technological developments in the field of data science.                                                                                                 | Technical/Scientific Competence               | WPF - Elective Required Course                           |
|                                |                      | Students are familiar with current thematic trends in the field of data science.                                                                                                            | Technical/Scientific Competence               | WPF - Elective Required Course                           |
|                                |                      | Students are familiar with basic concepts and methods in the fields of Systematic Innovative Thinking, Systemic Management, and Innovation Management.                                      | Technical/Scientific Competence               | MDS - Management for Data Science                        |
|                                |                      | Students are familiar with the relevant academic discourse in the respective foreign country.                                                                                               | Personal/Social Competence                    | MDS - Management for Data Science                        |
|                                |                      | Students are familiar with the cultural factors influencing the field of data science in the relevant foreign country.                                                                      | Personal/Social Competence                    | MDS - Management for Data Science                        |
|                                |                      | Students are familiar with the principles governing scientific work.                                                                                                                        | Technical/Scientific Competence               | MWA - Master's Thesis & Scientific Work                  |
|                                |                      | Students are familiar with the basic applications of data collection, data storage, data analysis, and data utilization in the context of business management applications.                 | Technical/Scientific Competence               | MDS - Management for Data Science                        |
|                                |                      | Students are familiar with the fundamental applications of data collection, data storage, data analysis, and data utilization in the context of natural science and technical applications. | Technical/Scientific Competence               | MDS - Management for Data Science                        |
|                                |                      | Students are familiar with advanced ethical and legal requirements for data processing.                                                                                                     | Personal/Social Competence                    | ETHR - Ethics & Law                                      |
|                                |                      | Students are familiar with advanced methods and tools for project management and the management of data-driven products.                                                                    | Personal/Social Skills                        | MDS - Management for Data Science                        |
|                                |                      | Students can compare the project management methods and tools covered in terms of their suitability for specific projects.                                                                  | Personal/Social Competence                    | MDS - Management for Data Science                        |
|                                |                      | Students can apply project management methods and tools in                                                                                                                                  | Personal/Social                               | MDS - Manage-                                            |

| Professional Field Title | Task | Competency Description                                                                                                                                                                              | Competency Mapping               | Curriculum Modules                        |
|--------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------------------------------------|
|                          |      | projects.                                                                                                                                                                                           | Competence                       | ment for Data Science                     |
|                          |      | Students can apply these rules to a specific project.                                                                                                                                               | Technical/Scientific Competence  | MWA - Master's Thesis & Academic Writing  |
|                          |      | Students can structure and manage a data-centric project.                                                                                                                                           | Technical/Scientific Competence  | MDS - Management for Data Science         |
|                          |      | Students can write a research proposal and align the problem statement, research question, and methodological approach.                                                                             | Technical/Academic Competence    | MWA - Master's Thesis & Academic Writing  |
|                          |      | Students can apply the knowledge they have gained in the first two semesters to a data-centered project.                                                                                            | Technical/Scientific Competence  | MDS - Management for Data Science         |
|                          |      | Students are able to independently design and carry out a research project.                                                                                                                         | Technical/Scientific Competence  | MWA - Master's Thesis & Academic Writing  |
|                          |      | Students can independently write a master's thesis in the field of data science.                                                                                                                    | Technical/Scientific Competence  | MWA - Master's Thesis & Academic Research |
|                          |      | Students can critically evaluate scientific findings.                                                                                                                                               | Technical/Scientific Competence  | MWA - Master's Thesis & Academic Writing  |
|                          |      | Students are able to apply specific creative techniques to generate innovations.                                                                                                                    | Technical/Academic Competence    | MDS - Management for Data Science         |
|                          |      | Students are able to analyze the use of large amounts of data and strategies for utilizing it within the context of ethical and legal frameworks, and to develop approaches based on this analysis. | Technical/Academic Competence    | ETHR - Ethics & Law                       |
|                          |      | Students are also able to independently design and implement data-driven applications in this field, taking domain-specific requirements into account.                                              | Technical/Scientific Competence  | MDS - Management for Data Science         |
|                          |      | Students understand the specific challenges of this field of application and are familiar with established best-practice methods in this area.                                                      | Professional/Academic Competence | MDS - Management for Data Science         |
|                          |      | Students understand how various factors and discourse influence the discipline of data science in the relevant foreign country.                                                                     | Personal/Social Competence       | MDS - Management for Data Science         |
|                          |      | Students also know how to present findings to an academic community.                                                                                                                                | Personal/Social Competence       | MWA - Master's Thesis & Academic Writing  |
|                          |      | Students know how to conduct academic reviews.                                                                                                                                                      | Technical/Scientific Competence  | MWA - Master's Thesis & Academic Writing  |

## 2 CURRICULUM

### 2.1 Curriculum data

|                                                                              | FT                  | PT                  | Comments (if any)                                                                                                            |
|------------------------------------------------------------------------------|---------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>First Year of Study</b><br>(YYYY/MM <sub>+1</sub> )                       | 2027/28             | 2027/28             |                                                                                                                              |
| <b>Standard duration of study</b><br>(Number of semesters)                   | 4                   | 4                   |                                                                                                                              |
| <b>SWS</b><br>(Total for all semesters)                                      | 48.5                | 48.5                |                                                                                                                              |
| <b>ASWS</b><br>(Total for all semesters)                                     | 54.5                | 56                  |                                                                                                                              |
| <b>ECTS</b><br>(Total for all semesters)                                     | 120                 | 120                 |                                                                                                                              |
| <b>Winter Semester Start</b><br>(Date, Note: possibly calendar week)         | Calendar Week<br>40 | Calendar Week<br>40 |                                                                                                                              |
| <b>Winter Semester End</b><br>(Date, Note: possibly calendar week)           | Calendar Week<br>5  | Week 5              |                                                                                                                              |
| <b>Start of summer semester</b><br>(Date, Note: possibly calendar week)      | Week 11             | Week 11             |                                                                                                                              |
| <b>Summer semester end</b><br>(Date, Note: possibly calendar week)           | Calendar Week<br>28 | Week 28             |                                                                                                                              |
| <b>Winter Semester Weeks</b>                                                 | 15                  | 15                  |                                                                                                                              |
| <b>SS Weeks</b>                                                              | 15                  | 15                  |                                                                                                                              |
| <b>Mandatory semester abroad</b><br>(Semester Specification)                 | No                  | No                  |                                                                                                                              |
| <b>Language of Instruction</b><br>(Specify)                                  | English             | German              | The percentage of English-language specialized courses in the pt format accounts for 35,35 % of the total weekly class hours |
| <b>Professional internship</b><br>(Semester, duration in weeks per semester) | No                  | No                  |                                                                                                                              |

## 2.2 Curriculum matrix

The following list of courses does not include the workload associated with supervising master's theses. For each thesis supervised, 0.6 SWS is allocated; that is, with 25 accredited study places in the full-time program, this results in an additional ASWS workload of 15 ASWS, bringing the total ASWS workload to 69.5 ASWS over all 4 semesters, including Master's thesis supervision. For the part-time program format, an additional ASWS workload of 19.8 is incurred, resulting in a total ASWS workload of 75.8 ASWS over all 4 semesters, including master's thesis supervision.

In the part-time program, the courses "Scientific Work" in the third semester and "Business Ethics, Compliance & Law" in the fourth semester are offered jointly with the AI Systems Engineering program. This results in a group size of 0.5 for these " " courses. By combining these groups, a reduction of 1.5 ASWS per program is achieved.

The 22 ECTS credits for the master's thesis are divided into 20 ECTS credits for the thesis itself and 2 ECTS credits for the final examination before a committee.

### 2.2.1 Curriculum matrix full-time

#### 1. Semester

| Course no.                              | Course title                          | LV-Typ | T | E | WSH | No. of groups | ASWS | ALVS | MODUL | ECTS |
|-----------------------------------------|---------------------------------------|--------|---|---|-----|---------------|------|------|-------|------|
| MDS.1                                   | Leadership, Team & Project Management | ILV    |   | X | 1   | 1             | 1    | 15   | MDS   | 2    |
| MDS.2                                   | Systemic Innovation                   | ILV    |   | X | 1   | 1             | 1    | 15   | MDS   | 2    |
| MLAL.1                                  | Statistical Learning 1                | ILV    | X | X | 3   | 1             | 3    | 45   | MLAL  | 6    |
| MLAL.2                                  | Statistical Learning Lab 1            | UE     | X | X | 1   | 1             | 1    | 15   | MLAL  | 2.5  |
| SDDE.1                                  | Data Engineering                      | ILV    | X | X | 2   | 1             | 2    | 30   | SDDE  | 4    |
| SDDE.2                                  | Software Development 1                | ILV    | X | X | 3   | 1             | 3    | 45   | SDDE  | 6    |
| SDDE.3                                  | Data Engineering Lab                  | UE     | X | X | 2   | 1             | 2    | 30   | SDDE  | 5    |
| SDDE.4                                  | Software Development Lab 1            | UE     | X | X | 1   | 2             | 2    | 30   | SDDE  | 2.5  |
| Total line:                             |                                       |        |   |   | 14  |               | 15   | 225  |       | 30.0 |
| Course hours = Total WSH x course weeks |                                       |        |   |   | 210 |               |      |      |       |      |

## 2. Semester

| Course no.                              | Course title                     | LV-Typ | T | E | WSH | No. of groups | ASWS | ALVS | MODUL | ECTS |
|-----------------------------------------|----------------------------------|--------|---|---|-----|---------------|------|------|-------|------|
| MDS.3                                   | Study Trip                       | ILV    |   | X | 2   | 1             | 2    | 30   | MDS   | 3    |
| MLAL.3                                  | Machine Learning & Deep Learning | ILV    | X | X | 5   | 1             | 5    | 75   | MLAL  | 10   |
| MLAL.5                                  | Statistical Learning 2           | ILV    | X | X | 3   | 1             | 3    | 45   | MLAL  | 6    |
| MLAL.6                                  | Statistical Learning Lab 2       | UE     | X | X | 1   | 1             | 1    | 15   | MLAL  | 2.5  |
| SDDE.5                                  | Software Development 2           | ILV    | X | X | 3   | 1             | 3    | 45   | SDDE  | 6    |
| SDDE.6                                  | Software Development Lab 2       | UE     | X | X | 1   | 1             | 1    | 15   | SDDE  | 2.5  |
| Total line:                             |                                  |        |   |   | 15  |               | 15   | 225  |       | 30.0 |
| Course hours = Total WSH x course weeks |                                  |        |   |   | 225 |               |      |      |       |      |

## 3. Semester

| Course no.                              | Course title                                    | LV-Typ | T | E | WSH   | No. of groups | ASWS | ALVS  | MODUL | ECTS |
|-----------------------------------------|-------------------------------------------------|--------|---|---|-------|---------------|------|-------|-------|------|
| DPR.1                                   | Big Data Processing                             | ILV    | X | X | 2     | 1             | 2    | 30    | DPR   | 4    |
| DPR.2                                   | No-Code & Low-Code Analysis Platforms           | ILV    | X | X | 2     | 1             | 2    | 30    | DPR   | 4    |
| DPR.3                                   | Data Visualization & Visual Analytics           | ILV    |   | X | 2     | 1             | 2    | 30    | DPR   | 4    |
| DPR.4                                   | Artificial Intelligence                         | ILV    | X | X | 2.5   | 1             | 2.5  | 37.5  | DPR   | 4    |
| MDS.4                                   | Integrated Application Project                  | PT     | X | X | 2     | 3             | 6    | 90    | MDS   | 4    |
| MDS.5                                   | Data Science for Business & Commerce            | ILV    |   | X | 2     | 1             | 2    | 30    | MDS   | 4    |
| MDS.6                                   | Data Science for Engineering & Natural Sciences | ILV    |   | X | 2     | 1             | 2    | 30    | MDS   | 4    |
| MWA.1                                   | Research Methods & Methodology                  | SE     |   | X | 1     | 1             | 1    | 15    | MWA   | 2    |
| Total line:                             |                                                 |        |   |   | 15.5  |               | 19.5 | 292.5 |       | 30   |
| Course hours = Total WSH x course weeks |                                                 |        |   |   | 232.5 |               |      |       |       |      |

#### 4. Semester

| Course no.                              | Course title                           | LV-Typ | T | E | WSH | No. of groups | ASWS | ALVS | MODUL | ECTS |
|-----------------------------------------|----------------------------------------|--------|---|---|-----|---------------|------|------|-------|------|
| DPR.5                                   | Trends in Data Science                 | ILV    |   | X | 2   | 1             | 2    | 30   | DPR   | 3    |
| MDS.4                                   | Ethics, Compliance & Legal Regulations | ILV    |   | X | 2   | 1             | 2    | 30   | MDS   | 3    |
| MWA.2                                   | Master Thesis Colloquium               | SE     |   | X | 1   | 1             | 1    | 15   | MWA   | 2    |
| MWA.2                                   | Master Thesis                          | SE     | X | X | 0   | 1             | 0    | 0    | MWA   | 22*  |
| Total line:                             |                                        |        |   |   | 5   |               | 5    | 75   |       | 30   |
| Course hours = Total WSH x course weeks |                                        |        |   |   | 75  |               |      |      |       |      |

\* The 22 ECTS credits for the master's thesis are divided into 20 ECTS credits for the thesis itself and 2 ECTS credits for the final oral examination

| Abbreviations |                                   |
|---------------|-----------------------------------|
| E             | Lecture in English language       |
| ECTS          | ECTS – Credit points              |
| LV            | Course                            |
| LVS           | Course hour(s)                    |
| WSH           | Weekly semester hour(s)           |
| T             | Lecture with technical background |
| WP            | Elective subject                  |

#### Summary curriculum data

| Description                                                                                              | WSH     | ASWS | ALVS  | ECTS    |
|----------------------------------------------------------------------------------------------------------|---------|------|-------|---------|
| Total number of courses over all semesters                                                               | 49.5    | 54.5 | 817.5 | 120     |
| Total number of courses in 1st year of study                                                             | 29      | 30   | 450   | 60      |
| Total number of courses in 2nd year of study                                                             | 20.5    | 24.5 | 367.5 | 60      |
| Total number of courses in 3rd year of study                                                             |         |      |       |         |
| Total number of technical events over all semesters                                                      | 33.5    |      |       | 91      |
| Percentage of technical courses over all semesters based on WSH / ECTS                                   | 67.68 % |      |       | 75.83 % |
| Total number of specialized courses in English over all semesters                                        | 49.5    |      |       | 120     |
| Proportion of specialized courses in English over all semesters (Calculation excluding language courses) | 100 %   |      |       | 100 %   |

## 2.2.2 Curriculum matrix part-time

### 1. Semester

| Course no.                              | Course title                                | LV-Typ | T | E | WSH | No. of groups | ASWS | ALVS | MODUL | ECTS |
|-----------------------------------------|---------------------------------------------|--------|---|---|-----|---------------|------|------|-------|------|
| MDS.1                                   | Leadership in the Team & Project Management | ILV    |   |   | 1   | 1             | 1    | 15   | MDS   | 2    |
| MDS.3                                   | Systemic Innovation                         | ILV    |   |   | 1   | 1             | 1    | 15   | MDS   | 2    |
| MLAL.1                                  | Statistical Learning 1                      | ILV    | X |   | 3   | 1             | 3    | 45   | MLAL  | 6    |
| MLAL.2                                  | Statistical Learning 1 Lab                  | UE     | X |   | 1   | 2             | 2    | 30   | MLAL  | 2.5  |
| SDDE.1                                  | Data Engineering                            | ILV    | X |   | 2   | 1             | 2    | 30   | SDDE  | 4    |
| SDDE.2                                  | Software Development 1                      | ILV    | X |   | 3   | 1             | 3    | 45   | SDDE  | 6    |
| SDDE.3                                  | Data Engineering Lab                        | UE     | X |   | 2   | 1             | 2    | 30   | SDDE  | 5    |
| SDDE.4                                  | Software Development 1 Lab                  | UE     | X |   | 1   | 2             | 2    | 30   | SDDE  | 2.5  |
| Total line:                             |                                             |        |   |   | 14  |               | 16   | 240  |       | 30.0 |
| Course hours = Total WSH x course weeks |                                             |        |   |   | 210 |               |      |      |       |      |

### 2. Semester

| Course no.                              | Course title                         | LV-Typ | T | E | WSH | No. of groups | ASWS | ALVS | MODUL | ECTS |
|-----------------------------------------|--------------------------------------|--------|---|---|-----|---------------|------|------|-------|------|
| MDS.2                                   | Study Trip (E)                       | ILV    |   | X | 2   | 1             | 2    | 30   | MDS   | 3    |
| MLAL.3                                  | Machine Learning & Deep Learning (E) | ILV    | X | X | 5   | 1             | 5    | 75   | MLAL  | 10   |
| MLAL.5                                  | Statistical Learning 2               | ILV    | X |   | 3   | 1             | 3    | 45   | MLAL  | 6    |
| MLAL.6                                  | Statistical Learning 2 Lab           | UE     | X |   | 1   | 2             | 2    | 30   | MLAL  | 2.5  |
| SDDE.5                                  | Software Development 2               | ILV    | X |   | 3   | 1             | 3    | 45   | SDDE  | 6    |
| SDDE.6                                  | Software Development 2 Lab           | UE     | X |   | 1   | 2             | 2    | 30   | SDDE  | 2.5  |
| Total line:                             |                                      |        |   |   | 15  |               | 17   | 255  |       | 30.0 |
| Course hours = Total WSH x course weeks |                                      |        |   |   | 225 |               |      |      |       |      |

### 3. Semester

| Course no.                              | Course title                                                      | LV-Typ | T | E | WSH   | No. of groups | ASWS | ALVS  | MODUL | ECTS |
|-----------------------------------------|-------------------------------------------------------------------|--------|---|---|-------|---------------|------|-------|-------|------|
| DPR.1                                   | Big Data Processing                                               | ILV    | X |   | 2     | 1             | 2    | 30    | DPR   | 4    |
| DPR.9                                   | Artificial Intelligence (E)                                       | ILV    | X | X | 2.5   | 1             | 2.5  | 37.5  | DPR   | 4    |
| MDS.4                                   | Practical Project                                                 | PT     | X |   | 2     | 3             | 6    | 90    | MDS   | 4    |
| MDS.5                                   | Data Science for Business & Commerce                              | ILV    |   |   | 2     | 1             | 2    | 30    | MDS   | 4    |
| MDS.6                                   | Data Science for Engineering & Natural Sciences (E)               | ILV    |   | X | 2     | 1             | 2    | 30    | MDS   | 4    |
| MWA.1                                   | Academic Work                                                     | SE     |   |   | 1     | 0.5           | 0.5  | 7.5   | MWA   | 2    |
| WPF.1                                   | Application-Oriented Analytics Platforms (E) (WP)*                | ILV    | X | X | 2     | 1             | 2    | 30    | WPF   | 4    |
| WPF.2                                   | Data Visualization & Visual Analytics (E) (WP)*                   | ILV    |   | X | 2     | 1             | 2    | 30    | WPF   | 4    |
| WPF.3                                   | Internet of Things (E) (WP)*                                      | ILV    | X | X | 2     | 1             | 2    | 30    | WPF   | 4    |
| WPF.4                                   | Digital Twin Simulation (E) (WP)*                                 | ILV    |   | X | 2     | 1             | 2    | 30    | WPF   | 4    |
| WPF.5                                   | Process Automation (E) (WP)*                                      | ILV    | X | X | 2     | 1             | 2    | 30    | WPF   | 4    |
| WPF.6                                   | Quantitative Process and Quality Management (Six Sigma) (E) (WP)* | ILV    |   | X | 2     | 1             | 2    | 30    | WPF   | 4    |
| WPF.7                                   | Operational & Strategic Management of Applications (E) (WP)*      | ILV    | X | X | 2     | 1             | 2    | 30    | WPF   | 4    |
| WPF.8                                   | Human AI Interaction (E) (WP)*                                    | ILV    |   | X | 2     | 1             | 2    | 30    | WPF   | 4    |
| Total line:                             |                                                                   |        |   |   | 15.5  |               | 19.0 | 285.0 |       | 30   |
| Course hours = Total WSH x course weeks |                                                                   |        |   |   | 232.5 |               |      |       |       |      |

#### 4. Semester

| Course no.                              | Course title                       | LV-Typ | T | E | WSH | No. of groups | ASWS | ALVS | MODUL | ECTS |
|-----------------------------------------|------------------------------------|--------|---|---|-----|---------------|------|------|-------|------|
| ETHR.1                                  | Business Ethics, Compliance & Law  | ILV    |   |   | 2   | 0.5           | 1.0  | 15.0 | ETHR  | 3    |
| MWA.2                                   | Master's Thesis                    | SE     | X |   | 0   | 1             | 0    | 0    | MWA   | 22*  |
| MWA.2                                   | Master's Thesis Colloquium         | SE     |   |   | 1   | 1             | 1    | 15   | MWA   | 2    |
| WPF.10                                  | Trends in ERP (E) (WP)*            | ILV    |   | X | 2   | 1             | 2    | 30   | WPF   | 3    |
| WPF.11                                  | Trends in Smart Products (E) (WP)* | ILV    |   | X | 2   | 1             | 2    | 30   | WPF   | 3    |
| WPF.12                                  | Trends in AI Engineering (E) (WP)* | ILV    |   | X | 2   | 1             | 2    | 30   | WPF   | 3    |
| WPF.9                                   | Trends in Data Science (E) (WP)*   | ILV    |   | X | 2   | 1             | 2    | 30   | WPF   | 3    |
| Total line:                             |                                    |        |   |   | 5   |               | 4.0  | 60.0 |       | 30   |
| Course hours = Total WSH x course weeks |                                    |        |   |   | 75  |               |      |      |       |      |

\* The 22 ECTS credits for the master's thesis are divided into 20 ECTS credits for the thesis itself and 2 ECTS credits for the final oral examination

| Abbreviations |                                   |
|---------------|-----------------------------------|
| E             | Lecture in English language       |
| ECTS          | ECTS – Credit points              |
| LV            | Course                            |
| LVS           | Course hour(s)                    |
| WSH           | Weekly semester hour(s)           |
| T             | Lecture with technical background |
| WP            | Elective subject                  |

### Summary curriculum data

| Description                                                                                              | WSH     | ASWS | ALVS | ECTS    |
|----------------------------------------------------------------------------------------------------------|---------|------|------|---------|
| Total number of courses over all semesters                                                               | 49.5    | 56   | 840  | 120     |
| Total number of courses in 1st year of study                                                             | 29      | 33   | 495  | 60      |
| Total number of courses in 2nd year of study                                                             | 20.5    | 23   | 345  | 60      |
| Total number of courses in 3rd year of study                                                             |         |      |      |         |
| Total number of technical events over all semesters                                                      | 33.5    |      |      | 91      |
| Percentage of technical courses over all semesters based on WSH / ECTS                                   | 67.68 % |      |      | 75.83 % |
| Total number of specialized courses in English over all semesters                                        | 17.5    |      |      | 32      |
| Proportion of specialized courses in English over all semesters (Calculation excluding language courses) | 35.35 % |      |      | 26.67 % |

## 2.3 Modularization

### 2.3.1 Module descriptions full-time

| Module number:             | Software Development & Data Engineering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Scope: |      |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 26.0   | ECTS |
| Degree program             | University of Applied Sciences Master's Program Data Science & Intelligent Analytics full-time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |      |
| Position in the curriculum | 1. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |      |
|                            | 2. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |      |
| Level                      | 1. Semester: Master's degree program / 2. Semester: Master's degree program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |      |
| Previous knowledge         | <p>1. Semester: Students have prior knowledge in information technology equivalent to 6 ECTS and are therefore familiar with basic programming concepts (e.g., variables, branching, loops) as well as typical programming approaches (e.g., functional programming). / 1. Semester: Students have prior knowledge in information technology equivalent to 6 ECTS and are therefore familiar with the concept of the relational database and can read simple SQL queries. / 2. Semester: 1st semester: Students have prior knowledge in information technology equivalent to 6 ECTS and are therefore familiar with the concept of the relational database and can read simple SQL queries. / 1st semester: Students have prior knowledge in information technology equivalent to 6 ECTS and are therefore familiar with basic programming concepts (e.g., variables, branching, loops) as well as typical programming approaches (e.g., functional programming). / 2nd semester: Module examination SDDE.A1 (Software Development 1) / 2. Semester: 1st semester: Students have prior knowledge in information technology equivalent to 6 ECTS and are therefore familiar with the concept of the relational database and can read simple SQL queries. / 1st semester: Students have prior knowledge in information technology equivalent to 6 ECTS and are therefore familiar with basic programming concepts (e.g., variables, branching, loops) as well as typical programming approaches (e.g., functional programming). / 2nd semester: Module examination SDDE.A1 (Software Development 1)</p> |        |      |
| Blocked                    | no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |      |
| Participant group          | Bachelor graduates, beginners                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |
| Literature recommendation  | <u>Software Development Lab 1 /UE / LV-Nr: SDDE.4 / 1.Semester / ECTS: 2.5</u><br>- Lutz, M (2025): Learning Python, O'Reilly (ISBN: 978-1098171308)<br>- Sommerville, I. (2015): Software Engineering, Global Edition (Ed. 10), Pearson Education, London (ISBN: 978-1292096131)<br>- Williams, L.; Zimmermann, T. (2016): Perspectives on Data Science for Software Engineering (Ed. 1), Morgan Kaufmann, Burlington (ISBN: 978-0128042069)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |
|                            | <u>Software Development Lab 2 /UE / LV-Nr: SDDE.6 / 2.Semester / ECTS: 2.5</u><br>- Lutz, M (2025): Learning Python, O'Reilly (ISBN: 978-1098171308)<br>- Sommerville, I. (2015): Software Engineering, Global Edition (Ed. 10), Pearson Education, London (ISBN: 978-1292096131)<br>- Williams, L.; Zimmermann, T. (2016): Perspectives on Data Science for Software Engineering (Ed. 1), Morgan Kaufmann, Burlington (ISBN: 978-0128042069)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |
|                            | <u>Data Engineering /ILV / LV-Nr: SDDE.1 / 1.Semester / ECTS: 4</u><br>- Kleppmann, M. (2017): Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems (Ed. 1), O'Reilly Media, Farnham (ISBN: 978-1449373320)<br>- Daniel, K. (2026): NoSQL Handbook for Modern Developers: A Practical Guide to Build, Scale, and Secure Cloud-Native Applications, Independently published (ISBN: 979-8245616483)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |      |
|                            | <u>Data Engineering Lab /UE / LV-Nr: SDDE.3 / 1.Semester / ECTS: 5</u><br>- Kleppmann, M. (2017): Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems (Ed. 1), O'Reilly Media, Farnham (ISBN: 978-1449373320)<br>- Daniel, K. (2026): NoSQL Handbook for Modern Developers: A Practical Guide to Build, Scale, and Secure Cloud-Native Applications, Independently published (ISBN: 979-8245616483)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |      |
|                            | <u>Software Development 1 /ILV / LV-Nr: SDDE.2 / 1.Semester / ECTS: 6</u><br>- Lutz, M (2025): Learning Python, O'Reilly (ISBN: 978-1098171308)<br>- Sommerville, I. (2015): Software Engineering, Global Edition (Ed. 10), Pearson Education, London (ISBN: 978-1292096131)<br>- Williams, L.; Zimmermann, T. (2016): Perspectives on Data Science for Software Engineering (Ed. 1), Morgan Kaufmann, Burlington (ISBN: 978-0128042069)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |      |
|                            | <u>Software Development 2 /ILV / LV-Nr: SDDE.5 / 2.Semester / ECTS: 6</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                       | <ul style="list-style-type: none"> <li>- Lutz, M (2025): Learning Python, O'Reilly (ISBN: 978-1098171308)</li> <li>- Sommerville, I. (2015): Software Engineering, Global Edition (Ed. 10), Pearson Education, London (ISBN: 978-1292096131)</li> <li>- Williams, L.; Zimmermann, T. (2016): Perspectives on Data Science for Software Engineering (Ed. 1), Morgan Kaufmann, Burlington (ISBN: 978-0128042069)</li> </ul> |
| Acquisition of skills | <p><u>Software Development Lab 1 /UE / LV-Nr: SDDE.4 / 1.Semester / ECTS: 2.5</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can independently implement basic application concepts</li> <li>• can develop basic application concepts and put them into an implementable form</li> </ul>                                                                                                       |

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Acquisition of skills | <p><u>Software Development Lab 2 /UE / LV-Nr: SDDE.6 / 2.Semester / ECTS: 2.5</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can independently implement advanced application concepts</li> <li>• can develop advanced application concepts and put them into an implementable form</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                       | <p><u>Data Engineering /ILV / LV-Nr: SDDE.1 / 1.Semester / ECTS: 4</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can describe various advanced data storage concepts (e.g., NoSQL databases, distributed databases, etc.)</li> <li>• can compare and select data storage concepts with regard to their suitability for projects</li> <li>• can describe the specific data storage requirements that arise from the use of very large volumes of data (big data)</li> </ul>                                                                                                                                                                                                                                                                                          |
|                       | <p><u>Data Engineering Lab /UE / LV-Nr: SDDE.3 / 1.Semester / ECTS: 5</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can implement storage concepts themselves in the context of a specific problem</li> <li>• can design the implementation of these systems with a view to scalability and operational requirements</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                       | <p><u>Software Development 1 /ILV / LV-Nr: SDDE.2 / 1.Semester / ECTS: 6</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can apply the basic concepts of software development (e.g., object orientation, functional programming, etc.) that are frequently used in the field of data science</li> <li>• can apply the concepts they have studied in software development environments commonly used in data analysis (e.g., in Python)</li> <li>• can identify the common tools used in software development within data science</li> <li>• can design basic applications in order to automate basic functionalities</li> <li>• can independently implement the applications they have designed</li> </ul>                                                            |
|                       | <p><u>Software Development 2 /ILV / LV-Nr: SDDE.5 / 2.Semester / ECTS: 6</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can apply advanced concepts of software development (e.g., pipelines, testing, etc.) that are frequently used in the field of data science</li> <li>• can describe the use of the concepts they have studied in software development environments commonly used in data analysis (e.g., in Python)</li> <li>• can design advanced applications in order to automate basic functionalities</li> <li>• can independently implement the applications they have designed</li> </ul>                                                                                                                                                              |
| Course contents       | <p><u>Software Development Lab 1 /UE / LV-Nr: SDDE.4 / 1.Semester / ECTS: 2.5</u></p> <p>In the lab, the content of the integrated lecture "Software Development 1" is deepened through practical exercises. The insights gained are discussed as a group, thereby providing a thorough understanding of the subject matter and consolidating the knowledge conveyed theoretically in the integrated lecture.</p>                                                                                                                                                                                                                                                                                                                                                                               |
|                       | <p><u>Software Development Lab 2 /UE / LV-Nr: SDDE.6 / 2.Semester / ECTS: 2.5</u></p> <p>In the lab, the content of the integrated lecture "Software Development 2" is deepened through practical exercises. The insights gained are discussed as a group, thereby providing a thorough understanding of the subject matter and consolidating the knowledge conveyed theoretically in the integrated lecture.</p>                                                                                                                                                                                                                                                                                                                                                                               |
|                       | <p><u>Data Engineering /ILV / LV-Nr: SDDE.1 / 1.Semester / ECTS: 4</u></p> <p>The following topics are covered in the course:</p> <ul style="list-style-type: none"> <li>- Characteristics of high-performance data systems (scalability, maintainability, reliability)</li> <li>- Established concepts of data storage (relational model)</li> <li>- Historical concepts of data storage (hierarchical model, network model)</li> <li>- Modern concepts of data storage (wide-column model, graph model, key-value model, document model, column-oriented model)</li> <li>- Database systems matching the models covered</li> <li>- Scaling of data systems (replication and partitioning)</li> <li>- Writing to and reading from data systems (index structures, write strategies)</li> </ul> |
|                       | <p><u>Data Engineering Lab /UE / LV-Nr: SDDE.3 / 1.Semester / ECTS: 5</u></p> <p>The following topics are covered in the course:</p> <ul style="list-style-type: none"> <li>- Design and implementation of problem-centered NoSQL databases (e.g., key-value stores, document stores, column-oriented data stores, etc.)</li> <li>- Design and implementation of storage solutions for large data volumes (big data)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                 |
|                       | <p><u>Software Development 1 /ILV / LV-Nr: SDDE.2 / 1.Semester / ECTS: 6</u></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>The following topics are covered in the course:</p> <ul style="list-style-type: none"> <li>- The process of software engineering and project management for data-intensive applications</li> <li>- Programming paradigms for use in the field of data science</li> <li>- Effective and efficient data structures for data-intensive applications</li> <li>- Tools and software ecosystems for the development and testing of data-intensive software systems</li> </ul>                        |
|  | <p><u>Software Development 2 /ILV / LV-Nr: SDDE.5 / 2.Semester / ECTS: 6</u></p> <p>The following topics are covered in the course:</p> <ul style="list-style-type: none"> <li>- Architecture models for data-driven software development and systems.</li> <li>- Integration models and paradigms for implementing complex, process-oriented software ecosystems for analytical and data-driven systems</li> <li>- Application of proven design patterns for data-driven applications</li> </ul> |

|                               |                                                                                                                                                                                                                                                                      |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Course contents               | <ul style="list-style-type: none"> <li>- Design and implementation of efficient and scalable software systems for data-driven applications</li> <li>- Testing of software applications (e.g., unit tests, integration tests, etc.)</li> </ul>                        |
|                               |                                                                                                                                                                                                                                                                      |
| Teaching and learning methods | <u>Software Development Lab 1 /UE / LV-Nr: SDDE.4 / 1.Semester / ECTS: 2.5</u><br>The following methods are used:<br><ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Working on practice exercises</li> </ul>                            |
|                               | <u>Software Development Lab 2 /UE / LV-Nr: SDDE.6 / 2.Semester / ECTS: 2.5</u><br>The following methods are used:<br><ul style="list-style-type: none"> <li>- Working on practice exercises</li> <li>- Interactive workshop</li> </ul>                               |
|                               | <u>Data Engineering /ILV / LV-Nr: SDDE.1 / 1.Semester / ECTS: 4</u><br>The following methods are used:<br><ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Working on practice exercises</li> <li>- Interactive workshop</li> </ul>       |
|                               | <u>Data Engineering Lab /UE / LV-Nr: SDDE.3 / 1.Semester / ECTS: 5</u><br>The following methods are used:<br><ul style="list-style-type: none"> <li>- Working on practice exercises</li> <li>- Lecture with discussion</li> </ul>                                    |
|                               | <u>Software Development 1 /ILV / LV-Nr: SDDE.2 / 1.Semester / ECTS: 6</u><br>The following methods are used:<br><ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Working on practice exercises</li> <li>- Interactive workshop</li> </ul> |
|                               | <u>Software Development 2 /ILV / LV-Nr: SDDE.5 / 2.Semester / ECTS: 6</u><br>The following methods are used:<br><ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Working on practice exercises</li> <li>- Interactive workshop</li> </ul> |
| Evaluation Methods Criteria   | <u>Software Development Lab 1 /UE / LV-Nr: SDDE.4 / 1.Semester / ECTS: 2.5</u><br>Term paper<br>Project                                                                                                                                                              |
|                               | <u>Software Development Lab 2 /UE / LV-Nr: SDDE.6 / 2.Semester / ECTS: 2.5</u><br>Term paper<br>Project                                                                                                                                                              |
|                               | <u>Data Engineering /ILV / LV-Nr: SDDE.1 / 1.Semester / ECTS: 4</u><br>Written exam                                                                                                                                                                                  |
|                               | <u>Data Engineering Lab /UE / LV-Nr: SDDE.3 / 1.Semester / ECTS: 5</u><br>Term paper<br>Project                                                                                                                                                                      |
|                               | <u>Software Development 1 /ILV / LV-Nr: SDDE.2 / 1.Semester / ECTS: 6</u><br>Written exam                                                                                                                                                                            |
|                               | <u>Software Development 2 /ILV / LV-Nr: SDDE.5 / 2.Semester / ECTS: 6</u><br>Written exam                                                                                                                                                                            |

| Module number:             | Machine Learning & Algorithmic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Scope: |      |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
| MLAL                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 27.0   | ECTS |
| Degree program             | University of Applied Sciences Master's Program Data Science & Intelligent Analytics full-time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |      |
| Position in the curriculum | 1. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |
|                            | 2. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |
| Level                      | 1. Semester: Master's degree program / 2. Semester: Master's degree program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |
| Previous knowledge         | 1. Semester: Students have prior knowledge in mathematics/statistics equivalent to 8 ECTS and are therefore familiar with basic statistical measures as well as fundamental statistical test procedures (e.g., t-test). / 2. Semester: 1st semester: Students have prior knowledge in mathematics/statistics equivalent to 8 ECTS and are therefore familiar with basic statistical measures as well as fundamental statistical test procedures (e.g., t-test). / 2nd semester: No prerequisites / 2nd semester: Module examination MLAL.A1 (Algorithmics 1) / 2. Semester: Module examination MLAL.A1 (Algorithmics 1) |        |      |
| Blocked                    | no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        |      |
| Participant group          | Bachelor graduates, beginners                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |      |
| Literature recommendation  | <u>Statistical Learning Lab 1 /UE / LV-Nr: MLAL.2 / 1.Semester / ECTS: 2.5</u><br>- James, G.; Witten, D; Hastie, T.; Tibshirani, R. (2023). An Introduction to Statistical Learning: with Applications with Python (ISBN: 978-3031387463)<br>- Bruce. P.; Bruce, A.; Gedeck, P. (2020): Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python (ISBN: 978-1492072942)<br>- Geron, A. (2022): Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, (ISBN: 978-1098125974)                                     |        |      |
|                            | <u>Machine Learning &amp; Deep Learning /ILV / LV-Nr: MLAL.3 / 2.Semester / ECTS: 10</u><br>- James, G.; Witten, D; Hastie, T.; Tibshirani, R. (2023). An Introduction to Statistical Learning: with Applications with Python (ISBN: 978-3031387463)<br>- Bruce. P.; Bruce, A.; Gedeck, P. (2020): Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python (ISBN: 978-1492072942)<br>- Geron, A. (2022): Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, (ISBN: 978-1098125974)                           |        |      |
|                            | <u>Statistical Learning Lab 2 /UE / LV-Nr: MLAL.6 / 2.Semester / ECTS: 2.5</u><br>- James, G.; Witten, D; Hastie, T.; Tibshirani, R. (2023). An Introduction to Statistical Learning: with Applications with Python (ISBN: 978-3031387463)<br>- Bruce. P.; Bruce, A.; Gedeck, P. (2020): Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python (ISBN: 978-1492072942)<br>- Geron, A. (2022): Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, (ISBN: 978-1098125974)                                     |        |      |
|                            | <u>Statistical Learning 1 /ILV / LV-Nr: MLAL.1 / 1.Semester / ECTS: 6</u><br>- James, G.; Witten, D; Hastie, T.; Tibshirani, R. (2023). An Introduction to Statistical Learning: with Applications with Python (ISBN: 978-3031387463)<br>- Bruce. P.; Bruce, A.; Gedeck, P. (2020): Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python (ISBN: 978-1492072942)<br>- Geron, A. (2022): Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, (ISBN: 978-1098125974)                                          |        |      |
|                            | <u>Statistical Learning 2 /ILV / LV-Nr: MLAL.5 / 2.Semester / ECTS: 6</u><br>- James, G.; Witten, D; Hastie, T.; Tibshirani, R. (2023). An Introduction to Statistical Learning: with Applications with Python (ISBN: 978-3031387463)<br>- Bruce. P.; Bruce, A.; Gedeck, P. (2020): Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python (ISBN: 978-1492072942)<br>- Geron, A. (2022): Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, (ISBN: 978-1098125974)                                          |        |      |
| Acquisition of skills      | <u>Statistical Learning Lab 1 /UE / LV-Nr: MLAL.2 / 1.Semester / ECTS: 2.5</u><br>The participants: <ul style="list-style-type: none"> <li>• can practically follow basic data science algorithms</li> <li>• can configure basic data science algorithms for specific purposes</li> <li>• can apply the algorithms covered to isolated problems</li> </ul>                                                                                                                                                                                                                                                              |        |      |
|                            | Machine Learning & Deep Learning /ILV / LV-Nr: MLAL.3 / 2.Semester / ECTS: 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |      |

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               | <p>The participants:</p> <ul style="list-style-type: none"> <li>• can identify tools (e.g., libraries, cloud platforms, or software tools) that can be used to support machine learning</li> <li>• can compare the tools they have studied with regard to their suitability for specific problems</li> <li>• can design end-to-end machine learning projects</li> <li>• can independently carry out end-to-end machine learning projects</li> </ul>                                                                                                                                                                                                                                                                                                  |
|                               | <p><u>Statistical Learning Lab 2 /UE / LV-Nr: MLAL.6 / 2.Semester / ECTS: 2.5</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can practically follow advanced data science algorithms</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Acquisition of skills         | <ul style="list-style-type: none"> <li>• can configure advanced data science algorithms for specific purposes</li> <li>• can apply the algorithms covered to isolated problems</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                               | <p><u>Statistical Learning 1 /ILV / LV-Nr: MLAL.1 / 1.Semester / ECTS: 6</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can describe how basic algorithms in the field of data science work</li> <li>• can understand the statistical concepts and approaches behind the algorithms covered</li> <li>• can select suitable algorithms for given problems</li> <li>• can identify the data structures, runtime characteristics, and complexity classes required by the algorithms covered</li> <li>• can apply the algorithms covered to isolated problems</li> </ul>                                                                                                                                                      |
|                               | <p><u>Statistical Learning 2 /ILV / LV-Nr: MLAL.5 / 2.Semester / ECTS: 6</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can practically follow advanced data science algorithms</li> <li>• can configure advanced data science algorithms for specific purposes</li> <li>• can apply the algorithms covered to isolated problems</li> </ul>                                                                                                                                                                                                                                                                                                                                                                               |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Course contents               | <p><u>Statistical Learning Lab 1 /UE / LV-Nr: MLAL.2 / 1.Semester / ECTS: 2.5</u></p> <p>In the lab, the content of the integrated lecture "Statistical Learning 1" is deepened through practical exercises. The insights gained are discussed as a group, thereby providing a thorough understanding of the subject matter and consolidating the knowledge conveyed theoretically in the integrated lecture.</p>                                                                                                                                                                                                                                                                                                                                    |
|                               | <p><u>Machine Learning &amp; Deep Learning /ILV / LV-Nr: MLAL.3 / 2.Semester / ECTS: 10</u></p> <p>The following topics are covered in the course:</p> <ul style="list-style-type: none"> <li>- Classical neural networks as a complement to classical data science algorithms (e.g., random forests, SCM, etc.)</li> <li>- Convolutional artificial neural networks (CNN)</li> <li>- Recurrent artificial neural networks (RNN, LSTM)</li> <li>- Advanced artificial neural networks (GAN, FARM, BERT, CGAN, etc.)</li> </ul> <p>The network types discussed are subject to constant change. For this reason, only a few network types are mentioned here as examples. In particular, the course also covers and applies current network types.</p> |
|                               | <p><u>Statistical Learning Lab 2 /UE / LV-Nr: MLAL.6 / 2.Semester / ECTS: 2.5</u></p> <p>In the lab, the content of the integrated lecture "Statistical Learning 2" is deepened through practical exercises. The insights gained are discussed as a group, thereby providing a thorough understanding of the subject matter and consolidating the knowledge conveyed theoretically in the integrated lecture.</p>                                                                                                                                                                                                                                                                                                                                    |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                               | <p><u>Statistical Learning 1 /ILV / LV-Nr: MLAL.1 / 1.Semester / ECTS: 6</u></p> <p>The following topics are covered in the course:</p> <ul style="list-style-type: none"> <li>- Statistical measures (point and interval estimators)</li> <li>- Statistical test procedures</li> <li>- Clustering algorithms (classification trees, agglomerative hierarchical clustering, etc.)</li> <li>- Regression algorithms (regression trees, random forests, etc.)</li> <li>- Association algorithms</li> <li>- Data preprocessing techniques (e.g., principal component analysis)</li> </ul>                                                                                                                                                               |
|                               | <p><u>Statistical Learning 2 /ILV / LV-Nr: MLAL.5 / 2.Semester / ECTS: 6</u></p> <p>The following topics are covered in the course:</p> <ul style="list-style-type: none"> <li>- Advanced modeling techniques</li> <li>- Ensemble methods</li> <li>- Optimization of models</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Teaching and learning methods | <p><u>Statistical Learning Lab 1 /UE / LV-Nr: MLAL.2 / 1.Semester / ECTS: 2.5</u></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

|  |                                                                                                                                                                                                                                                                              |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Working on practice exercises</li> <li>- Interactive workshop</li> </ul>                                                                                                                     |
|  | <p><u>Machine Learning &amp; Deep Learning /ILV / LV-Nr: MLAL.3 / 2.Semester / ECTS: 10</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Working on practice exercises</li> <li>- Interactive workshop</li> </ul>                     |
|  | <p><u>Statistical Learning Lab 2 /UE / LV-Nr: MLAL.6 / 2.Semester / ECTS: 2.5</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Working on practice exercises</li> <li>- Interactive workshop</li> </ul>                               |
|  | <p><u>Statistical Learning 1 /ILV / LV-Nr: MLAL.1 / 1.Semester / ECTS: 6</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Working on practice exercises</li> <li>- Interactive workshop</li> </ul> |

|                               |                                                                                                                                                                                                        |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching and learning methods | <u>Statistical Learning 2 /ILV / LV-Nr: MLAL.5 / 2.Semester / ECTS: 6</u><br>The following methods are used:<br>- Lecture with discussion<br>- Working on practice exercises<br>- Interactive workshop |
| Evaluation Methods Criteria   | <u>Statistical Learning Lab 1 /UE / LV-Nr: MLAL.2 / 1.Semester / ECTS: 2.5</u><br>Term paper<br>Project                                                                                                |
|                               | <u>Machine Learning &amp; Deep Learning /ILV / LV-Nr: MLAL.3 / 2.Semester / ECTS: 10</u><br>Portfolio                                                                                                  |
|                               | <u>Statistical Learning Lab 2 /UE / LV-Nr: MLAL.6 / 2.Semester / ECTS: 2.5</u><br>Term paper<br>Project                                                                                                |
|                               | <u>Statistical Learning 1 /ILV / LV-Nr: MLAL.1 / 1.Semester / ECTS: 6</u><br>Written exam                                                                                                              |
|                               | <u>Statistical Learning 2 /ILV / LV-Nr: MLAL.5 / 2.Semester / ECTS: 6</u><br>Written exam                                                                                                              |
|                               |                                                                                                                                                                                                        |

| Module number:             | Management for Data Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Scope: |      |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
| MDS                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 22     | ECTS |
| Degree program             | University of Applied Sciences Master's Program Data Science & Intelligent Analytics full-time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |      |
| Position in the curriculum | 1. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      |
|                            | 2. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      |
|                            | 3. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      |
|                            | 4. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      |
| Level                      | 1. Semester: Master's degree program / 2. Semester: Master's degree program / 3. Semester: Master's degree program / 4. Semester: Master's degree program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |
| Previous knowledge         | 1. Semester: No prerequisites / 2. Semester: No prerequisites / 3. Semester: No prerequisites / 4. Semester: No prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |      |
| Blocked                    | no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |      |
| Participant group          | Bachelor graduates, beginners                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |      |
| Literature recommendation  | <u>Ethics, Compliance &amp; Legal Regulations /ILV / LV-Nr: MDS.4 / 4.Semester / ECTS: 3</u><br>- Meyer-Galow, E. (2020): Business Ethik 3.0: Die neue integrale Ethik aus der Sicht eines CEOs (Ed. 1), Springer Gabler, (ISBN: 978-3658307851)<br>- Wybitul, T. (2025): Arbeitsbuch AI Act: Gebrauchsanleitung für Unternehmen zur Umsetzung der KI-Verordnung (Ed. 1), r&w/Fachmedien Recht und Wirtschaft, (ISBN: 978-3800519569)<br>- Franz, M. (2026): Rechtssicherer AI-Einsatz im Unternehmen: Use Cases beurteilt nach AI Act, Datenschutz, Urheberrecht und weiteren Gesetzen (Ed. 1), Springer Gabler, (ISBN: 978-3658499440)                          |        |      |
|                            | <u>Data Science for Business &amp; Commerce /ILV / LV-Nr: MDS.5 / 3.Semester / ECTS: 4</u><br>- VanderPlas, J. (2023): Python Data Science Handbook: Essential Tools for Working with Data (Ed. 2), O'Reilly, (ISBN: 978-1098121228)<br>- Cady, F. (2017): The Data Science Handbook (Ed. 2), Wiley, Hoboken (ISBN: 978-1119092940)<br>- Saporta, G.; Maraney, S. (2022): Practical Fraud Prevention: Fraud and AML Analytics for Fintech and eCommerce, Using SQL and Python (Ed. 1), O'Reilly, (ISBN: 978-1492093329)<br>- Meier, A.; Stormer, H. (2012): eBusiness & eCommerce: Management der digitalen                                                       |        |      |
|                            | <u>Data Science for Engineering &amp; Natural Sciences /ILV / LV-Nr: MDS.6 / 3.Semester / ECTS: 4</u><br>- VanderPlas, J. (2023): Python Data Science Handbook: Essential Tools for Working with Data (Ed. 2), O'Reilly, (ISBN: 978-1098121228)<br>- Cady, F. (2017): The Data Science Handbook (Ed. 2), Wiley, Hoboken (ISBN: 978-1119092940)                                                                                                                                                                                                                                                                                                                    |        |      |
|                            | <u>Integrated Application Project /PT / LV-Nr: MDS.4 / 3.Semester / ECTS: 4</u><br>- Patzak, G.; Rattay, G. (2017): Projektmanagement: Projekte, Projektportfolios, Programme und projektorientierte Unternehmen (Ed. 7), Linde Verlag, Wien (ISBN: 978-3714303216)<br>- Schöneck, N. M.; Voß, W. (2013): Das Forschungsprojekt: Planung, Durchführung und Auswertung einer quantitativen Studie (Ed. 2), Springer VS, Wiesbaden (ISBN: 978-3531195018)                                                                                                                                                                                                           |        |      |
|                            | <u>Leadership, Team &amp; Project Management /ILV / LV-Nr: MDS.1 / 1.Semester / ECTS: 2</u><br>- Michels, B. (2017): Projektmanagement Handbuch (Ed. 3), CreateSpace Independent Publishing Platform, online (ISBN: 978-1545335482)<br>- Gellert, M.; Nowak, C. (2010): Teamarbeit, Teamentwicklung, Teamberatung: Ein Praxisbuch für die Arbeit in und mit Teams (Ed. 4), Limmer, C., Meezen (ISBN: 978-3928922135)<br>- Kerzner, H. (2017): Project Management: A Systems Approach to Planning, Scheduling, and Controlling (Ed. 12), Wiley, Weinheim (ISBN: 978-1119165354)                                                                                    |        |      |
|                            | <u>Study Trip /ILV / LV-Nr: MDS.3 / 2.Semester / ECTS: 3</u><br>- Dumetz, J; Trompenaars, F.; Dumetz, J.; Saginova, O.; Covey, S.; Hampden-Turner, S.; Woolliams, P.; Schmitz, J.; Foster, D.; Belbin, M; Schein, E. (2012): Cross-cultural management textbook: Lessons from the world leading experts in cross-cultural management (Ed. 1), CreateSpace Independent Publishing Platform, Delaware (ISBN: 978-1479159680)<br>- Beise, M. (2013): Lead Markets. Country-Specific Success Factors of the Global Diffusion of - Thomas, D. C. (2014): Cross-Cultural Management: Essential Concepts (Ed. 4), SAGE Publishing, Thousand Oaks (ISBN: 978-14112939560) |        |      |
|                            | <u>Systemic Innovation /ILV / LV-Nr: MDS.2 / 1.Semester / ECTS: 2</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <ul style="list-style-type: none"> <li>- Achouri C. (2015) Systemisches Management. In: Human Resources Management: Eine praxisbasierte Einführung. 2. Auflage, Gabler, Wiesbaden (ISBN: 978-3834947390).</li> <li>- Bils, S.; Töpfer, G.L.: Exnovation und Innovation: Synergie von Ende und Anfang in Veränderungen (Systemisches Management)., Schäfer Poeschel, 2024</li> <li>- Brenner, W.; Uebernicket, F. (2016) Design Thinking for Innovation: Research and Practice. 1. Auflage, Springer, Berlin (ISBN: 978-3319260983).</li> <li>- Brown, T. (2019) Change by Design: how design thinking transforms organizations and inspires innovation. 2. Auflage, Harper Business, New York (ISBN: 978-3319260983).</li> <li>- Orloff, M. A. (2012) Modern TRIZ: A Practical Course with EASyTRIZ Technology. 1. Auflage, Springer, Berlin (ISBN: 978-3642252174).</li> <li>- Tidd, J.; Bessant, J. (2024) Managing Innovation: Integrating Technological, Market and Organizational Change. 8. Auflage, Wiley, Chichester (ISBN: 978-1118360637).</li> </ul> |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Acquisition of skills | <p><u>Ethics, Compliance &amp; Legal Regulations /ILV / LV-Nr: MDS.4 / 4.Semester / ECTS: 3</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can describe advanced ethical and legal requirements for the processing of data</li> <li>• can apply these advanced requirements with regard to data-driven projects</li> <li>• can analyze the use of large volumes of data and utilization strategies on the basis of these ethical and legal frameworks and develop approaches based on this</li> </ul>                                                                                                                      |
|                       | <p><u>Data Science for Business &amp; Commerce /ILV / LV-Nr: MDS.5 / 3.Semester / ECTS: 4</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can identify fundamental areas of application for data collection, data storage, data analysis, and data use in the context of business applications</li> <li>• can understand the particular challenges of this field of application and can describe established best-practice methods in this area</li> <li>• can design and implement data-based applications in this area themselves, taking domain-specific requirements into account</li> </ul>                            |
|                       | <p><u>Data Science for Engineering &amp; Natural Sciences /ILV / LV-Nr: MDS.6 / 3.Semester / ECTS: 4</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can identify fundamental areas of application for data collection, data storage, data analysis, and data use in the context of scientific and technical applications</li> <li>• can understand the particular challenges of this field of application and can identify established best-practice methods in this area</li> <li>• can design and implement data-based applications in this area themselves, taking domain-specific requirements into account</li> </ul> |
|                       | <p><u>Integrated Application Project /PT / LV-Nr: MDS.4 / 3.Semester / ECTS: 4</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can apply the knowledge from their first two semesters in a data-centered project</li> <li>• can structure and manage a data-centered project</li> </ul>                                                                                                                                                                                                                                                                                                                                     |
|                       | <p><u>Leadership, Team &amp; Project Management /ILV / LV-Nr: MDS.1 / 1.Semester / ECTS: 2</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can describe advanced methods and tools for project management and the management of data-driven products</li> <li>• can compare the project management methods and tools covered with regard to their suitability for particular projects</li> <li>• can apply the methods and tools of project management in projects</li> </ul>                                                                                                                                               |
|                       | <p><u>Study Trip /ILV / LV-Nr: MDS.3 / 2.Semester / ECTS: 3</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can describe the discipline-relevant discourse in the respective host country</li> <li>• can describe the cultural factors influencing the discipline of data science in the respective host country</li> <li>• can understand the factors and discourse that influence the discipline of data science in the respective host country</li> </ul>                                                                                                                                                                |
|                       | <p><u>Systemic Innovation /ILV / LV-Nr: MDS.2 / 1.Semester / ECTS: 2</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can describe basic concepts and methods from the fields of Systematic Innovative Thinking, systemic management, and innovation management</li> <li>• can apply specific creative techniques for generating innovations</li> </ul>                                                                                                                                                                                                                                                                      |
| Course contents       | <p><u>Ethics, Compliance &amp; Legal Regulations /ILV / LV-Nr: MDS.4 / 4.Semester / ECTS: 3</u></p> <p>The following topics are covered in the course:</p> <ul style="list-style-type: none"> <li>- Data protection (e.g., GDPR)</li> <li>- Privacy (e-Privacy Regulation)</li> <li>- Handling data from an ethical/moral perspective</li> <li>- Compliance</li> </ul>                                                                                                                                                                                                                                                                                |
|                       | <p><u>Data Science for Business &amp; Commerce /ILV / LV-Nr: MDS.5 / 3.Semester / ECTS: 4</u></p> <p>The following topics are covered in the course:</p> <ul style="list-style-type: none"> <li>- CRM at the strategic level</li> <li>- CRM in process management</li> <li>- CRM at the operational level (CRM software systems)</li> <li>- Operational CRM</li> <li>- Analytical CRM</li> <li>- Communicative CRM</li> </ul>                                                                                                                                                                                                                         |
|                       | <p><u>Data Science for Engineering &amp; Natural Sciences /ILV / LV-Nr: MDS.6 / 3.Semester / ECTS: 4</u></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

The following exemplary topics are covered in the course:

- Biology (e.g., genome research, medical diagnostic procedures, etc.)
- Physics (e.g., object recognition through image data processing, etc.)
- Chemistry (e.g., processing of data-intensive experiments, etc.)
- Sustainability
- Data-driven maintenance (e.g., predictive maintenance, digital twin)
- Data-optimized product design (e.g., designing product characteristics using artificial neural networks)
- Analysis of sensor data (e.g., obstacle detection, obstacle avoidance, prediction, etc.)

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Course contents               | <ul style="list-style-type: none"> <li>- Cloud-based IoT systems (data storage and collection)</li> <li>- Sensor analysis via Raspberry Pi, Arduino, and wireless systems</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                               | <p><u>Integrated Application Project /PT / LV-Nr: MDS.4 / 3.Semester / ECTS: 4</u></p> <p>In this course, students work on a real, data-centered project along the entire data value chain (from data collection through integration and storage to the analysis and utilization of the data). This allows them to apply the skills built up in the first two semesters in a real-world setting and to gain new insights.</p>                                                                                                                                                                                                                                               |
|                               | <p><u>Leadership, Team &amp; Project Management /ILV / LV-Nr: MDS.1 / 1.Semester / ECTS: 2</u></p> <p>The following topics are covered in the course:</p> <ul style="list-style-type: none"> <li>- Project management techniques (e.g., SCRUM)</li> <li>- Project management tools in the field of data science (e.g., GitLab)</li> <li>- Techniques for documenting requirements (e.g., Sophist)</li> <li>- Mechanisms of gender roles, bias, and structural disadvantage, as well as practical approaches to the gender-inclusive design of work and learning environments</li> <li>- Models and methods of workload and resource analysis (work-life balance)</li> </ul> |
|                               | <p><u>Study Trip /ILV / LV-Nr: MDS.3 / 2.Semester / ECTS: 3</u></p> <p>The following topics are covered in the course:</p> <ul style="list-style-type: none"> <li>- Intercultural competence</li> <li>- Discussion with practitioners from the field</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                             |
|                               | <p><u>Systemic Innovation /ILV / LV-Nr: MDS.2 / 1.Semester / ECTS: 2</u></p> <p>The following topics are covered in the course:</p> <ul style="list-style-type: none"> <li>- Developing a holistic understanding of the subject areas (systemic management)</li> <li>- Methods for generating innovative ideas (e.g., Systematic Inventive Thinking, Design Thinking)</li> <li>- Project structures and management methods for the practical implementation of innovations (e.g., change management, conflict management)</li> <li>- IT-supported project documentation</li> </ul>                                                                                          |
| Teaching and learning methods | <p><u>Ethics, Compliance &amp; Legal Regulations /ILV / LV-Nr: MDS.4 / 4.Semester / ECTS: 3</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                               | <p><u>Data Science for Business &amp; Commerce /ILV / LV-Nr: MDS.5 / 3.Semester / ECTS: 4</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Interactive workshop</li> <li>- Case studies</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                |
|                               | <p><u>Data Science for Engineering &amp; Natural Sciences /ILV / LV-Nr: MDS.6 / 3.Semester / ECTS: 4</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Interactive workshop</li> <li>- Case studies</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                     |
|                               | <p><u>Integrated Application Project /PT / LV-Nr: MDS.4 / 3.Semester / ECTS: 4</u></p> <p>Coaching during the execution of the project</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                               | <p><u>Leadership, Team &amp; Project Management /ILV / LV-Nr: MDS.1 / 1.Semester / ECTS: 2</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Interactive workshop</li> <li>- Case studies</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                               |
|                               | <p><u>Study Trip /ILV / LV-Nr: MDS.3 / 2.Semester / ECTS: 3</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Interactive workshop</li> <li>- On-site visits with discussion</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                               | <p><u>Systemic Innovation /ILV / LV-Nr: MDS.2 / 1.Semester / ECTS: 2</u></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

|                             |                                                                                                                                            |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
|                             | <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Case studies</li> </ul> |
| Evaluation Methods Criteria | <p><u>Ethics, Compliance &amp; Legal Regulations /ILV / LV-Nr: MDS.4 / 4.Semester / ECTS: 3</u></p> <p>Written exam</p>                    |
|                             | <p><u>Data Science for Business &amp; Commerce /ILV / LV-Nr: MDS.5 / 3.Semester / ECTS: 4</u></p> <p>Seminar paper</p>                     |
|                             |                                                                                                                                            |

|                             |                                                                                                                        |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------|
| Evaluation Methods Criteria | <u>Data Science for Engineering &amp; Natural Sciences /ILV / LV-Nr: MDS.6 / 3.Semester / ECTS: 4</u><br>Seminar paper |
|                             | <u>Integrated Application Project /PT / LV-Nr: MDS.4 / 3.Semester / ECTS: 4</u><br>Project documentation               |
|                             | <u>Leadership, Team &amp; Project Management /ILV / LV-Nr: MDS.1 / 1.Semester / ECTS: 2</u><br>Seminar paper           |
|                             | <u>Study Trip /ILV / LV-Nr: MDS.3 / 2.Semester / ECTS: 3</u><br>Report                                                 |
|                             | <u>Systemic Innovation /ILV / LV-Nr: MDS.2 / 1.Semester / ECTS: 2</u><br>Seminar paper                                 |

| Module number:             | Data Processing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Scope: |      |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
| DPR                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 19     | ECTS |
| Degree program             | University of Applied Sciences Master's Program Data Science & Intelligent Analytics full-time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |      |
| Position in the curriculum | 3. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        |      |
|                            | 4. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        |      |
| Level                      | 3. Semester: Master's degree program / 4. Semester: Master's degree program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        |      |
| Previous knowledge         | 3. Semester: No prerequisites / 4. Semester: No prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |      |
| Blocked                    | no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |      |
| Participant group          | Bachelor graduates, beginners                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |      |
| Literature recommendation  | <u>Artificial Intelligence /ILV / LV-Nr: DPR.4 / 3.Semester / ECTS: 4</u><br>- Russell, S.; Norvig, P. (2021): Artificial Intelligence: A Modern Approach, Global Edition (Ed. 4), Addison Wesley, Boston (ISBN: 978-1292401133)<br>- Rissover, M. N. (2025): Artificial Intelligence: A Practical Guide to Understanding AI for Professionals and Students (Ed. 1), Digital Foundations, (ISBN: 979-8286961795)                                                                                                                                                                 |        |      |
|                            | <u>Big Data Processing /ILV / LV-Nr: DPR.1 / 3.Semester / ECTS: 4</u><br>- Kleppmann, M.; Riccomini, C. (2026): Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems (Ed. 2), O'Reilly, (ISBN: 978-1098119065)<br>- Chambers, B. (2018): Spark: The Definitive Guide: Big Data Processing Made Simple, O'Reilly, (ISBN: 978-1491912218)<br>- Marz, N.; Warren, J. (2015): Big Data: Principles and best practices of scalable realtime data systems (Ed. 1), Manning, (ISBN: 978-1617290343)                                 |        |      |
|                            | <u>Data Visualization &amp; Visual Analytics /ILV / LV-Nr: DPR.3 / 3.Semester / ECTS: 4</u><br>- Wilke, C. O. (2019): Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures, O'Reilly<br>- Knaflitz, C. N.; Kauschke, M. (2017): Storytelling mit Daten: Die Grundlagen der effektiven Kommunikation und Visualisierung mit Daten, Vahlen                                                                                                                                                                                                    |        |      |
|                            | <u>No-Code &amp; Low-Code Analysis Platforms /ILV / LV-Nr: DPR.2 / 3.Semester / ECTS: 4</u><br>- Ramjan, S.; Sunkpho, J. (2025): Utilizing RapidMiner, Python, and R for Data Mining Applications, IGI Global<br>- Shmueli, G.; Bruce, G. C.; Deokar, A. V., Patel, N. R. (2023): Machine Learning for Business Analytics: Concepts, Techniques and Applications in RapidMiner, Wiley<br>- Mishra, A. (2019): Machine Learning in the AWS Cloud: Add Intelligence to Applications with Amazon SageMaker and Amazon Rekognition (Ed. 1), Wiley, Chichester (ISBN: 978-1119556718) |        |      |
|                            | <u>Trends in Data Science /ILV / LV-Nr: DPR.5 / 4.Semester / ECTS: 3</u><br>Aufgrund der Veränderlichkeit der Inhalte werden hier nur beispielhaft einige Web-Quellen angeführt, die derzeit im Bereich Data Science Trends stark vertreten sind:<br>- Medium (2020): Towards Data Science (Ed. 1), Online, <a href="https://towardsdatascience.com/">https://towardsdatascience.com/</a> .<br>- KDNuggets (2020): Knowledge Discovery Nuggets (Ed. 1), Online, <a href="https://www.kdnuggets.com/">https://www.kdnuggets.com/</a> .                                            |        |      |
|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |      |
| Acquisition of skills      | <u>Artificial Intelligence /ILV / LV-Nr: DPR.4 / 3.Semester / ECTS: 4</u><br>The participants: <ul style="list-style-type: none"> <li>• can describe different strategies for implementing artificially intelligent systems</li> <li>• can understand the advantages and disadvantages of the strategies they have studied and can identify their challenges</li> <li>• can develop strategies for designing artificially intelligent systems for practical use</li> </ul>                                                                                                       |        |      |
|                            | <u>Big Data Processing /ILV / LV-Nr: DPR.1 / 3.Semester / ECTS: 4</u><br>The participants: <ul style="list-style-type: none"> <li>• can identify the particular challenges that arise in storing and processing large volumes of data (V model: volume, variety, velocity, veracity)</li> <li>• can identify ways to address these challenges (systems from the respective areas of the V model are discussed here as examples).</li> <li>• can develop and apply appropriate solutions themselves with a view to a specific problem</li> </ul>                                  |        |      |
|                            | <u>Data Visualization &amp; Visual Analytics /ILV / LV-Nr: DPR.3 / 3.Semester / ECTS: 4</u><br>The participants: <ul style="list-style-type: none"> <li>• can describe data visualization as well as visual communication</li> <li>• can independently develop visualizations and use them for communication purposes</li> <li>• can work with various visualization tools and libraries to present data and analysis results in a meaningful way</li> </ul>                                                                                                                     |        |      |
|                            | <u>No-Code &amp; Low-Code Analysis Platforms /ILV / LV-Nr: DPR.2 / 3.Semester / ECTS: 4</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        |      |
|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |      |

|  |                                                                                                                                                                                                                                                                                                            |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>The participants:</p> <ul style="list-style-type: none"><li>• can identify various application-oriented analysis platforms (e.g., KNIME, RapidMiner, Grafana)</li><li>• can compare the analysis platforms they have learned about with regard to their suitability for a particular use case</li></ul> |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Acquisition of skills         | <ul style="list-style-type: none"> <li>• can implement initial applications using the presented platforms</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                               | <p><u>Trends in Data Science /ILV / LV-Nr: DPR.5 / 4.Semester / ECTS: 3</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can describe current thematic trends in the field of data science</li> <li>• can describe current technological developments in the field of data science</li> <li>• can discuss current practical questions in the field of data science</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Course contents               | <p><u>Artificial Intelligence /ILV / LV-Nr: DPR.4 / 3.Semester / ECTS: 4</u></p> <p>The following topics are covered in the course:</p> <ul style="list-style-type: none"> <li>- Reasoning approaches (goal trees, rule-based expert systems)</li> <li>- Search approaches (depth-first, hill climbing, beam, optimal, branch and bound, A*, games, minimax, and alpha-beta)</li> <li>- Constraint approaches (search, domain reduction, visual object recognition)</li> <li>- Learning approaches (neural nets, back propagation, genetic algorithms, sparse spaces, phonology, near misses, felicity conditions, support vector machines, boosting)</li> <li>- Representation approaches (classes, trajectories, transitions)</li> <li>- Applications of artificial intelligence in various contexts</li> <li>- Weak versus strong artificial intelligence</li> </ul> |
|                               | <p><u>Big Data Processing /ILV / LV-Nr: DPR.1 / 3.Semester / ECTS: 4</u></p> <p>Students are introduced to the fundamental characteristics of big data. Particular attention is paid to how such data is handled, and the knowledge acquired is reinforced through examples. To solve big data problems, suitable frameworks are presented and worked on in interactive workshops using case studies. Examples of these include:</p> <ul style="list-style-type: none"> <li>- Apache Hadoop</li> <li>- Apache Spark</li> <li>- Apache Flink</li> <li>- Apache Storm</li> <li>- Apache Samza</li> <li>- Apache Kafka</li> </ul> <p>These frameworks are explained and applied using case examples. The centrally provided data labs can be used for this purpose.</p>                                                                                                    |
|                               | <p><u>Data Visualization &amp; Visual Analytics /ILV / LV-Nr: DPR.3 / 3.Semester / ECTS: 4</u></p> <p>The following topics are covered in the course:</p> <ul style="list-style-type: none"> <li>- Analysis tools with a visual focus, e.g., BI tools such as MS Power BI, Tableau, QlikView</li> <li>- Visualization libraries, e.g., matplotlib.pyplot, ggplot2</li> <li>- Principles of visual communication, e.g., Hichert SUCCESS</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                               | <p><u>No-Code &amp; Low-Code Analysis Platforms /ILV / LV-Nr: DPR.2 / 3.Semester / ECTS: 4</u></p> <p>The following topics are covered in the course:</p> <ul style="list-style-type: none"> <li>- Presentation of various application-oriented analysis platforms (e.g., KNIME, RapidMiner, Grafana)</li> <li>- Presentation of various cloud solutions for data analysis (e.g., Google Cloud, AWS, Azure)</li> <li>- Applying the presented platforms using example analysis datasets</li> <li>- Discussion of the various approaches</li> </ul>                                                                                                                                                                                                                                                                                                                      |
|                               | <p><u>Trends in Data Science /ILV / LV-Nr: DPR.5 / 4.Semester / ECTS: 3</u></p> <p>The content of this course is not fixed but is adapted to the trends currently prevailing. Exemplary topics may include:</p> <ul style="list-style-type: none"> <li>- New technologies in the field of big data processing</li> <li>- Trends in programming languages for data analysis</li> <li>- New data processing concepts (e.g., data lake)</li> <li>- New research questions in the field of data science</li> <li>- New questions arising in data science practice</li> </ul>                                                                                                                                                                                                                                                                                                |
| Teaching and learning methods | <p><u>Artificial Intelligence /ILV / LV-Nr: DPR.4 / 3.Semester / ECTS: 4</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Interactive workshop</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                               | <p><u>Big Data Processing /ILV / LV-Nr: DPR.1 / 3.Semester / ECTS: 4</u></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

|  |                                                                                                                                                                                                                                                                               |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Group work</li> <li>- Interactive workshop</li> </ul>                                                                                                      |
|  | <p><u>Data Visualization &amp; Visual Analytics /ILV / LV-Nr: DPR.3 / 3.Semester / ECTS: 4</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Interactive workshop</li> <li>- Case studies</li> </ul> |

|                               |                                                                                                                                                                                                                          |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching and learning methods | <u>No-Code &amp; Low-Code Analysis Platforms /ILV / LV-Nr: DPR.2 / 3.Semester / ECTS: 4</u><br>The following methods are used:<br>- Lecture with discussion<br>- Working on practice exercises<br>- Interactive workshop |
|                               | <u>Trends in Data Science /ILV / LV-Nr: DPR.5 / 4.Semester / ECTS: 3</u><br>The following methods are used:<br>- Lecture with discussion<br>- Interactive workshop                                                       |
| Evaluation Methods Criteria   | <u>Artificial Intelligence /ILV / LV-Nr: DPR.4 / 3.Semester / ECTS: 4</u><br>Written exam                                                                                                                                |
|                               | <u>Big Data Processing /ILV / LV-Nr: DPR.1 / 3.Semester / ECTS: 4</u><br>Written exam                                                                                                                                    |
|                               | <u>Data Visualization &amp; Visual Analytics /ILV / LV-Nr: DPR.3 / 3.Semester / ECTS: 4</u><br>Written exam or seminar paper                                                                                             |
|                               | <u>No-Code &amp; Low-Code Analysis Platforms /ILV / LV-Nr: DPR.2 / 3.Semester / ECTS: 4</u><br>Written exam or seminar paper                                                                                             |
|                               | <u>Trends in Data Science /ILV / LV-Nr: DPR.5 / 4.Semester / ECTS: 3</u><br>Seminar paper                                                                                                                                |

| Module number:                | Master's Thesis & Scientific Work                                                                                                                                                                                                                                                                                                                                                                                                                                       | Scope: |      |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
| MWA                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 26     | ECTS |
| Degree program                | University of Applied Sciences Master's Program Data Science & Intelligent Analytics full-time                                                                                                                                                                                                                                                                                                                                                                          |        |      |
| Position in the curriculum    | 3. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |
|                               | 4. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |
| Level                         | 3. Semester: Master's degree program / 4. Semester: Master's degree program                                                                                                                                                                                                                                                                                                                                                                                             |        |      |
| Previous knowledge            | 3. Semester: No prerequisites<br>/ 4. Semester: No prerequisites                                                                                                                                                                                                                                                                                                                                                                                                        |        |      |
| Blocked                       | no                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        |      |
| Participant group             | Bachelor graduates, beginners                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |      |
| Literature recommendation     | <u>Master Thesis Colloquium /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 2</u><br>PRIMÄRLITERATUR:<br>- Franck, N. (2007): Handbuch Wissenschaftliches Arbeiten (Ed. 2), Fischer Taschenbuch Verlag, Frankfurt am Main (ISBN: 978-3596151868)                                                                                                                                                                                                                                |        |      |
|                               | <u>Master Thesis /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 22</u><br>PRIMÄRLITERATUR:<br>- Franck, N. (2007): Handbuch Wissenschaftliches Arbeiten (Ed. 2), Fischer Taschenbuch Verlag, Frankfurt am Main (ISBN: 978-3596151868)                                                                                                                                                                                                                                          |        |      |
|                               | <u>Research Methods &amp; Methodology /SE / LV-Nr: MWA.1 / 3.Semester / ECTS: 2</u><br>PRIMÄRLITERATUR:<br>- Poser, H. (2001): Wissenschaftstheorie. Eine philosophische Einführung (Ed. 1), Reclam, Dithingen (ISBN: 978-3150181256)<br><br>SEKUNDÄRLITERATUR:<br>- Franck, N. (2017): Handbuch Wissenschaftliches Arbeiten (Ed. 3), Fischer Taschenbuch Verlag, Frankfurt am Main (ISBN: 978-3825247485)                                                              |        |      |
| Acquisition of skills         | <u>Master Thesis Colloquium /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 2</u><br>The participants: <ul style="list-style-type: none"> <li>• can describe the process of an academic review</li> <li>• can present results to an academic community</li> <li>• can critically examine academic findings</li> </ul>                                                                                                                                                           |        |      |
|                               | <u>Master Thesis /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 22</u><br>The participants: <ul style="list-style-type: none"> <li>• can independently write a master's thesis in the field of data science</li> <li>• can independently set up and carry out an academic project</li> </ul>                                                                                                                                                                                   |        |      |
|                               | <u>Research Methods &amp; Methodology /SE / LV-Nr: MWA.1 / 3.Semester / ECTS: 2</u><br>The participants: <ul style="list-style-type: none"> <li>• can describe the rules according to which academic work functions</li> <li>• can apply these rules to a specific project</li> <li>• can write a research proposal, aligning the research problem, research question, and methodological approach with one another</li> </ul>                                          |        |      |
| Course contents               | <u>Master Thesis Colloquium /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 2</u><br>The course supports students in designing and preparing their master's thesis. In the colloquium, the research question/hypothesis and the structure of the master's thesis are therefore presented and discussed. In addition, the academic methodology of the master's thesis is examined and critically reviewed, and guidance on the formal design of the master's thesis is provided. |        |      |
|                               | <u>Master Thesis /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 22</u><br>Students independently develop a project idea for their own master's thesis, describe it in the form of a proposal, and submit it to the program director for approval. Students then work on the topic and write a master's thesis, which is submitted for assessment.                                                                                                                              |        |      |
|                               | <u>Research Methods &amp; Methodology /SE / LV-Nr: MWA.1 / 3.Semester / ECTS: 2</u><br>Students are introduced to the fields of philosophy of science and academic work. The objectives of academic work are discussed and applied to students' own research problems. Within the course, students thus develop an initial draft proposal for a master's thesis.                                                                                                        |        |      |
| Teaching and learning methods | <u>Master Thesis Colloquium /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 2</u>                                                                                                                                                                                                                                                                                                                                                                                               |        |      |

|  |                                                                                                                                                                                                                  |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | The following methods are used:                                                                                                                                                                                  |
|  | <ul style="list-style-type: none"> <li>- Interactive workshop</li> <li>- Lecture with discussion</li> </ul>                                                                                                      |
|  | <u>Master Thesis /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 22</u><br>The following methods are used:<br><ul style="list-style-type: none"> <li>- Coaching during the preparation of the master's thesis</li> </ul> |

|                               |                                                                                                                                                                               |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching and learning methods | <u>Research Methods &amp; Methodology /SE / LV-Nr: MWA.1 / 3.Semester / ECTS: 2</u><br>The following methods are used:<br>- Lecture with discussion<br>- Interactive workshop |
| Evaluation Methods Criteria   | <u>Master Thesis Colloquium /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 2</u><br>Presentation                                                                                     |
|                               | <u>Master Thesis /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 22</u><br>Master's thesis                                                                                            |
|                               | <u>Research Methods &amp; Methodology /SE / LV-Nr: MWA.1 / 3.Semester / ECTS: 2</u><br>Report                                                                                 |

## 2.3.2 Module descriptions part-time

| Module number:<br>SDDE     | Software Development & Data Engineering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Scope: |      |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 26.0   | ECTS |
| Degree program             | University of Applied Sciences Master's Program Data Science & Intelligent Analytics part-time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |      |
| Position in the curriculum | 1. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |
|                            | 2. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |
| Level                      | 1. Semester: Master's program / 2. Semester: Master's program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |      |
| Previous knowledge         | <p>1. Semester: Students have prior knowledge in the field of information technology amounting to 6 ECTS and are therefore familiar with simple programming concepts (e.g. variables, branches, loops) as well as typical programming approaches (e.g. functional programming). / 1. Semester: Students have prior knowledge in the field of information technology amounting to 6 ECTS and are therefore familiar with the concept of the relational database and can read simple SQL queries. / 2. Semester: 1st semester: Students have prior knowledge in the field of information technology amounting to 6 ECTS and are therefore familiar with the concept of the relational database and can read simple SQL queries. / 1st semester: Students have prior knowledge in the field of information technology amounting to 6 ECTS and are therefore familiar with simple programming concepts (e.g. variables, branches, loops) as well as typical programming approaches (e.g. functional programming). / 2nd semester: Module examination SDDE.A1 (Software Development 1) / 2. Semester: 1st semester: Students have prior knowledge in the field of information technology amounting to 6 ECTS and are therefore familiar with the concept of the relational database and can read simple SQL queries. / 1st semester: Students have prior knowledge in the field of information technology amounting to 6 ECTS and are therefore familiar with simple programming concepts (e.g. variables, branches, loops) as well as typical programming approaches (e.g. functional programming). / 2nd semester: Module examination SDDE.A1 (Software Development 1)</p> |        |      |
| Blocked                    | no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        |      |
| Participant group          | Bachelor graduates, beginners                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |      |
| Literature recommendation  | <u>Data Engineering /ILV / LV-Nr: SDDE.1 / 1.Semester / ECTS: 4</u><br>- Kleppmann, M. (2017): Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems (Ed. 1), O'Reilly Media, Farnham (ISBN: 978-1449373320)<br>- Daniel, K. (2026): NoSQL Handbook for Modern Developers: A Practical Guide to Build, Scale, and Secure Cloud-Native Applications, Independently published (ISBN: 979-8245616483)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |      |
|                            | <u>Data Engineering Lab /UE / LV-Nr: SDDE.3 / 1.Semester / ECTS: 5</u><br>- Kleppmann, M. (2017): Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems (Ed. 1), O'Reilly Media, Farnham (ISBN: 978-1449373320)<br>- Daniel, K. (2026): NoSQL Handbook for Modern Developers: A Practical Guide to Build, Scale, and Secure Cloud-Native Applications, Independently published (ISBN: 979-8245616483)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |      |
|                            | <u>Software Development 1 /ILV / LV-Nr: SDDE.2 / 1.Semester / ECTS: 6</u><br>- Lutz, M (2025): Learning Python, O'Reilly (ISBN: 978-1098171308)<br>- Sommerville, I. (2015): Software Engineering, Global Edition (Ed. 10), Pearson Education, London (ISBN: 978-1292096131)<br>- Williams, L.; Zimmermann, T. (2016): Perspectives on Data Science for Software Engineering (Ed. 1), Morgan Kaufmann, Burlington (ISBN: 978-0128042069)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |      |
|                            | <u>Software Development 1 Lab /UE / LV-Nr: SDDE.4 / 1.Semester / ECTS: 2.5</u><br>- Lutz, M (2025): Learning Python, O'Reilly (ISBN: 978-1098171308)<br>- Sommerville, I. (2015): Software Engineering, Global Edition (Ed. 10), Pearson Education, London (ISBN: 978-1292096131)<br>- Williams, L.; Zimmermann, T. (2016): Perspectives on Data Science for Software Engineering (Ed. 1), Morgan Kaufmann, Burlington (ISBN: 978-0128042069)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |      |
|                            | <u>Software Development 2 /ILV / LV-Nr: SDDE.5 / 2.Semester / ECTS: 6</u><br>- Lutz, M (2025): Learning Python, O'Reilly (ISBN: 978-1098171308)<br>- Sommerville, I. (2015): Software Engineering, Global Edition (Ed. 10), Pearson Education, London (ISBN: 978-1292096131)<br>- Williams, L.; Zimmermann, T. (2016): Perspectives on Data Science for Software Engineering (Ed. 1), Morgan Kaufmann, Burlington (ISBN: 978-0128042069)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |      |
|                            | <u>Software Development 2 Lab /UE / LV-Nr: SDDE.6 / 2.Semester / ECTS: 2.5</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |      |

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                       | <ul style="list-style-type: none"> <li>- Lutz, M (2025): Learning Python, O'Reilly (ISBN: 978-1098171308)</li> <li>- Sommerville, I. (2015): Software Engineering, Global Edition (Ed. 10), Pearson Education, London (ISBN: 978-1292096131)</li> <li>- Williams, L.; Zimmermann, T. (2016): Perspectives on Data Science for Software Engineering (Ed. 1), Morgan Kaufmann, Burlington (ISBN: 978-0128042069)</li> </ul>                                                                                |
| Acquisition of skills | <p><u>Data Engineering /ILV / LV-Nr: SDDE.1 / 1.Semester / ECTS: 4</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can describe different, advanced data storage concepts (e.g. NoSQL databases, distributed databases, etc.)</li> <li>• can compare and select data storage concepts in terms of their suitability for projects</li> <li>• can describe the special requirements for data storage that arise from the use of very large volumes of data (big data)</li> </ul> |
|                       | <p><u>Data Engineering Lab /UE / LV-Nr: SDDE.3 / 1.Semester / ECTS: 5</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can implement storage concepts themselves in the context of a specific problem</li> <li>• can design the implementation of these systems with a view to scalability and operational requirements</li> </ul>                                                                                                                                              |

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Acquisition of skills | <p><u>Software Development 1 /ILV / LV-Nr: SDDE.2 / 1.Semester / ECTS: 6</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can apply the basic concepts of software development (e.g. object orientation, functional programming, etc.) that are frequently used in the field of data science</li> <li>• can apply the concepts they have learned in software development environments commonly used in data analysis (e.g. in Python)</li> <li>• can name the common tools used in software development in data science</li> <li>• can design basic applications in order to automate basic functionalities</li> <li>• can implement the applications they have designed independently</li> </ul>                                                                   |
|                       | <p><u>Software Development 1 Lab /UE / LV-Nr: SDDE.4 / 1.Semester / ECTS: 2.5</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can implement basic application concepts independently</li> <li>• can develop basic application concepts and put them into an implementable form</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                       | <p><u>Software Development 2 /ILV / LV-Nr: SDDE.5 / 2.Semester / ECTS: 6</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can apply advanced concepts of software development (e.g. pipelines, testing, etc.) that are frequently used in the field of data science</li> <li>• can describe the use of the concepts they have learned in software development environments commonly used in data analysis (e.g. in Python)</li> <li>• can design advanced applications in order to automate basic functionalities</li> <li>• can implement the applications they have designed independently</li> </ul>                                                                                                                                                             |
|                       | <p><u>Software Development 2 Lab /UE / LV-Nr: SDDE.6 / 2.Semester / ECTS: 2.5</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can implement advanced application concepts independently</li> <li>• can develop advanced application concepts and put them into an implementable form</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Course contents       | <p><u>Data Engineering /ILV / LV-Nr: SDDE.1 / 1.Semester / ECTS: 4</u></p> <p>The following topics are discussed in the course:</p> <ul style="list-style-type: none"> <li>- Characteristics of high-performance data systems (scalability, maintainability, reliability)</li> <li>- Established concepts of data storage (relational model)</li> <li>- Historical concepts of data storage (hierarchical model, network model)</li> <li>- Modern concepts of data storage (wide-column model, graph model, key-value model, document model, column-oriented model)</li> <li>- Database systems matching the models covered</li> <li>- Scaling of data systems (replication and partitioning)</li> <li>- Writing and reading in data systems (index structures, write strategies)</li> </ul> |
|                       | <p><u>Data Engineering Lab /UE / LV-Nr: SDDE.3 / 1.Semester / ECTS: 5</u></p> <p>The following topics are discussed in the course:</p> <ul style="list-style-type: none"> <li>- Design and implementation of problem-centered NoSQL databases (e.g. key-value stores, document stores, column-oriented data stores, etc.)</li> <li>- Design and implementation of storage solutions for large volumes of data (big data)</li> </ul>                                                                                                                                                                                                                                                                                                                                                          |
|                       | <p><u>Software Development 1 /ILV / LV-Nr: SDDE.2 / 1.Semester / ECTS: 6</u></p> <p>The following topics are discussed in the course:</p> <ul style="list-style-type: none"> <li>- The process of software engineering and project management for data-intensive applications</li> <li>- Programming paradigms for use in the field of data science</li> <li>- Effective and efficient data structures for data-intensive applications</li> <li>- Tools and software ecosystems for developing and testing data-intensive software systems</li> </ul>                                                                                                                                                                                                                                        |
|                       | <p><u>Software Development 1 Lab /UE / LV-Nr: SDDE.4 / 1.Semester / ECTS: 2.5</u></p> <p>In the lab, the content of the integrated lecture "Software Development 1" is deepened through practical exercises. The insights gained are discussed in the group and thus allow a deep understanding of the subject matter and a consolidation of the knowledge that was conveyed theoretically in the integrated lecture.</p>                                                                                                                                                                                                                                                                                                                                                                    |
|                       | <p><u>Software Development 2 /ILV / LV-Nr: SDDE.5 / 2.Semester / ECTS: 6</u></p> <p>The following topics are discussed in the course:</p> <ul style="list-style-type: none"> <li>- Architecture models for data-driven software development and systems.</li> <li>- Integration models and paradigms for implementing complex, process-oriented software ecosystems for analytical and data-driven systems</li> <li>- Application of proven design patterns for data-driven applications</li> <li>- Design and implementation of efficient and scalable software systems for data-driven applications</li> <li>- Testing of software applications (e.g. unit tests, integration tests, etc.)</li> </ul>                                                                                      |

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               | <p><u>Software Development 2 Lab /UE / LV-Nr: SDDE.6 / 2.Semester / ECTS: 2.5</u></p> <p>In the lab, the content of the integrated lecture "Software Development 2" is deepened through practical exercises. The insights gained are discussed in the group and thus allow a deep understanding of the subject matter and a consolidation of the knowledge that was conveyed theoretically in the integrated lecture.</p> |
| Teaching and learning methods | <p><u>Data Engineering /ILV / LV-Nr: SDDE.1 / 1.Semester / ECTS: 4</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Working through practice exercises</li> <li>- Interactive workshop</li> </ul>                                                                                                                                               |

|                               |                                                                                                                                                                                                             |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching and learning methods | <u>Data Engineering Lab /UE / LV-Nr: SDDE.3 / 1.Semester / ECTS: 5</u><br>The following methods are used:<br>- Working through practice exercises<br>- Lecture with discussion                              |
|                               | <u>Software Development 1 /ILV / LV-Nr: SDDE.2 / 1.Semester / ECTS: 6</u><br>The following methods are used:<br>- Lecture with discussion<br>- Working through practice exercises<br>- Interactive workshop |
|                               | <u>Software Development 1 Lab /UE / LV-Nr: SDDE.4 / 1.Semester / ECTS: 2.5</u><br>The following methods are used:<br>- Lecture with discussion<br>- Working through practice exercises                      |
|                               | <u>Software Development 2 /ILV / LV-Nr: SDDE.5 / 2.Semester / ECTS: 6</u><br>The following methods are used:<br>- Lecture with discussion<br>- Working through practice exercises<br>- Interactive workshop |
|                               | <u>Software Development 2 Lab /UE / LV-Nr: SDDE.6 / 2.Semester / ECTS: 2.5</u><br>The following methods are used:<br>- Working through practice exercises<br>- Interactive workshop                         |
| Evaluation Methods Criteria   | <u>Data Engineering /ILV / LV-Nr: SDDE.1 / 1.Semester / ECTS: 4</u><br>Written exam                                                                                                                         |
|                               | <u>Data Engineering Lab /UE / LV-Nr: SDDE.3 / 1.Semester / ECTS: 5</u><br>Term paper<br>Project                                                                                                             |
|                               | <u>Software Development 1 /ILV / LV-Nr: SDDE.2 / 1.Semester / ECTS: 6</u><br>Written exam                                                                                                                   |
|                               | <u>Software Development 1 Lab /UE / LV-Nr: SDDE.4 / 1.Semester / ECTS: 2.5</u><br>Term paper<br>Project                                                                                                     |
|                               | <u>Software Development 2 /ILV / LV-Nr: SDDE.5 / 2.Semester / ECTS: 6</u><br>Written exam                                                                                                                   |
|                               | <u>Software Development 2 Lab /UE / LV-Nr: SDDE.6 / 2.Semester / ECTS: 2.5</u><br>Term paper<br>Project                                                                                                     |

| Module number:             | Machine Learning & Algorithmic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Scope: |      |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
| MLAL                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 27.0   | ECTS |
| Degree program             | University of Applied Sciences Master's Program Data Science & Intelligent Analytics part-time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |      |
| Position in the curriculum | 1. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |      |
|                            | 2. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |      |
| Level                      | 1. Semester: Master's program / 2. Semester: Master's program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |
| Previous knowledge         | 1. Semester: Students have prior knowledge in mathematics/statistics amounting to 8 ECTS and are therefore familiar with simple statistical measures as well as basic statistical test procedures (e.g. t-test). / 2. Semester: 1st semester: Students have prior knowledge in mathematics/statistics amounting to 8 ECTS and are therefore familiar with simple statistical measures as well as basic statistical test procedures (e.g. t-test). / 2nd semester: No prerequisites / 2nd semester: Module examination MLAL.A1 (Algorithms 1) / 2. Semester: Module examination MLAL.A1 (Algorithms 1) |        |      |
| Blocked                    | no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |      |
| Participant group          | Bachelor graduates, beginners                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |
| Literature recommendation  | <u>Machine Learning &amp; Deep Learning (E) /ILV / LV-Nr: MLAL.3 / 2.Semester / ECTS: 10</u><br>- James, G.; Witten, D; Hastie, T.; Tibshirani, R. (2023). An Introduction to Statistical Learning: with Applications with Python (ISBN: 978-3031387463)<br>- Bruce. P.; Bruce, A.; Gedeck, P. (2020): Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python (ISBN: 978-1492072942)<br>- Geron, A. (2022): Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, (ISBN: 978-1098125974)     |        |      |
|                            | <u>Statistical Learning 1 /ILV / LV-Nr: MLAL.1 / 1.Semester / ECTS: 6</u><br>- James, G.; Witten, D; Hastie, T.; Tibshirani, R. (2023). An Introduction to Statistical Learning: with Applications with Python (ISBN: 978-3031387463)<br>- Bruce. P.; Bruce, A.; Gedeck, P. (2020): Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python (ISBN: 978-1492072942)<br>- Geron, A. (2022): Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, (ISBN: 978-1098125974)                        |        |      |
|                            | <u>Statistical Learning 1 Lab /UE / LV-Nr: MLAL.2 / 1.Semester / ECTS: 2.5</u><br>- James, G.; Witten, D; Hastie, T.; Tibshirani, R. (2023). An Introduction to Statistical Learning: with Applications with Python (ISBN: 978-3031387463)<br>- Bruce. P.; Bruce, A.; Gedeck, P. (2020): Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python (ISBN: 978-1492072942)<br>- Geron, A. (2022): Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, (ISBN: 978-1098125974)                   |        |      |
|                            | <u>Statistical Learning 2 /ILV / LV-Nr: MLAL.5 / 2.Semester / ECTS: 6</u><br>- James, G.; Witten, D; Hastie, T.; Tibshirani, R. (2023). An Introduction to Statistical Learning: with Applications with Python (ISBN: 978-3031387463)<br>- Bruce. P.; Bruce, A.; Gedeck, P. (2020): Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python (ISBN: 978-1492072942)<br>- Geron, A. (2022): Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, (ISBN: 978-1098125974)                        |        |      |
|                            | <u>Statistical Learning 2 Lab /UE / LV-Nr: MLAL.6 / 2.Semester / ECTS: 2.5</u><br>- James, G.; Witten, D; Hastie, T.; Tibshirani, R. (2023). An Introduction to Statistical Learning: with Applications with Python (ISBN: 978-3031387463)<br>- Bruce. P.; Bruce, A.; Gedeck, P. (2020): Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python (ISBN: 978-1492072942)<br>- Geron, A. (2022): Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, (ISBN: 978-1098125974)                   |        |      |
| Acquisition of skills      | <u>Machine Learning &amp; Deep Learning (E) /ILV / LV-Nr: MLAL.3 / 2.Semester / ECTS: 10</u><br>The participants:<br><ul style="list-style-type: none"> <li>• can name the tools (e.g. libraries, cloud platforms or software tools) that can be used to support machine learning</li> <li>• can compare the tools they have learned about in terms of their suitability for specific problems</li> <li>• can design end-to-end machine learning projects</li> <li>• can carry out end-to-end machine learning projects independently</li> </ul>                                                      |        |      |

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               | <u>Statistical Learning 1 /ILV / LV-Nr: MLAL.1 / 1.Semester / ECTS: 6</u><br>The participants: <ul style="list-style-type: none"> <li>• can describe how basic algorithms in the field of data science work</li> <li>• can understand the statistical concepts and working methods behind the algorithms covered</li> <li>• can select suitable algorithms for given problems</li> <li>• can name the data structures, runtime characteristics and complexity classes required by the algorithms covered</li> <li>• can apply the algorithms covered to isolated problems</li> </ul>                                                                                                                                                          |
|                               | <u>Statistical Learning 1 Lab /UE / LV-Nr: MLAL.2 / 1.Semester / ECTS: 2.5</u><br>The participants: <ul style="list-style-type: none"> <li>• can practically follow the workings of basic data science algorithms</li> <li>• can configure basic data science algorithms for specific purposes</li> <li>• can apply the algorithms covered to isolated problems</li> </ul>                                                                                                                                                                                                                                                                                                                                                                    |
|                               | <u>Statistical Learning 2 /ILV / LV-Nr: MLAL.5 / 2.Semester / ECTS: 6</u><br>The participants: <ul style="list-style-type: none"> <li>• can practically follow the workings of advanced data science algorithms</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Acquisition of skills         | <ul style="list-style-type: none"> <li>• can configure advanced data science algorithms for specific purposes</li> <li>• can apply the algorithms covered to isolated problems</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                               | <u>Statistical Learning 2 Lab /UE / LV-Nr: MLAL.6 / 2.Semester / ECTS: 2.5</u><br>The participants: <ul style="list-style-type: none"> <li>• can practically follow the workings of advanced data science algorithms</li> <li>• can configure advanced data science algorithms for specific purposes</li> <li>• can apply the algorithms covered to isolated problems</li> </ul>                                                                                                                                                                                                                                                                                                                                                              |
| Course contents               | <u>Machine Learning &amp; Deep Learning (E) /ILV / LV-Nr: MLAL.3 / 2.Semester / ECTS: 10</u><br>The following topics are discussed in the course: <ul style="list-style-type: none"> <li>- Classic neural networks as a complement to classic data science algorithms (e.g. Random Forests, SCM, etc.)</li> <li>- Convolutional artificial neural networks (CNN)</li> <li>- Recurrent artificial neural networks (RNN, LSTM)</li> <li>- Advanced artificial neural networks (GAN, FARM, BERT, CGAN, etc.)</li> </ul> The types of networks discussed are subject to constant change. For this reason, only a few network types are named here as examples. In particular, current network types are also discussed and applied in the course. |
|                               | <u>Statistical Learning 1 /ILV / LV-Nr: MLAL.1 / 1.Semester / ECTS: 6</u><br>The following topics are discussed in the course: <ul style="list-style-type: none"> <li>- Statistical measures (point and interval estimators)</li> <li>- Statistical test procedures</li> <li>- Grouping algorithms (classification trees, agglomerative hierarchical clustering, etc.)</li> <li>- Regression algorithms (regression trees, random forests, etc.)</li> <li>- Associative algorithms</li> <li>- Data preprocessing procedures (e.g. principal component analysis)</li> </ul>                                                                                                                                                                    |
|                               | <u>Statistical Learning 1 Lab /UE / LV-Nr: MLAL.2 / 1.Semester / ECTS: 2.5</u><br>In the lab, the content of the integrated lecture "Statistical Learning 1" is deepened through practical exercises. The insights gained are discussed in the group and thus allow a deep understanding of the subject matter and a consolidation of the knowledge that was conveyed theoretically in the integrated lecture.                                                                                                                                                                                                                                                                                                                                |
|                               | <u>Statistical Learning 2 /ILV / LV-Nr: MLAL.5 / 2.Semester / ECTS: 6</u><br>The following topics are discussed in the course: <ul style="list-style-type: none"> <li>- advanced modeling procedures</li> <li>- Ensemble methods</li> <li>- Optimization of models</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                               | <u>Statistical Learning 2 Lab /UE / LV-Nr: MLAL.6 / 2.Semester / ECTS: 2.5</u><br>In the lab, the content of the integrated lecture "Statistical Learning 2" is deepened through practical exercises. The insights gained are discussed in the group and thus allow a deep understanding of the subject matter and a consolidation of the knowledge that was conveyed theoretically in the integrated lecture.                                                                                                                                                                                                                                                                                                                                |
| Teaching and learning methods | <u>Machine Learning &amp; Deep Learning (E) /ILV / LV-Nr: MLAL.3 / 2.Semester / ECTS: 10</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

|                             |                                                                                                                                                                                                                                                                                   |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                             | <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Working through practice exercises</li> <li>- Interactive workshop</li> </ul>                                                                                                                     |
|                             | <p><u>Statistical Learning 1 /ILV / LV-Nr: MLAL.1 / 1.Semester / ECTS: 6</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Working through practice exercises</li> <li>- Interactive workshop</li> </ul> |
|                             | <p><u>Statistical Learning 1 Lab /UE / LV-Nr: MLAL.2 / 1.Semester / ECTS: 2.5</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Working through practice exercises</li> <li>- Interactive workshop</li> </ul>                               |
|                             | <p><u>Statistical Learning 2 /ILV / LV-Nr: MLAL.5 / 2.Semester / ECTS: 6</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Working through practice exercises</li> <li>- Interactive workshop</li> </ul> |
|                             | <p><u>Statistical Learning 2 Lab /UE / LV-Nr: MLAL.6 / 2.Semester / ECTS: 2.5</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Working through practice exercises</li> <li>- Interactive workshop</li> </ul>                               |
|                             | <p><u>Machine Learning &amp; Deep Learning (E) /ILV / LV-Nr: MLAL.3 / 2.Semester / ECTS: 10</u></p> <p>Portfolio</p>                                                                                                                                                              |
| Evaluation Methods Criteria | <p><u>Statistical Learning 1 /ILV / LV-Nr: MLAL.1 / 1.Semester / ECTS: 6</u></p> <p>Written exam</p>                                                                                                                                                                              |

|                             |                                                                                                         |
|-----------------------------|---------------------------------------------------------------------------------------------------------|
| Evaluation Methods Criteria | <u>Statistical Learning 1 Lab /UE / LV-Nr: MLAL.2 / 1.Semester / ECTS: 2.5</u><br>Term paper<br>Project |
|                             | <u>Statistical Learning 2 /ILV / LV-Nr: MLAL.5 / 2.Semester / ECTS: 6</u><br>Written exam               |
|                             | <u>Statistical Learning 2 Lab /UE / LV-Nr: MLAL.6 / 2.Semester / ECTS: 2.5</u><br>Term paper<br>Project |

| Module number:             | Management for Data Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Scope: |      |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
| MDS                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 19     | ECTS |
| Degree program             | University of Applied Sciences Master's Program Data Science & Intelligent Analytics part-time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |      |
| Position in the curriculum | 1. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |      |
|                            | 2. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |      |
|                            | 3. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |      |
| Level                      | 1. Semester: Master's program / 2. Semester: Master's program / 3. Semester: Master's program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |      |
| Previous knowledge         | 1. Semester: No prerequisites / 2. Semester: No prerequisites / 3. Semester: No prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |      |
| Blocked                    | no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      |
| Participant group          | Bachelor graduates, beginners                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |      |
| Literature recommendation  | <u>Data Science for Business &amp; Commerce /ILV / LV-Nr: MDS.5 / 3.Semester / ECTS: 4</u><br>- VanderPlas, J. (2023): Python Data Science Handbook: Essential Tools for Working with Data (Ed. 2), O'Reilly, (ISBN: 978-1098121228)<br>- Cady, F. (2017): The Data Science Handbook (Ed. 2), Wiley, Hoboken (ISBN: 978-1119092940)<br>- Saporta, G.; Maraney, S. (2022): Practical Fraud Prevention: Fraud and AML Analytics for Fintech and eCommerce, Using SQL and Python (Ed. 1), O'Reilly, (ISBN: 978-1492093329)<br>- Meier, A.; Stormer, H. (2012): eBusiness & eCommerce: Management der digitalen                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |      |
|                            | <u>Data Science for Engineering &amp; Natural Sciences (E) /ILV / LV-Nr: MDS.6 / 3.Semester / ECTS: 4</u><br>- VanderPlas, J. (2023): Python Data Science Handbook: Essential Tools for Working with Data (Ed. 2), O'Reilly, (ISBN: 978-1098121228)<br>- Cady, F. (2017): The Data Science Handbook (Ed. 2), Wiley, Hoboken (ISBN: 978-1119092940)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      |
|                            | <u>Leadership in the Team &amp; Project Management /ILV / LV-Nr: MDS.1 / 1.Semester / ECTS: 2</u><br>- Michels, B. (2017): Projektmanagement Handbuch (Ed. 3), CreateSpace Independent Publishing Platform, online (ISBN: 978-1545335482)<br>- Gellert, M.; Nowak, C. (2010): Teamarbeit, Teamentwicklung, Teambberatung: Ein Praxisbuch für die Arbeit in und mit Teams (Ed. 4), Limmer, C., Meezen (ISBN: 978-3928922135)<br>- Kerzner, H. (2017): Project Management: A Systems Approach to Planning, Scheduling, and Controlling (Ed. 12), Wiley, Weinheim (ISBN: 978-1119165354)                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |      |
|                            | <u>Practical Project /PT / LV-Nr: MDS.4 / 3.Semester / ECTS: 4</u><br>- Patzak, G.; Rattay, G. (2017): Projektmanagement: Projekte, Projektportfolios, Programme und projektorientierte Unternehmen (Ed. 7), Linde Verlag, Wien (ISBN: 978-3714303216)<br>- Schöneck, N. M.; Voß, W. (2013): Das Forschungsprojekt: Planung, Durchführung und Auswertung einer quantitativen Studie (Ed. 2), Springer VS, Wiesbaden (ISBN: 978-3531195018)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |      |
|                            | <u>Study Trip (E) /ILV / LV-Nr: MDS.2 / 2.Semester / ECTS: 3</u><br>- Dumetz, J; Trompenaars, F.; Dumetz, J.; Saginova, O.; Covey, S.; Hampden-Turner, S.; Woolliams, P.; Schmitz, J.; Foster, D.; Belbin, M; Schein, E. (2012): Cross-cultural management textbook: Lessons from the world leading experts in cross-cultural management (Ed. 1), CreateSpace Independent Publishing Platform, Delaware (ISBN: 978-1479159680)<br>- Beise, M. (2013): Lead Markets. Country-Specific Success Factors of the Global Diffusion of - Thomas, D. C. (2014): Cross-Cultural Management: Essential Concepts (Ed. 4), SAGE Publishing, Thousand Oaks (ISBN: 978-14112939560)                                                                                                                                                                                                                                                                                                                                                                                    |        |      |
|                            | <u>Systemic Innovation /ILV / LV-Nr: MDS.3 / 1.Semester / ECTS: 2</u><br>- Achouri C. (2015) Systemisches Management. In: Human Resources Management: Eine praxisbasierte Einführung. 2. Auflage, Gabler, Wiesbaden (ISBN: 978-3834947390).<br>- Bils, S.; Töpfer, G.L.: Exnovation und Innovation: Synergie von Ende und Anfang in Veränderungen (Systemisches Management)., Schäfer Poeschel, 2024<br>- Brenner, W.; Uebernickel, F. (2016) Design Thinking for Innovation: Research and Practice. 1. Auflage, Springer, Berlin (ISBN: 978-3319260983).<br>- Brown, T. (2019) Change by Design: how design thinking transforms organizations and inspires innovation. 2. Auflage, Harper Business, New York (ISBN: 978-3319260983).<br>- Orloff, M. A. (2012) Modern TRIZ: A Practical Course with EASyTRIZ Technology. 1. Auflage, Springer, Berlin (ISBN: 978-3642252174).<br>- Tidd, J.; Bessant, J. (2024) Managing Innovation: Integrating Technological, Market and Organizational Change. 8. Auflage, Wiley, Chichester (ISBN: 978-1118360637). |        |      |
| Acquisition of skills      | <u>Data Science for Business &amp; Commerce /ILV / LV-Nr: MDS.5 / 3.Semester / ECTS: 4</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |      |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>The participants:</p> <ul style="list-style-type: none"> <li>• can name basic areas of application for data collection, data storage, data analysis and data use in the context of business applications</li> <li>• can understand the particular challenges of this field of application and can describe established best practice methods in this area</li> <li>• can design and implement data-based applications in this area themselves, taking domain-specific requirements into account</li> </ul>                                                                                                                 |
|  | <p><u>Data Science for Engineering &amp; Natural Sciences (E) /ILV / LV-Nr: MDS.6 / 3.Semester / ECTS: 4</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can name basic areas of application for data collection, data storage, data analysis and data use in the context of scientific and technical applications</li> <li>• can understand the particular challenges of this field of application and can name established best practice methods in this area</li> <li>• can design and implement data-based applications in this area themselves, taking domain-specific requirements</li> </ul> |

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Acquisition of skills | into account                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                       | <u>Leadership in the Team &amp; Project Management /ILV / LV-Nr: MDS.1 / 1.Semester / ECTS: 2</u><br>The participants:<br><ul style="list-style-type: none"> <li>• can describe advanced methods and tools of project management and the management of data-driven products</li> <li>• can compare the project management methods and tools covered in terms of their suitability for specific projects</li> <li>• can apply the project management methods and tools in projects</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                            |
|                       | <u>Practical Project /PT / LV-Nr: MDS.4 / 3.Semester / ECTS: 4</u><br>The participants:<br><ul style="list-style-type: none"> <li>• can apply their knowledge from the first two semesters in a data-centered project</li> <li>• can structure and manage a data-centered project</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                       | <u>Study Trip (E) /ILV / LV-Nr: MDS.2 / 2.Semester / ECTS: 3</u><br>The participants:<br><ul style="list-style-type: none"> <li>• can describe the field-relevant discourse in the country concerned</li> <li>• can describe the cultural factors influencing the discipline of data science in the country concerned</li> <li>• can describe the influencing factors and discourse that affect the discipline of data science in the country concerned</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                       | <u>Systemic Innovation /ILV / LV-Nr: MDS.3 / 1.Semester / ECTS: 2</u><br>The participants:<br><ul style="list-style-type: none"> <li>• can describe basic concepts and methods from the subject areas of Systematic Inventive Thinking, systemic management and innovation management</li> <li>• can apply specific creativity techniques for generating innovations</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Course contents       | <u>Data Science for Business &amp; Commerce /ILV / LV-Nr: MDS.5 / 3.Semester / ECTS: 4</u><br>The following topics are discussed in the course:<br><ul style="list-style-type: none"> <li>- CRM at the strategic level</li> <li>- CRM in process management</li> <li>- CRM at the operational level (CRM software systems)</li> <li>- Operational CRM</li> <li>- Analytical CRM</li> <li>- Communicative CRM</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                       | <u>Data Science for Engineering &amp; Natural Sciences (E) /ILV / LV-Nr: MDS.6 / 3.Semester / ECTS: 4</u><br>The following sample topics are discussed in the course:<br><ul style="list-style-type: none"> <li>- Biology (e.g. genome research, medical diagnostic procedures, etc.)</li> <li>- Physics (e.g. object recognition through image data processing, etc.)</li> <li>- Chemistry (e.g. processing of data-intensive experiments, etc.)</li> <li>- Sustainability</li> <li>- Data-driven maintenance (e.g. predictive maintenance, digital twin)</li> <li>- Data-optimized product design (e.g. designing product properties using ANN)</li> <li>- Analysis of sensor data (e.g. obstacle detection, obstacle avoidance, prediction, etc.)</li> <li>- Cloud-based IoT systems (data storage and collection)</li> <li>- Sensor analysis via Raspberry Pi, Arduino, wireless systems</li> </ul> |
|                       | <u>Leadership in the Team &amp; Project Management /ILV / LV-Nr: MDS.1 / 1.Semester / ECTS: 2</u><br>The following topics are discussed in the course:<br><ul style="list-style-type: none"> <li>- Project management techniques (e.g. SCRUM)</li> <li>- Project management tools in the field of data science (e.g. GitLab)</li> <li>- Techniques for documenting requirements (e.g. Sophist)</li> <li>- Mechanisms of gender roles, bias and structural disadvantage, as well as practical approaches to gender-inclusive design of work and learning environments</li> <li>- Models and methods for workload and resource analysis (work-life balance)</li> </ul>                                                                                                                                                                                                                                    |
|                       | <u>Practical Project /PT / LV-Nr: MDS.4 / 3.Semester / ECTS: 4</u><br>In this course, students work on a real, data-centered project along the entire data value chain (from collecting the data through its integration and storage to analyzing and making the data usable). This allows them to try out the skills they built up in the first two semesters in a real setting and to gain new insights.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                       | <u>Study Trip (E) /ILV / LV-Nr: MDS.2 / 2.Semester / ECTS: 3</u><br>The following topics are discussed in the course:<br><ul style="list-style-type: none"> <li>- Intercultural competence</li> <li>- Discussion with representatives from the field</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                       | <u>Systemic Innovation /ILV / LV-Nr: MDS.3 / 1.Semester / ECTS: 2</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               | <p>The following topics are discussed in the course:</p> <ul style="list-style-type: none"> <li>- Developing a holistic understanding of the subject areas (systemic management)</li> <li>- Methods for generating innovative ideas (e.g. Systematic Inventive Thinking, Design Thinking)</li> <li>- Project structures and management methods for the practical implementation of innovations (e.g. change management, conflict management)</li> <li>- IT-supported project documentation</li> </ul> |
| Teaching and learning methods | <p><u>Data Science for Business &amp; Commerce /ILV / LV-Nr: MDS.5 / 3.Semester / ECTS: 4</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Interactive workshop</li> </ul>                                                                                                                                                                                                                                                  |

|                               |                                                                                                                                                                                                                       |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching and learning methods | - Case studies                                                                                                                                                                                                        |
|                               | <u>Data Science for Engineering &amp; Natural Sciences (E) /ILV / LV-Nr: MDS.6 / 3.Semester / ECTS: 4</u><br>The following methods are used:<br>- Lecture with discussion<br>- Interactive workshop<br>- Case studies |
|                               | <u>Leadership in the Team &amp; Project Management /ILV / LV-Nr: MDS.1 / 1.Semester / ECTS: 2</u><br>The following methods are used:<br>- Lecture with discussion<br>- Interactive workshop<br>- Case studies         |
|                               | <u>Practical Project /PT / LV-Nr: MDS.4 / 3.Semester / ECTS: 4</u><br>Coaching during project implementation                                                                                                          |
|                               | <u>Study Trip (E) /ILV / LV-Nr: MDS.2 / 2.Semester / ECTS: 3</u><br>The following methods are used:<br>- Interactive workshop<br>- On-site visits with discussion                                                     |
|                               | <u>Systemic Innovation /ILV / LV-Nr: MDS.3 / 1.Semester / ECTS: 2</u><br>The following methods are used:<br>- Lecture with discussion<br>- Case studies                                                               |
| Evaluation Methods Criteria   | <u>Data Science for Business &amp; Commerce /ILV / LV-Nr: MDS.5 / 3.Semester / ECTS: 4</u><br>Seminar paper                                                                                                           |
|                               | <u>Data Science for Engineering &amp; Natural Sciences (E) /ILV / LV-Nr: MDS.6 / 3.Semester / ECTS: 4</u><br>Seminar paper                                                                                            |
|                               | <u>Leadership in the Team &amp; Project Management /ILV / LV-Nr: MDS.1 / 1.Semester / ECTS: 2</u><br>Seminar paper                                                                                                    |
|                               | <u>Practical Project /PT / LV-Nr: MDS.4 / 3.Semester / ECTS: 4</u><br>Project documentation                                                                                                                           |
|                               | <u>Study Trip (E) /ILV / LV-Nr: MDS.2 / 2.Semester / ECTS: 3</u><br>Report                                                                                                                                            |
|                               | <u>Systemic Innovation /ILV / LV-Nr: MDS.3 / 1.Semester / ECTS: 2</u><br>Seminar paper                                                                                                                                |

| Module number:             | Data Processing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Scope: |      |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
| DPR                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 8      | ECTS |
| Degree program             | University of Applied Sciences Master's Program Data Science & Intelligent Analytics part-time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |      |
| Position in the curriculum | 3. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        |      |
| Level                      | 3. Semester: Master's program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |      |
| Previous knowledge         | 3. Semester: No prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |      |
| Blocked                    | no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |      |
| Participant group          | Bachelor graduates, beginners                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |      |
| Literature recommendation  | <u>Big Data Processing /ILV / LV-Nr: DPR.1 / 3.Semester / ECTS: 4</u><br>- Kleppmann, M.; Riccomini, C. (2026): Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems (Ed. 2), O'Reilly, (ISBN: 978-1098119065)<br>- Chambers, B. (2018): Spark: The Definitive Guide: Big Data Processing Made Simple, O'Reilly, (ISBN: 978-1491912218)<br>- Marz, N.; Warren, J. (2015): Big Data: Principles and best practices of scalable realtime data systems (Ed. 1), Manning, (ISBN: 978-1617290343)                                                                                                                                                                                                                                                                                                                                 |        |      |
|                            | <u>Artificial Intelligence (E) /ILV / LV-Nr: DPR.9 / 3.Semester / ECTS: 4</u><br>- Russell, S.; Norvig, P. (2021): Artificial Intelligence: A Modern Approach, Global Edition (Ed. 4), Addison Wesley, Boston (ISBN: 978-1292401133)<br>- Rissover, M. N. (2025): Artificial Intelligence: A Practical Guide to Understanding AI for Professionals and Students (Ed. 1), Digital Foundations, (ISBN: 979-8286961795)                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |
| Acquisition of skills      | <u>Big Data Processing /ILV / LV-Nr: DPR.1 / 3.Semester / ECTS: 4</u><br>The participants:<br><ul style="list-style-type: none"> <li>• can name the particular challenges that arise when storing and processing large volumes of data (V model: Volume, Variety, Velocity, Veracity)</li> <li>• can name ways of meeting these challenges (systems from the respective areas of the V model are discussed here as examples)</li> <li>• can develop and apply appropriate solutions themselves with a specific problem in mind</li> </ul>                                                                                                                                                                                                                                                                                                                                        |        |      |
|                            | <u>Artificial Intelligence (E) /ILV / LV-Nr: DPR.9 / 3.Semester / ECTS: 4</u><br>The participants:<br><ul style="list-style-type: none"> <li>• can describe different strategies for implementing artificially intelligent systems</li> <li>• can understand the advantages and disadvantages of the strategies covered and can name their challenges</li> <li>• can develop strategies to design artificially intelligent systems for practical use</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                  |        |      |
| Course contents            | <u>Big Data Processing /ILV / LV-Nr: DPR.1 / 3.Semester / ECTS: 4</u><br>Students are introduced to the fundamental characteristics of big data. Particular attention is paid to how such data is handled, and the knowledge acquired is reinforced with examples. Suitable frameworks are presented for solving big data problems and are worked on with case studies in interactive workshops. Examples include:<br><ul style="list-style-type: none"> <li>- Apache Spark</li> <li>- Apache Flink</li> <li>- Apache Storm</li> <li>- Apache Samza</li> <li>- Apache Kafka</li> </ul> These frameworks are explained and applied using case examples. The centrally provided data labs can be used for this purpose.                                                                                                                                                            |        |      |
|                            | <u>Artificial Intelligence (E) /ILV / LV-Nr: DPR.9 / 3.Semester / ECTS: 4</u><br>The following topics are discussed in the course:<br><ul style="list-style-type: none"> <li>- Reasoning approaches (goal trees, rule-based expert systems)</li> <li>- Search approaches (depth-first, hill climbing, beam, optimal, branch and bound, A*, games, minimax, and alpha-beta)</li> <li>- Constraint approaches (search, domain reduction, visual object recognition)</li> <li>- Learning approaches (neural nets, back propagation, genetic algorithms, sparse spaces, phonology, near misses, felicity conditions, support vector machines, boosting)</li> <li>- Representation approaches (classes, trajectories, transitions)</li> <li>- Possible applications of artificial intelligence in different contexts</li> <li>- Weak versus strong artificial intelligence</li> </ul> |        |      |

|                               |                                                                                                                                                                                 |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching and learning methods | <u>Big Data Processing /ILV / LV-Nr: DPR.1 / 3.Semester / ECTS: 4</u><br>The following methods are used:<br>- Lecture with discussion<br>- Group work<br>- Interactive workshop |
|                               | <u>Artificial Intelligence (E) /ILV / LV-Nr: DPR.9 / 3.Semester / ECTS: 4</u><br>The following methods are used:<br>- Lecture with discussion<br>- Interactive workshop         |
| Evaluation Methods Criteria   | <u>Big Data Processing /ILV / LV-Nr: DPR.1 / 3.Semester / ECTS: 4</u><br>Written exam                                                                                           |
|                               | <u>Artificial Intelligence (E) /ILV / LV-Nr: DPR.9 / 3.Semester / ECTS: 4</u><br>Written exam                                                                                   |

| Module number:             | Elective                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Scope: |      |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
| WPF                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 11     | ECTS |
| Degree program             | University of Applied Sciences Master's Program Data Science & Intelligent Analytics part-time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |      |
| Position in the curriculum | 3. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |      |
|                            | 4. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |      |
| Level                      | 3. Semester: Master / 3. Semester: Master's program / 4. Semester: Master's degree program / 4. Semester: Master's program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |      |
| Previous knowledge         | 3. Semester: none / 3. Semester: no prerequisites / 3. Semester: No prerequisites / 3. Semester: No prerequisites / 4. Semester: no prerequisites / 4. Semester: no prerequisites / 4. Semester: No prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |
| Blocked                    | no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |      |
| Participant group          | Bachelor graduates, beginners                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |
| Literature recommendation  | <u>Application-Oriented Analytics Platforms (E) (WP)* /ILV / LV-Nr: WPF.1 / 3.Semester / ECTS: 4</u><br>- Ramjan, S.; Sunkpho, J. (2025): Utilizing RapidMiner, Python, and R for Data Mining Applications, IGI Global<br>- Shmueli, G.; Bruce, G. C.; Deokar, A. V., Patel, N. R. (2023): Machine Learning for Business Analytics: Concepts, Techniques and Applications in RapidMiner, Wiley<br>- Mishra, A. (2019): Machine Learning in the AWS Cloud: Add Intelligence to Applications with Amazon SageMaker and Amazon Rekognition (Ed. 1), Wiley, Chichester (ISBN: 978-1119556718)                                                 |        |      |
|                            | <u>Trends in ERP (E) (WP)* /ILV / LV-Nr: WPF.10 / 4.Semester / ECTS: 3</u><br>keine Angabe                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |      |
|                            | <u>Trends in Smart Products (E) (WP)* /ILV / LV-Nr: WPF.11 / 4.Semester / ECTS: 3</u><br>- Huber W.; Industrie 4.0 kompakt – Wie Technologien unsere Wirtschaft und unsere Unternehmen verändern: Transformation und Veränderung des gesamten Unternehmens; Wiesbaden; 2018<br>- Iyer B., Venkatraman V.; "What comes after smart products?", Harvard Business Review; 2015<br>- Roth A.; Einführung und Umsetzung von Industrie 4.0: Grundlagen, Vorgehensmodell und Use Cases aus der Praxis; Wiesbaden; 2016                                                                                                                           |        |      |
|                            | <u>Trends in AI Engineering (E) (WP)* /ILV / LV-Nr: WPF.12 / 4.Semester / ECTS: 3</u><br>PRIMÄRLITERATUR:<br>- European Journal of Information Systems<br>- Information Systems Journal<br>- Information Systems Research<br>- Journal of AIS<br>- Journal of Information Technology<br>- Journal of MIS<br>- Journal of Strategic Information Systems<br>- MIS Quarterly                                                                                                                                                                                                                                                                 |        |      |
|                            | <u>Data Visualization &amp; Visual Analytics (E) (WP)* /ILV / LV-Nr: WPF.2 / 3.Semester / ECTS: 4</u><br>- Wilke, C. O. (2019): Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures, O'Reilly<br>- Knaflitz, C. N.; Kauschke, M. (2017): Storytelling mit Daten: Die Grundlagen der effektiven Kommunikation und Visualisierung mit Daten, Vahlen                                                                                                                                                                                                                                                   |        |      |
|                            | <u>Internet of Things (E) (WP)* /ILV / LV-Nr: WPF.3 / 3.Semester / ECTS: 4</u><br>Perry L.; Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security; Birmingham; 2018<br>Sinclair B.; IoT Inc: How Your Company Can Use the Internet of Things to Win in the Outcome Economy; 2017<br>Thomas O., Nüttgens M., Fellmann M. (Herausgeber); Smart Service Engineering: Konzepte und Anwendungsszenarien für die digitale Transformation; Wiesbaden; 2017                                                                                |        |      |
|                            | <u>Digital Twin Simulation (E) (WP)* /ILV / LV-Nr: WPF.4 / 3.Semester / ECTS: 4</u><br>Nath, S. V. (2021). Building Industrial Digital Twins : Design, Develop, and Deploy Digital Twin Solutions for Real-World Industries Using Azure Digital Twins.<br><br>Zhang, Y. (2024). Digital Twin Architectures, Networks, and Applications (1st ed. 2024).<br><br>Blaschke, F. (2024). Implementation and Benefits of Digital Twin on Decision Making and Data Quality Management. (1st ed.).<br><br>Digital Twin Technology. (2023). IntechOpen.<br><br>Tao, F., Zhang, M., & Nee, A. Y. C. (2019). Digital twin driven smart manufacturing. |        |      |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><u>Process Automation (E) (WP)* /ILV / LV-Nr: WPF.5 / 3.Semester / ECTS: 4</u></p> <ul style="list-style-type: none"> <li>* Reicher M., Weber B.: Enabling Flexibility in Process-aware Information Systems, Springer 2012, Kapitel 2-4</li> <li>* Quarre, F.: Robotic Process Automation, O'Reilly, 2019</li> <li>* Critchley, S.; Dynamics 365 CE Essentials: Administering and Configuring Solutions, Apress; 2018</li> <li>* Yapa, S.; Customizing Dynamics 365: Implementing and Releasing Business Solutions, Apress; 2019</li> <li>* Salatino, M., Aliverti, E.: jBPM 6 Developer Guide; Packt Publishing, 2014</li> <li>* Allweyer, Thomas: BPMN 2.0 - Business Process Model and Notation: Einführung in den Standard für die Geschäftsprozessmodellierung.- Books on Demand, 2015</li> </ul> |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Literature recommendation | <p><u>Quantitative Process and Quality Management (Six Sigma) (E) (WP)* /ILV / LV-Nr: WPF.6 / 3.Semester / ECTS: 4</u></p> <p>Töpferer, A.; Six Sigma Konzeption und Erfolgsbeispiele für praktizierende Null-Fehler-Qualität; Berlin/Heidelberg/New York 2007; 4. Auflage<br/>George M.; Rowlands D.; Price M.; Maxey J.; The Lean Six Sigma Pocket Toolbook; New York; 2005<br/>Lunau St. (Hrsg.); Six Sigma + Lean Toolset; 5. Auflage; Heidelberg; 2014</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                           | <p><u>Operational &amp; Strategic Management of Applications (E) (WP)* /ILV / LV-Nr: WPF.7 / 3.Semester / ECTS: 4</u></p> <p>- Thomas Söbbing, Axel Funk, Wolfgang Fritzemeyer, Holger Heinbuch, Sandra Neuhaus, Robert Niedermeier, Joachim Schrey: Handbuch IT-Outsourcing: Recht, Strategie, Prozesse, IT, Steuern samt Business Process Outsourcing (Recht in der Praxis), C.F. Müller, 3.Auflage, 2006.<br/>- Ernst Tiemeyer: Handbuch IT-Management. Konzepte, Methoden, Lösungen und Arbeitshilfen für die Praxis. Hanser Fachbuch; 2009.<br/>- Wolfgang Johannsen, Matthias Goeken: Referenzmodelle für IT-Governance. Strategische Effektivität und Effizienz mit COBIT, ITIL &amp; Co, Dpunkt Verlag, 2007.<br/>- Olaf Resch: Einführung in das IT-Management: Grundlagen, Umsetzung, Best Practice, Erich Schmidt Verlag, 2009.</p>                                                                                                                                                                          |
|                           | <p><u>Human AI Interaction (E) (WP)* /ILV / LV-Nr: WPF.8 / 3.Semester / ECTS: 4</u></p> <p>- A. Dix, J. Finlay, G.D. Abowd, R. Beale: Human-Computer Interaction.Third Edition, Prentice Hall 2003, ISBN 978-0130461094<br/>- Cooper, Reimann, and Cronin; About Face 3: The Essentials of Interaction Design; Wiley, 2007. ISBN 0470084111<br/>- Lazar, Feng, and Hochheiser; Research Methods in Human-Computer Interaction; Wiley, 2010. ISBN 0470723378<br/>- Stone, Jarrett, Woodruffe, and Minocha; User Interface Design and Evaluation; Morgan Kaufmann, March 2005. ISBN 0120884364<br/>- A. Kerren, A. Ebert, J. Meyer: Human-Centered Visualization Environments.Springer 2007, ISBN 978-3540719489<br/>- Sarodnick, F., &amp; Brau, H.: Methoden der Usability-Evaluation. Bern: Hans Huber, 2011.<br/>- Shneiderman, B., &amp; Plaisant, C.: Designing the user interface (5th ed.). Boston: Addison-Wesley, 2009.<br/>- Nielsen, Jakob: Designing Web Usability, dtsh. Ausg., Markt und Technik, 2004</p> |
|                           | <p><u>Trends in Data Science (E) (WP)* /ILV / LV-Nr: WPF.9 / 4.Semester / ECTS: 3</u></p> <p>Aufgrund der Veränderlichkeit der Inhalte werden hier nur beispielhaft einige Web-Quellen angeführt, die derzeit im Bereich Data Science Trends stark vertreten sind:<br/>- Medium (2020): Towards Data Science (Ed. 1), Online, <a href="https://towardsdatascience.com/">https://towardsdatascience.com/</a>.<br/>- KDNuggets (2020): Knowledge Discovery Nuggets (Ed. 1), Online, <a href="https://www.kdnuggets.com/">https://www.kdnuggets.com/</a>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Acquisition of skills     | <p><u>Application-Oriented Analytics Platforms (E) (WP)* /ILV / LV-Nr: WPF.1 / 3.Semester / ECTS: 4</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can name different application-oriented analytics platforms (e.g. KNIME, RapidMiner, Grafana)</li> <li>• can compare the analytics platforms they have learned about in terms of their suitability for a specific use case</li> <li>• can implement initial applications using the platforms presented</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                           | <p><u>Trends in ERP (E) (WP)* /ILV / LV-Nr: WPF.10 / 4.Semester / ECTS: 3</u></p> <p>Knows current trends in the field of ERP systems</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                           | <p><u>Trends in Smart Products (E) (WP)* /ILV / LV-Nr: WPF.11 / 4.Semester / ECTS: 3</u></p> <p>The following learning outcomes are developed in the course:</p> <ul style="list-style-type: none"> <li>- Students understand the concepts of smart applications such as smart house, smart city, smart production, connected vehicles, etc.</li> <li>- Students know and understand the latest trends in the field of these applications</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                           | <p><u>Trends in AI Engineering (E) (WP)* /ILV / LV-Nr: WPF.12 / 4.Semester / ECTS: 3</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can name current thematic trends in the field of AI engineering, modern software development and applications</li> <li>• can name current technological developments in the field of AI engineering, modern software development and applications</li> <li>• can name current practical questions from the field of AI engineering, modern software development and applications</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                           | <p><u>Data Visualization &amp; Visual Analytics (E) (WP)* /ILV / LV-Nr: WPF.2 / 3.Semester / ECTS: 4</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can describe data visualization as well as visual communication</li> <li>• can develop visualizations independently and use them for communication purposes</li> <li>• can work with various presentation tools and visualization libraries in order to present data and analysis results in a meaningful way</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                           | <p><u>Internet of Things (E) (WP)* /ILV / LV-Nr: WPF.3 / 3.Semester / ECTS: 4</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• know basic IoT architectures</li> <li>• know methods of data generation</li> <li>• know the fundamentals of data transmission</li> <li>• know options for data storage</li> <li>• know forms of data visualization</li> <li>• understand the challenges of data security</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                           | <p><u>Digital Twin Simulation (E) (WP)* /ILV / LV-Nr: WPF.4 / 3.Semester / ECTS: 4</u></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>The participants:</p> <ul style="list-style-type: none"><li>• understand the fundamentals of modeling and can apply them</li><li>• know typical applications and advantages of simulations</li><li>• know simulation domains and simulation software for smart products and solutions</li><li>• can create models and simulation processes</li><li>• can interpret simulation results</li><li>• can define a smart communicating product</li><li>• are familiar with the concepts of digital twin, condition monitoring, predictive maintenance</li></ul> |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Acquisition of skills | <p><u>Process Automation (E) (WP)* /ILV / LV-Nr: WPF.5 / 3.Semester / ECTS: 4</u></p> <p>The students:</p> <ul style="list-style-type: none"> <li>- know the challenges involved in process automation.</li> <li>- can select processes for automation.</li> <li>- know the approach and factors for successful process automation.</li> <li>- can create process automations in selected software.</li> <li>- know the interfaces to ERP and CRM systems.</li> <li>- know the approaches to interprocess communication and can implement them.</li> <li>- know the basic structure of cloud-based IT applications for process automation in a business environment, using the example of Microsoft Dynamics 365.</li> <li>- know basic and advanced functionalities of process automation in Microsoft Dynamics 365.</li> <li>- can implement UIs for process automation in browser- and app-based form, using the example of Microsoft technologies.</li> </ul> |
|                       | <p><u>Quantitative Process and Quality Management (Six Sigma) (E) (WP)* /ILV / LV-Nr: WPF.6 / 3.Semester / ECTS: 4</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• know the fundamentals of descriptive and inferential statistics</li> <li>• know how to examine measurement setups for repeatability and reproducibility</li> <li>• can calculate sample sizes</li> <li>• can monitor the stability of process results using statistical control methods</li> <li>• can assess the capability of processes to meet customer requirements</li> <li>• know methods for searching for the causes of result deviations using test procedures</li> <li>• know the basic functionalities of the statistics software „Minitab“</li> <li>• can use "Minitab" in the context of process analysis</li> </ul>                                                                                                                                    |
|                       | <p><u>Operational &amp; Strategic Management of Applications (E) (WP)* /ILV / LV-Nr: WPF.7 / 3.Semester / ECTS: 4</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can describe the operational design and control options of an IT organization</li> <li>• can describe details of IT management areas such as staff scheduling, quality management, portfolio management, IT strategy management, IT governance and compliance concepts</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                       | <p><u>Human AI Interaction (E) (WP)* /ILV / LV-Nr: WPF.8 / 3.Semester / ECTS: 4</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can explain the basic principles of human-AI interaction and can apply them to modern AI systems such as LLMs, chatbots, agents and decision-making systems</li> <li>• can analyze user needs, tasks and usage contexts when working with AI</li> <li>• can develop interaction models and UX patterns for AI systems</li> <li>• can analyze the distribution of human-machine roles and can design different areas of application</li> </ul>                                                                                                                                                                                                                                                                                                                                                           |
|                       | <p><u>Trends in Data Science (E) (WP)* /ILV / LV-Nr: WPF.9 / 4.Semester / ECTS: 3</u></p> <p>The participants:</p> <ul style="list-style-type: none"> <li>• can name current thematic trends in the field of data science</li> <li>• can name current technological developments in the field of data science</li> <li>• can name current practical questions from the field of data science</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Course contents       | <p><u>Application-Oriented Analytics Platforms (E) (WP)* /ILV / LV-Nr: WPF.1 / 3.Semester / ECTS: 4</u></p> <p>The following topics are discussed in the course:</p> <ul style="list-style-type: none"> <li>- Presentation of different application-oriented analytics platforms (e.g. KNIME, RapidMiner, Grafana)</li> <li>- Presentation of different cloud solutions for data analysis (e.g. Google Cloud, AWS, Azure)</li> <li>- Applying the presented platforms using sample analysis datasets</li> <li>- Discussion of the different approaches</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                 |
|                       | <p><u>Trends in ERP (E) (WP)* /ILV / LV-Nr: WPF.10 / 4.Semester / ECTS: 3</u></p> <ul style="list-style-type: none"> <li>- Current developments in the field of enterprise application systems with specific reference to ERP systems and business process management</li> <li>- Models, examples, best-practice cases</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                       | <p><u>Trends in Smart Products (E) (WP)* /ILV / LV-Nr: WPF.11 / 4.Semester / ECTS: 3</u></p> <p>The content of this course is not fixed but is adapted to the trends currently prevailing. Sample topics may include:</p> <ul style="list-style-type: none"> <li>- Current best-practice approaches and concepts in application areas (e.g. smart home, smart city, smart production, connected vehicles, etc.)</li> <li>- Current best-practice approaches with regard to development processes and tools</li> <li>- Current research and development activities and research and development results</li> </ul>                                                                                                                                                                                                                                                                                                                                                 |
|                       | <p><u>Trends in AI Engineering (E) (WP)* /ILV / LV-Nr: WPF.12 / 4.Semester / ECTS: 3</u></p> <p>The content of this course is not fixed but is adapted to the trends currently prevailing. Sample topics may include:</p> <ul style="list-style-type: none"> <li>- New technologies in the field of AI engineering</li> <li>- Trends in programming languages for AI</li> <li>- New design concepts in the field of AI</li> <li>- New questions in the field of AI research</li> <li>- New questions in the field of AI</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><u>Data Visualization &amp; Visual Analytics (E) (WP)* /ILV / LV-Nr: WPF.2 / 3.Semester / ECTS: 4</u></p> <p>The following topics are discussed in the course:</p> <ul style="list-style-type: none"> <li>- Analysis tools with a visual focus, e.g. BI tools such as MS Power BI, Tableau, QlikView</li> <li>- Visualization libraries, e.g. matplotlib.pyplot, ggplot2</li> <li>- Rules of visual communication, e.g. Hichert SUCCESS</li> </ul> |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Course contents | <p><u>Internet of Things (E) (WP)* /ILV / LV-Nr: WPF.3 / 3.Semester / ECTS: 4</u></p> <p>Introduction</p> <ul style="list-style-type: none"> <li>- IoT architecture (e.g. reference models)</li> <li>- Requirements for IoT systems</li> <li>- IoT data transmission protocols</li> <li>- Use of IoT in an industrial context (examples)</li> <li>- Fundamentals of sensor technology</li> <li>- Fundamentals of embedded systems</li> </ul> <p>Implementation</p> <ul style="list-style-type: none"> <li>- Approach to implementing IoT</li> <li>- Prototype implementation of IoT</li> <li>- Selection of sensors</li> <li>- Collection, visualization and analysis of data</li> <li>- Challenges in implementation</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                 | <p><u>Digital Twin Simulation (E) (WP)* /ILV / LV-Nr: WPF.4 / 3.Semester / ECTS: 4</u></p> <p>Fundamentals and modeling:</p> <ul style="list-style-type: none"> <li>-Introduction to digital twins, their significance and areas of application</li> <li>-Teaching the theoretical fundamentals and methods of modeling</li> </ul> <p>Simulation and software:</p> <ul style="list-style-type: none"> <li>-Overview of simulation techniques and their typical applications</li> <li>-Getting to know various simulation software and practical exercises</li> </ul> <p>Smart products and solutions:</p> <ul style="list-style-type: none"> <li>-Creation and analysis of models for smart, communicating products</li> <li>-Integration of digital twins into IoT systems and their advantages</li> </ul> <p>Advanced concepts and applications:</p> <ul style="list-style-type: none"> <li>-Introduction to advanced topics such as condition monitoring and predictive maintenance</li> <li>-Discussion of the role of digital twins in future technology development.</li> </ul> <p>Practical project:</p> <ul style="list-style-type: none"> <li>-Planning and carrying out your own digital twin project to apply what you have learned</li> </ul> |
|                 | <p><u>Process Automation (E) (WP)* /ILV / LV-Nr: WPF.5 / 3.Semester / ECTS: 4</u></p> <ul style="list-style-type: none"> <li>- Basic concepts: business process, workflow, BPMS, WFMS, RPA, etc.</li> <li>- Selection criteria for workflow engines for process automation</li> <li>- Architecture and integrations of workflows for process automation</li> <li>- Overview of interprocess communication</li> <li>- Transactional properties of processes, simulation and code generation</li> <li>- Fundamentals of Microsoft Dynamics 365: modules and navigation, base entities and standard workflows</li> <li>- Organizational and technical implementation with configuration and declarative programming</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                 | <p><u>Quantitative Process and Quality Management (Six Sigma) (E) (WP)* /ILV / LV-Nr: WPF.6 / 3.Semester / ECTS: 4</u></p> <p>The following topics are discussed in the course:</p> <ul style="list-style-type: none"> <li>- Fundamentals of descriptive statistics</li> <li>- Measurement system analysis</li> <li>- Sample size determination</li> <li>- Statistical process control</li> <li>- Process control charts</li> <li>- Process capability analysis</li> <li>- Components of Variance analysis (COV)</li> <li>- Review of the fundamentals of inferential statistics</li> <li>- Determining root causes of errors through hypothesis testing (t-test, chi-square, ANOVA)</li> <li>- Multiple regression analysis</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                 | <p><u>Operational &amp; Strategic Management of Applications (E) (WP)* /ILV / LV-Nr: WPF.7 / 3.Semester / ECTS: 4</u></p> <ul style="list-style-type: none"> <li>- Staff scheduling and resource management</li> <li>- Contract management and financial management (cost and activity accounting)</li> <li>- Quality management and quality assurance (reviews, audits, etc.)</li> <li>- Employee information and communication</li> <li>- IT strategy and IT portfolio management</li> <li>- Risk management; IT governance and compliance</li> <li>- ITIL, CoBIT</li> <li>- Service level agreements and outsourcing</li> <li>- Balanced scorecard methodology</li> <li>- IT management tools (ADOit, etc.)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                 | <p><u>Human AI Interaction (E) (WP)* /ILV / LV-Nr: WPF.8 / 3.Semester / ECTS: 4</u></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

- |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <ul style="list-style-type: none"><li>- Fundamentals of human-AI interaction<ul style="list-style-type: none"><li>- Human cognition, mental models, decision-making behavior</li><li>- HCI principles for AI systems</li></ul></li><li>- UX design for AI<ul style="list-style-type: none"><li>- Interaction patterns (conversational UI, agents, multimodal interfaces)</li><li>- Prompt design, system messages, feedback loops</li><li>- Trust and user acceptance</li></ul></li><li>- Explainable &amp; Transparent AI (XAI)<ul style="list-style-type: none"><li>- Types of explanation, user groups, design principles</li><li>- Usability and control of AI</li></ul></li><li>- Human-in-the-Loop &amp; Human-on-the-Loop</li></ul> |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Course contents               | <ul style="list-style-type: none"> <li>- Matching human-machine roles</li> <li>- Task allocation, limits of automation</li> <li>- Error prevention &amp; recovery design</li> <li>- Empathic &amp; social aspects of AI interaction</li> <li>- Social responses, trust</li> <li>- persuasive and adaptive systems</li> <li>- Methods &amp; tools</li> <li>- Usability testing for AI systems</li> <li>- Prototyping tools</li> <li>- Evaluation methods (task success, trust metrics, cognitive load)</li> </ul>                                                                       |
|                               | <p><u>Trends in Data Science (E) (WP)* /ILV / LV-Nr: WPF.9 / 4.Semester / ECTS: 3</u></p> <p>The content of this course is not fixed but is adapted to the trends currently prevailing. Sample topics may include:</p> <ul style="list-style-type: none"> <li>- New technologies in the field of big data processing</li> <li>- Trends in programming languages in data analysis</li> <li>- New concepts for processing data (e.g. data lake)</li> <li>- New questions in the field of data science research</li> <li>- New questions in the field of data science practice</li> </ul> |
| Teaching and learning methods | <p><u>Application-Oriented Analytics Platforms (E) (WP)* /ILV / LV-Nr: WPF.1 / 3.Semester / ECTS: 4</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Working through practice exercises</li> <li>- Interactive workshop</li> </ul>                                                                                                                                                                                                                                                                           |
|                               | <p><u>Trends in ERP (E) (WP)* /ILV / LV-Nr: WPF.10 / 4.Semester / ECTS: 3</u></p> <p>Lecture, group work, presentation and discussion of assignments</p>                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                               | <p><u>Trends in Smart Products (E) (WP)* /ILV / LV-Nr: WPF.11 / 4.Semester / ECTS: 3</u></p> <p>Lecture, exercise</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                               | <p><u>Trends in AI Engineering (E) (WP)* /ILV / LV-Nr: WPF.12 / 4.Semester / ECTS: 3</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Interactive workshop</li> </ul>                                                                                                                                                                                                                                                                                                                                        |
|                               | <p><u>Data Visualization &amp; Visual Analytics (E) (WP)* /ILV / LV-Nr: WPF.2 / 3.Semester / ECTS: 4</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Interactive workshop</li> <li>- Case studies</li> </ul>                                                                                                                                                                                                                                                                                                |
|                               | <p><u>Internet of Things (E) (WP)* /ILV / LV-Nr: WPF.3 / 3.Semester / ECTS: 4</u></p> <p>Lecture, individual work with software, group work, presentation and discussion of assignments</p>                                                                                                                                                                                                                                                                                                                                                                                            |
|                               | <p><u>Digital Twin Simulation (E) (WP)* /ILV / LV-Nr: WPF.4 / 3.Semester / ECTS: 4</u></p> <p>Lecture, group work, presentation and discussion of assignments</p>                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                               | <p><u>Process Automation (E) (WP)* /ILV / LV-Nr: WPF.5 / 3.Semester / ECTS: 4</u></p> <p>Lecture, discussions, practical examples, PC exercises</p>                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                               | <p><u>Quantitative Process and Quality Management (Six Sigma) (E) (WP)* /ILV / LV-Nr: WPF.6 / 3.Semester / ECTS: 4</u></p> <p>Lecture, individual work with software, group work, presentation and discussion of assignments</p>                                                                                                                                                                                                                                                                                                                                                       |
|                               | <p><u>Operational &amp; Strategic Management of Applications (E) (WP)* /ILV / LV-Nr: WPF.7 / 3.Semester / ECTS: 4</u></p> <p>Lecture, group work, presentation and discussion of assignments</p>                                                                                                                                                                                                                                                                                                                                                                                       |
|                               | <p><u>Human AI Interaction (E) (WP)* /ILV / LV-Nr: WPF.8 / 3.Semester / ECTS: 4</u></p> <p>Lecture, group work (project), presentation and discussion of assignments</p>                                                                                                                                                                                                                                                                                                                                                                                                               |
|                               | <p><u>Trends in Data Science (E) (WP)* /ILV / LV-Nr: WPF.9 / 4.Semester / ECTS: 3</u></p> <p>The following methods are used:</p> <ul style="list-style-type: none"> <li>- Lecture with discussion</li> <li>- Interactive workshop</li> </ul>                                                                                                                                                                                                                                                                                                                                           |
| Evaluation Methods Criteria   | <p><u>Application-Oriented Analytics Platforms (E) (WP)* /ILV / LV-Nr: WPF.1 / 3.Semester / ECTS: 4</u></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

|  |                                                                            |
|--|----------------------------------------------------------------------------|
|  | Written exam                                                               |
|  | Seminar paper                                                              |
|  | <u>Trends in ERP (E) (WP)* /ILV / LV-Nr: WPF.10 / 4.Semester / ECTS: 3</u> |
|  | Seminar paper                                                              |

|                             |                                                                                                                                                      |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Evaluation Methods Criteria | <u>Trends in Smart Products (E) (WP)* /ILV / LV-Nr: WPF.11 / 4.Semester / ECTS: 3</u><br>Seminar paper                                               |
|                             | <u>Trends in AI Engineering (E) (WP)* /ILV / LV-Nr: WPF.12 / 4.Semester / ECTS: 3</u><br>Seminar paper                                               |
|                             | <u>Data Visualization &amp; Visual Analytics (E) (WP)* /ILV / LV-Nr: WPF.2 / 3.Semester / ECTS: 4</u><br>Written exam<br>Seminar paper               |
|                             | <u>Internet of Things (E) (WP)* /ILV / LV-Nr: WPF.3 / 3.Semester / ECTS: 4</u><br>Seminar paper<br>Written exam                                      |
|                             | <u>Digital Twin Simulation (E) (WP)* /ILV / LV-Nr: WPF.4 / 3.Semester / ECTS: 4</u><br>Written exam<br>Seminar paper                                 |
|                             | <u>Process Automation (E) (WP)* /ILV / LV-Nr: WPF.5 / 3.Semester / ECTS: 4</u><br>Seminar paper<br>Written exam                                      |
|                             | <u>Quantitative Process and Quality Management (Six Sigma) (E) (WP)* /ILV / LV-Nr: WPF.6 / 3.Semester / ECTS: 4</u><br>Written exam<br>Seminar paper |
|                             | <u>Operational &amp; Strategic Management of Applications (E) (WP)* /ILV / LV-Nr: WPF.7 / 3.Semester / ECTS: 4</u><br>Written exam<br>Seminar paper  |
|                             | <u>Human AI Interaction (E) (WP)* /ILV / LV-Nr: WPF.8 / 3.Semester / ECTS: 4</u><br>Written exam<br>Seminar paper                                    |
|                             | <u>Trends in Data Science (E) (WP)* /ILV / LV-Nr: WPF.9 / 4.Semester / ECTS: 3</u><br>Seminar paper                                                  |

| Module number:             | Master's Thesis & Scientific Work                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Scope: |      |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
| MWA                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 26     | ECTS |
| Degree program             | University of Applied Sciences Master's Program Data Science & Intelligent Analytics part-time                                                                                                                                                                                                                                                                                                                                                                                       |        |      |
| Position in the curriculum | 3. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |      |
|                            | 4. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |      |
| Level                      | 3. Semester: Master's program / 4. Semester: Master's program                                                                                                                                                                                                                                                                                                                                                                                                                        |        |      |
| Previous knowledge         | 3. Semester: no prerequisites<br>/ 4. Semester: No prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                     |        |      |
| Blocked                    | no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |      |
| Participant group          | Bachelor graduates, beginners                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |      |
| Literature recommendation  | <u>Academic Work /SE / LV-Nr: MWA.1 / 3.Semester / ECTS: 2</u><br>- Poser, H. (2001): Wissenschaftstheorie. Eine philosophische Einführung (Ed. 1), Reclam, Dithingen (ISBN: 978-3150181256)<br>- Franck, N. (2017): Handbuch Wissenschaftliches Arbeiten (Ed. 3), Fischer Taschenbuch Verlag, Frankfurt am Main (ISBN: 978-3825247485)                                                                                                                                              |        |      |
|                            | <u>Master's Thesis Colloquium /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 2</u><br>- Poser, H. (2001): Wissenschaftstheorie. Eine philosophische Einführung (Ed. 1), Reclam, Dithingen (ISBN: 978-3150181256)<br>- Franck, N. (2017): Handbuch Wissenschaftliches Arbeiten (Ed. 3), Fischer Taschenbuch Verlag, Frankfurt am Main (ISBN: 978-3825247485)                                                                                                                                 |        |      |
|                            | <u>Master's Thesis /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 22</u><br>- Poser, H. (2001): Wissenschaftstheorie. Eine philosophische Einführung (Ed. 1), Reclam, Dithingen (ISBN: 978-3150181256)<br>- Franck, N. (2017): Handbuch Wissenschaftliches Arbeiten (Ed. 3), Fischer Taschenbuch Verlag, Frankfurt am Main (ISBN: 978-3825247485)                                                                                                                                           |        |      |
| Acquisition of skills      | <u>Academic Work /SE / LV-Nr: MWA.1 / 3.Semester / ECTS: 2</u><br>The participants:<br>• can describe the rules by which academic work functions<br>• can apply these rules to a specific project<br>• can write an exposé and coordinate the research problem, research question and methodological approach                                                                                                                                                                        |        |      |
|                            | <u>Master's Thesis Colloquium /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 2</u><br>The participants:<br>• can describe the process of an academic review<br>• can present results before an academic community<br>• can critically question academic findings                                                                                                                                                                                                                            |        |      |
|                            | <u>Master's Thesis /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 22</u><br>The participants:<br>• can independently write a master's thesis in the field of data science<br>• can independently set up and carry out an academic project                                                                                                                                                                                                                                                   |        |      |
| Course contents            | <u>Academic Work /SE / LV-Nr: MWA.1 / 3.Semester / ECTS: 2</u><br>Students are introduced to the areas of philosophy of science and academic work. The objectives of academic work are discussed and applied to their own research problems. As part of the course, students thus develop an initial exposé draft for a master's thesis.                                                                                                                                             |        |      |
|                            | <u>Master's Thesis Colloquium /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 2</u><br>The course accompanies students in the conception and preparation of their master's thesis. In the colloquium, the research question/hypothesis and the structure of the master's thesis are therefore presented and discussed. In addition, the academic methodology of the master's thesis is discussed and examined critically, and guidance is given on the formal design of the master's thesis. |        |      |
|                            | <u>Master's Thesis /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 22</u><br>Students independently design a project idea for their own master's thesis, describe it in the form of an exposé and submit it to the program management for approval. The students then work on the topic and write a master's thesis, which is submitted for assessment.                                                                                                                                      |        |      |

|                               |                                                                                                                                                                       |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching and learning methods | <u>Academic Work /SE / LV-Nr: MWA.1 / 3.Semester / ECTS: 2</u><br>The following methods are used:<br>- Lecture with discussion<br>- Interactive workshop              |
|                               | <u>Master's Thesis Colloquium /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 2</u><br>The following methods are used:<br>- Interactive workshop<br>- Lecture with discussion |
|                               | <u>Master's Thesis /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 22</u><br>The following methods are used:<br>- Coaching during the preparation of the master's thesis      |

|                             |                                                                                             |
|-----------------------------|---------------------------------------------------------------------------------------------|
| Evaluation Methods Criteria | <u>Academic Work /SE / LV-Nr: MWA.1 / 3.Semester / ECTS: 2</u><br>Report                    |
|                             | <u>Master's Thesis Colloquium /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 2</u><br>Presentation |
|                             | <u>Master's Thesis /SE / LV-Nr: MWA.2 / 4.Semester / ECTS: 22</u><br>Master's thesis        |

| Module number:                | Ethics & Law                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Scope: |      |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|
| ETHR                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3      | ECTS |
| Degree program                | University of Applied Sciences Master's Program Data Science & Intelligent Analytics part-time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      |
| Position in the curriculum    | 4. Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |      |
| Level                         | 4. Semester: Master's program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |      |
| Previous knowledge            | 4. Semester: No prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |      |
| Blocked                       | no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |      |
| Participant group             | Bachelor graduates, beginners                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |      |
| Literature recommendation     | <u>Business Ethics, Compliance &amp; Law /ILV / LV-Nr: ETHR.1 / 4.Semester / ECTS: 3</u><br>- Meyer-Galow, E. (2020): Business Ethik 3.0: Die neue integrale Ethik aus der Sicht eines CEOs (Ed. 1), Springer Gabler, (ISBN: 978-3658307851)<br>- Wybitul, T. (2025): Arbeitsbuch AI Act: Gebrauchsanleitung für Unternehmen zur Umsetzung der KI-Verordnung (Ed. 1), r&w/Fachmedien Recht und Wirtschaft, (ISBN: 978-3800519569)<br>- Franz, M. (2026): Rechtssicherer AI-Einsatz im Unternehmen: Use Cases beurteilt nach AI Act, Datenschutz, Urheberrecht und weiteren Gesetzen (Ed. 1), Springer Gabler, (ISBN: 978-3658499440) |        |      |
| Acquisition of skills         | <u>Business Ethics, Compliance &amp; Law /ILV / LV-Nr: ETHR.1 / 4.Semester / ECTS: 3</u><br>The participants: <ul style="list-style-type: none"> <li>• can describe advanced ethical and legal requirements for the processing of data</li> <li>• can apply these advanced requirements with regard to data-driven projects</li> <li>• can analyze the use of large volumes of data and exploitation strategies on the basis of these ethical and legal frameworks and, building on this, develop approaches</li> </ul>                                                                                                              |        |      |
| Course contents               | <u>Business Ethics, Compliance &amp; Law /ILV / LV-Nr: ETHR.1 / 4.Semester / ECTS: 3</u><br>The following topics are discussed in the course: <ul style="list-style-type: none"> <li>- Data protection (e.g. GDPR)</li> <li>- Privacy (e-Privacy Regulation)</li> <li>- Handling data from an ethical/moral perspective</li> <li>- Compliance</li> </ul>                                                                                                                                                                                                                                                                             |        |      |
| Teaching and learning methods | <u>Business Ethics, Compliance &amp; Law /ILV / LV-Nr: ETHR.1 / 4.Semester / ECTS: 3</u><br>The following methods are used: <ul style="list-style-type: none"> <li>- Lecture with discussion</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                              |        |      |
| Evaluation Methods Criteria   | <u>Business Ethics, Compliance &amp; Law /ILV / LV-Nr: ETHR.1 / 4.Semester / ECTS: 3</u><br>Written exam                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |

### 3 ADMISSION REQUIREMENTS

The general admission requirements are governed by § 4 FHG as amended; accordingly, the subject-specific admission requirement for a university of applied sciences master's program is a completed, subject-relevant university of applied sciences bachelor's program or the completion of an equivalent program comprising at least 180 ECTS credits at a recognized domestic or foreign postsecondary educational institution.

1. For this program, bachelor's degrees or equivalent postsecondary qualifications in the field of **information technology**<sup>1</sup> are considered relevant if they cover the core subject areas (a) computer use, (b) database design and management, and (c) software and application development<sup>2</sup> in a combined total of **at least 6 ECTS credits**. In addition, such bachelor's degree programs or equivalent postsecondary educational qualifications must have covered topics in the fields of natural sciences, **mathematics, and statistics**<sup>3</sup> —which encompass the core subject areas (d) Mathematics and (e) Statistics<sup>4</sup> —totaling **at least 8 ECTS credits**. In keeping with the part-time nature of this program, documented professional qualifications may be taken into account when assessing relevant prior academic achievements.

Applicants who cannot demonstrate these subject-specific prerequisites through their first degree may demonstrate their subject-specific qualifications for admission to the master's program through relevant external continuing education in the above-mentioned areas (e.g., certificate courses) or through documented professional experience. Verification of the aforementioned subject-specific qualifications is assessed and documented during the admissions process.

2. In its program structure, Kufstein University of Applied Sciences in Tyrol provides for the integration of bachelor's and master's programs in accordance with the Bologna Process. Upon successful completion of a bachelor's degree, graduates have several options for pursuing a master's degree, including programs outside of Kufstein University of Applied Sciences in Tyrol. For this Master's program, graduates of the following degree programs at Kufstein University of Applied Sciences in Tyrol would be eligible for admission based on the aforementioned academic background:
  - Coding & Digital Design (formerly Web Business & Technology)
  - Industrial Engineering
3. The languages of instruction and examination at Kufstein University of Applied Sciences in Tyrol are German and English for the part-time program. Therefore, students from non-German-speaking countries must provide appropriate proof of German proficiency.
4. For the full-time, English-language program, the language of instruction and examination is exclusively English. Therefore, proof of English proficiency at a minimum B2 level on the is required.
5. Verification of compliance with the admission requirements is the responsibility of the program director of the Master's program in Data Science & Intelligent Analytics.

<sup>1</sup> Based on ISCED 2013, Fields of Education and Training No. 061 (Information and Communication Technologies (ICTs))

<sup>2</sup> Based on ISCED 2013, Fields of Education and Training No. 0611 (Computer use), 0612 (Database and network design and administration), and 0613 (Software and applications development and analysis)

<sup>3</sup> Based on ISCED 2013, Fields of Education and Training No. 05 (Natural Sciences, Mathematics, and Statistics)

<sup>4</sup> Based on ISCED 2013, Fields of Education and Training Nos. 0541 (Mathematics) and 0542 (Statistics)