Study regulations of the
FH 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 FH Kufstein Tirol

Organizational form: part-time
Duration: 4 semesters
Scope: 120 ECTS
Places for beginners per academic year: 25

Version 1
Decided by the FH Faculty Council on October 07, 2020

Content

With the amendment to the University Act 2020, the so-called "University of Applied Sciences Studies Act (FHStG)" has been renamed "University of Applied Sciences Act (FHG)". Accordingly, a necessary editorial adjustment was made in this document on January 13th, 2021 and the name FHStG was replaced by FHG.

1 OCCUPATIONAL PROFILES

1.1 Occupational fields

Graduates of the Master's course in Data Science and Intelligent Analytics can basically work in all industries that are involved in data collection, data storage, data analysis and data exploitation. However, due to their broad education, graduates are in great demand as employees and managers in the following core fields of activity:

- IT in the field of data analysis and use
- IT consultation in the field of data analysis and use
- Predictive analysis in a range of fields, including
    - Consumer and process-oriented data processing in companies
    - Data processing in the field of sensor data (e.g. Internet of Things)
    - Data evaluation in the field of scientific topics
- Preparation and presentation of data and analysis results
- Developing strategic options for data use
- Interpretation of data analysis and use with regard to ethics, compliance and law

The increasing importance of data in the age of digitization and the associated growing need for skilled workers to collect, store, analyze and use of data means graduates can enter a wide range of institutions and types of companies. This includes large companies in the national and international environment as well as small and medium-sized enterprises and organizations in the government and NGO environment.

Essential characteristics of the vocational fields of activity are thereby:

1. A **high level of understanding of technical backgrounds, methods and tools** of data analysis, which may have a high degree of complexity
2. A **high degree of flexibility in the application of these methods and tools** in different organizational contexts, which is achieved by a broad knowledge in both the professional context and in the context of the application.

Following an induction phase, graduates of this course of study are, in addition to operational activities, also able to take on management functions in the field of data collection, storage, analysis and use. Below, some typical occupational profiles are listed as examples. These occupational profiles deliberately cover a very broad spectrum to make it clear that graduates of the Master degree program can gain a foothold in very different areas depending on their specialization and previous experience. The Master's Course itself provides a sound education in this regard, focusing on the activities described across the data life cycle.

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

Data Application Developer

Data Application Developers have mastered development in the field of data-driven systems, develop corresponding tool or processing chains (also called "toolchains") and understand how they work. The practical development work is in the foreground here. These people usually build their work on previously-defined software interfaces and focus their work on the data pipeline between the output and input interfaces of corresponding software systems. This allows them to focus on the performance and scalability of these applications. They work primarily on the operational level and are usually detached from specific application domains. Under certain circumstances, however, they specialize in certain methods and techniques of data evaluation.

This occupational profile covers the following tasks:

- Developing data-driven systems
- Developing Toolchains
- Developing data-driven components for existing systems
- Developing analysis pipelines based on existing interfaces (API)

Data Engineer

Data Engineers master software engineering - i.e. the conception of software - in the field of data-driven systems and design architectures for data processing, such as toolchains and storage systems. On the one hand, they focus on the architecture, but also on the scalability of the applications for processing large quantities of data. The work focuses on the implementation of methods and techniques for the holistic integration of data and its use within the system landscape. In the course of this, these people work mainly on the operational level and often detached from a specific professional domain. Under certain circumstances, however, they specialize in certain methods and techniques of data evaluation.

This occupational profile covers the following tasks:

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

Big Data and Business Intelligence Consultant

Big Data and Business Intelligence Consultants offer consulting services with a special focus on the collection, storage, analysis and/or use of data. These people are particularly active at the middle and upper (strategic) management levels. To this end, they have extensive knowledge in the field of tools and methods, as well as a good overview of common practices in data science.

This occupational profile covers the following tasks:

- Advising clients on designing data-driven strategies
- Supporting clients in implementing data-driven strategies
- Advising clients on purchasing new systems
- Advising clients on developing data-driven business models
- Performing an initial analysis in the sense of a "Data Value Check”

Senior Data Scientist

Senior Data Scientists work within a company and on tasks in the context of data analysis, business intelligence and data-driven applications, including the collection, storage, analysis and/or use of data. Within this role, these people have a strong relationship with the particular application domain in which they work. This enables them to achieve a higher level of technical penetration in their work than is possible with traditional data application developers or data engineers. The core task lies at an operational and management level. They also prepare data-related decisions for representatives at a strategic level. In this context, these individuals have a very broad spectrum of knowledge in the field of data-driven applications. They also take on the role of technology scouts in the field of data-driven applications, driving the topic forward in their companies in doing so.

This occupational profile covers the following tasks:

- Preparing strategic decisions and develop strategic options
- Developing data-driven business models with a view to the application domain
- Analyzing company data for different departments
- Advising specialist departments in dealing with data
- Operating technology and methods scouting

- Advising specialist departments with regard to product/project compliance, including with regard to data protection

Manager for Data Science Teams

Managers for data science teams coordinate company-owned projects or organizational units whose focus is on the collection, storage, analysis and/or usage of data. The combination of technical knowledge from the field of data science with management and leadership skills is at the forefront of day-to-day work. In this role, people work primarily at the management and strategic level and often form the interface with other departments. Some of the tasks require skills that can be developed after appropriate training.

This occupational profile covers the following tasks:

- Performing management tasks in the implementation of data-driven projects
- Performing management tasks when operating data-driven products
- Leading employees in the context of relevant teams
- Designing the strategic use of data analysis
- Hiring professionals in the field of data science
- Forming the interface with other company divisions
- Performing effort estimates for project resources
- Evaluating the compliance of products/projects also with regard to data protection

1.2 Qualification profile

The qualification objectives of the Master's Degree in Data Science and Intelligent Analytics correspond to the scientific and professional requirements as well as to the requirements of the International Standard Classification of Education (ISCED) 0688[1]. The contents taught qualify the graduates for the specified professional fields of activity.

The desired learning outcomes are the ability to develop and implement data-driven products and solutions. This is achieved through practical training with a focus on data collection and storage, data analysis, data use and business-related basics.

During the course of their studies, students will acquire skills across the entire data life cycle, from data collection to data use. The A to E stages of the life cycle represent the actual processing stages in the typical sequence and are supported by the cross-sectional functions F and G.

The modules of the Master's Degree in Data Science and Intelligent Analytics focus on the development of skills across the entire data life cycle. **Fehler! Verweisquelle konnte nicht gefunden werden.** presents the relationship between the occupational profile, the key skills required for it and the module. Different modules, partly overlapping with one another, develop the necessary skills across the data life cycle.

[1] An ISCED 0688 classification ('Inter-disciplinary programs and qualifications involving Information and Communication Technologies') is proposed, as the modules of the Master's degree in Data Science and Intelligent Analytics focus on ISCED 06 ('Information and Communication Technologies') and only to a minor extent on ISCED 054 ('Mathematics and Statistics') and 0413 ('Management and Administration').

Skills across the professional fields of activity

Occupational Field Title	Task	Competence description	Assignment of competencies	Curriculum modules
Big Data and BI Consultant	Consulting customers in the field of data science	Students have gained first application experience with the platforms presented.	Professional-academic competences	WPF - compulsory elective subject
		Students are familiar with basic concepts and methods from the subject areas of Systematic Innovative Thinking, Systemic Management and Innovation Management.	Professional-academic competences	MDS - Management for Data Science
		Students are familiar with the functionality of basic algorithms in the field of data science.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students are familiar with the functionality of advanced algorithms in the field of data science.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students are familiar with the common tools used in the field of software development in Data Science.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are familiar with the basic concepts of software development (e.g. object orientation, functional programming etc.) which are frequently applied in the field of data science.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are familiar with the data structures, runtime specifics and complexity classes required by the algorithms covered.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students have basic knowledge of data visualization and visual communication.	Professional-academic competences	WPF - compulsory elective subject
		Students are familiar with different strategies for the implementation of artificially intelligent systems.	Professional-academic competences	DPR - Data Processing
		Students are familiar with different, application-oriented analysis platforms.	Professional-academic competences	WPF - compulsory elective subject
		Students are familiar with further ethical and legal requirements for data processing.	Personal/social skills	ETHR - Ethics & Law
		Students are familiar with advanced concepts of software development (e.g. pipelines, testing, etc.) which are frequently applied in the field of data science.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are familiar with advanced methods and tools for project management and managing data-driven products.	Personal/social skills	MDS - Management for Data Science
		Students are familiar with tools (e.g. libraries, cloud platforms or software tools), with which machine learning can be supported.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can work with different presentation tools and presentation libraries to present data and analysis results in a meaningful way.	Professional-academic competences	WPF - compulsory elective subject
		Students can apply the algorithms in isolated problems.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can compare the methods and tools of project management that were dealt with, with regard to their suitability in specific projects.	Personal/social skills	MDS - Management for Data Science
		Students can compare the tools developed with regard to their suitability for specific problems.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can independently apply the tools they have developed in the context of a specific project.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can compare the analysis platforms they have become familiar with, with regard to their suitability for a specific application.	Professional-academic competences	WPF - compulsory elective subject
		Students can apply the methods and tools of project management in projects.	Personal/social skills	MDS - Management for Data Science
		Students can apply these advanced requirements to data-driven projects.	Professional-academic competences	ETHR - Ethics & Law
		Students can structure and manage a data-centric project.	Professional-academic competences	MDS - Management for Data Science
		Students can design end-to-end machine learning projects.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can carry out end-to-end machine learning projects independently	Professional-academic competences	MLAL - Machine Learning & Algorithmics

Occupational Field Title	Task	Competence description	Assignment of competencies	Curriculum modules
		Students can develop and apply appropriate solutions to a specific problem.	Personal/social skills	DPR - Data Processing
		Students can configure basic algorithms of data science for specific purposes.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can practically understand basic algorithms of data science.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can develop basic application concepts and put them into an implementable form.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can implement basic application concepts independently.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can design basic applications to automate basic functionalities.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can develop visualizations independently and use them for communication purposes.	Professional-academic competences	WPF - compulsory elective subject
		Students can develop strategies to design artificially intelligent systems for practical use.	Professional-academic competences	DPR - Data Processing
		Students can configure advanced algorithms of data science for specific purposes.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can practically understand advanced algorithms of data science.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can develop advanced application concepts and bring them into an implementable form.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can implement advanced application concepts independently.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can design advanced applications to automate basic functionalities.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are able to apply specific creative techniques to generate innovations.	Professional-academic competences	MDS - Management for Data Science
		Students are able to analyze the use of large quantities of data and exploitation strategies based on these ethical and legal frameworks and to develop procedures based on them.	Professional-academic competences	ETHR - Ethics & Law
		Students are able to select suitable algorithms for given problems.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students are familiar with the application of the concepts developed in frequently-used software development environments in the field of data analysis (e.g. in Python, Mathlab or R).	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students understand the statistical concepts and working methods behind the algorithms covered.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students understand the advantages and disadvantages of the strategies developed and are aware of their challenges.	Professional-academic competences	DPR - Data Processing
Big Data Application Developer	Developing data-driven systems	Students have gained first application experience with the platforms presented.	Professional-academic competences	WPF - compulsory elective subject
		Students are familiar with the special challenges involved in storing and processing large quantities of data (V-model: Volume, Variety, Velocity, Veracity).	Professional-academic competences	DPR - Data Processing
		Students are familiar with the functionality of basic algorithms in the field of data science.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students are familiar with the common tools used in the field of software development in Data Science.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are familiar with the basic concepts of software development (e.g. object orientation, functional programming etc.) which are frequently applied in the field of data science.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are familiar with the data structures, runtime specifics and complexity classes required by the algorithms covered.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students are familiar with the data structures, runtime specifics and complexity classes required by the algorithms covered.	Professional-academic competences	MLAL - Machine Learning & Algorithmics

Occupational Field Title	Task	Competence description	Assignment of competencies	Curriculum modules
		Students have basic knowledge of data visualization and visual communication.	Professional-academic competences	WPF - compulsory elective subject
		Students know the options for meeting these challenges (exemplary systems from the respective areas of the V-model are discussed).	Professional-academic competences	DPR - Data Processing
		Students are familiar with different strategies for the implementation of artificially intelligent systems.	Professional-academic competences	DPR - Data Processing
		Students are familiar with different, application-oriented analysis platforms.	Professional-academic competences	WPF - compulsory elective subject
		Students are familiar with various advanced data storage concepts (e.g. NoSQL databases, distributed databases, etc.).	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are familiar with further ethical and legal requirements for data processing.	Personal/social skills	ETHR - Ethics & Law
		Students are familiar with advanced concepts of software development (e.g. pipelines, testing, etc.) which are frequently applied in the field of data science.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are familiar with tools (e.g. libraries, cloud platforms or software tools), with which machine learning can be supported.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can work with different presentation tools and presentation libraries to present data and analysis results in a meaningful way.	Professional-academic competences	WPF - compulsory elective subject
		Students can compare and select data storage concepts with regard to their suitability for projects.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can apply the algorithms in isolated problems.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can compare the tools developed with regard to their suitability for specific problems.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can compare the analysis platforms they have learned with regard to their suitability for a specific application.	Professional-academic competences	WPF - compulsory elective subject
		Students can apply these advanced requirements to data-driven projects.	Professional-academic competences	ETHR - Ethics & Law
		Students can carry out end-to-end machine learning projects.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can design end-to-end machine learning projects.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can carry out end-to-end machine learning projects independently	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can configure basic algorithms of data science for specific purposes.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can practically understand basic algorithms of data science.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can design basic applications to automate basic functionalities.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can implement storage concepts themselves in the context of a specific problem.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can develop visualizations independently and use them for communication purposes.	Professional-academic competences	WPF - compulsory elective subject
		Students can configure advanced algorithms of data science for specific purposes.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can practically understand advanced algorithms of data science.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can design advanced applications to automate basic functionalities.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are able to analyze the use of large quantities of data and exploitation strategies based on these ethical and legal frameworks and to develop procedures based on them.	Professional-academic competences	ETHR - Ethics & Law

Occupational Field Title	Task	Competence description	Assignment of competencies	Curriculum modules
		Students are able to select suitable algorithms for given problems.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students are able to select suitable algorithms for given problems.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students are familiar with the application of the concepts developed in frequently-used software development environments in the field of data analysis (e.g. in Python, Mathlab or R).	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are also able to design the implementation of these systems with regard to scalability and operational requirements.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students understand the special requirements for data storage resulting from the use of very quantities amounts of data (Big Data).	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students understand the statistical concepts and working methods behind the algorithms covered.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
Data Engineer	Developing data models and integration strategies	Students are familiar with the special challenges involved in storing and processing large quantities of data (V-model: Volume, Variety, Velocity, Veracity).	Professional-academic competences	DPR - Data Processing
		Students know the options for meeting these challenges (exemplary systems from the respective areas of the V-model are discussed).	Professional-academic competences	DPR - Data Processing
		Students are familiar with various advanced data storage concepts (e.g. NoSQL databases, distributed databases, etc.).	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are familiar with further ethical and legal requirements for data processing.	Personal/social skills	ETHR - Ethics & Law
		Students can compare and select data storage concepts with regard to their suitability for projects.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can implement storage concepts themselves in the context of a specific problem.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are able to analyze the use of large quantities of data and exploitation strategies based on these ethical and legal frameworks and to develop procedures based on them.	Professional-academic competences	ETHR - Ethics & Law
		Students are also able to design the implementation of these systems with regard to scalability and operational requirements.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students understand the special requirements for data storage resulting from the use of very quantities amounts of data (Big Data).	Professional-academic competences	SDDE - Software Development & Data Engineering
Data Scientist	Deals with data-driven issues within the company	Students have gained first application experience with the platforms presented.	Professional-academic competences	WPF - compulsory elective subject
		Students are familiar with the special challenges involved in storing and processing large quantities of data (V-model: Volume, Variety, Velocity, Veracity) occur.	Professional-academic competences	DPR - Data Processing
		Students are familiar with the functionality of basic algorithms in the field of data science.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students are familiar with the functionality of advanced algorithms in the field of data science.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students are familiar with the common tools used in the field of software development in Data Science.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are familiar with the basic concepts of software development (e.g. object orientation, functional programming etc.) which are frequently applied in the field of data science.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are familiar with the data structures, runtime specifics and complexity classes required by the algorithms covered.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students are familiar with the data structures, runtime specifics and complexity classes required by the algorithms covered.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students have basic knowledge of data visualization and visual communication.	Professional-academic competences	WPF - compulsory elective subject
		Students know the options for meeting these challenges (exemplary systems from the respective areas of the V-model are discussed).	Professional-academic competences	DPR - Data Processing
		Students are familiar with different strategies for the implementation of artificially intelligent systems.	Professional-academic competences	DPR - Data Processing

Occupational Field Title	Task	Competence description	Assignment of competencies	Curriculum modules
		Students are familiar with different, application-oriented analysis platforms.	Professional-academic competences	WPF - compulsory elective subject
		Students are familiar with various advanced data storage concepts (e.g. NoSQL databases, distributed databases, etc.).	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are familiar with further ethical and legal requirements for data processing.	Personal/social skills	ETHR - Ethics & Law
		Students are familiar with advanced concepts of software development (e.g. pipelines, testing, etc.) which are frequently applied in the field of data science.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are familiar with tools (e.g. libraries, cloud platforms or software tools), with which machine learning can be supported.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can work with different presentation tools and presentation libraries to present data and analysis results in a meaningful way.	Professional-academic competences	WPF - compulsory elective subject
		Students can compare and select data storage concepts with regard to their suitability for projects.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can apply the algorithms in isolated problems.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can apply the algorithms in isolated problems.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can compare the tools developed with regard to their suitability for specific problems.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can independently apply the tools they have developed in the context of a specific project.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can compare the analysis platforms they have learned with regard to their suitability for a specific application.	Professional-academic competences	WPF - compulsory elective subject
		Students can apply these advanced requirements to data-driven projects.	Professional-academic competences	ETHR - Ethics & Law
		Students can carry out end-to-end machine learning projects.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can design end-to-end machine learning projects.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can carry out end-to-end machine learning projects independently	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can develop and apply appropriate solutions to a specific problem.	Personal/social skills	DPR - Data Processing
		Students can configure basic algorithms of data science for specific purposes.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can practically understand basic algorithms of data science.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can develop basic application concepts and put them into an implementable form.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can implement basic application concepts independently.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can design basic applications to automate basic functionalities.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can implement storage concepts themselves in the context of a specific problem.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can develop visualizations independently and use them for communication purposes.	Professional-academic competences	WPF - compulsory elective subject
		Students can develop strategies to design artificially intelligent systems for practical use.	Professional-academic competences	DPR - Data Processing
		Students can configure advanced algorithms of data science for specific purposes.	Professional-academic competences	MLAL - Machine Learning & Algorithmics

Occupational Field Title	Task	Competence description	Assignment of competencies	Curriculum modules
		Students can practically understand advanced algorithms of data science.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students can develop advanced application concepts and bring them into an implementable form.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can implement advanced application concepts independently.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students can design advanced applications to automate basic functionalities.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are able to analyze the use of large quantities of data and exploitation strategies based on these ethical and legal frameworks and to develop procedures based on them.	Professional-academic competences	ETHR - Ethics & Law
		Students are able to select suitable algorithms for given problems.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students are able to select suitable algorithms for given problems.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students are familiar with the application of the concepts developed in frequently-used software development environments in the field of data analysis (e.g. in Python, Mathlab or R).	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are familiar with the application of the concepts developed in frequently-used software development environments in the field of data analysis (e.g. in Python, Mathlab or R).	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students are also able to design the implementation of these systems with regard to scalability and operational requirements.	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students understand the special requirements for data storage resulting from the use of very quantities amounts of data (Big Data).	Professional-academic competences	SDDE - Software Development & Data Engineering
		Students understand the statistical concepts and working methods behind the algorithms covered.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students understand the statistical concepts and working methods behind the algorithms covered.	Professional-academic competences	MLAL - Machine Learning & Algorithmics
		Students understand the advantages and disadvantages of the strategies developed and are aware of their challenges.	Professional-academic competences	DPR - Data Processing
Manager for Data Science Teams	Leading Data Scientists	Students are familiar with current practical issues in the field of data science.	Professional-academic competences	WPF - compulsory elective subject
		Students are familiar with current technological developments in the field of data science.	Professional-academic competences	WPF - compulsory elective subject
		Students are familiar with current thematic trends in the field of data science.	Professional-academic competences	WPF - compulsory elective subject
		Students are familiar with basic concepts and methods from the subject areas of Systematic Innovative Thinking, Systemic Management and Innovation Management.	Professional-academic competences	MDS - Management for Data Science
		Students are familiar with the discourse relevant to their subject in the foreign country concerned.	Personal/social skills	MDS - Management for Data Science
		Students are familiar the cultural factors influencing the discipline of Data Science in the foreign country concerned.	Personal/social skills	MDS - Management for Data Science
		Students are familiar with the rules by which academic methods function.	Professional-academic competences	MWA - Master Thesis & Academic Methods
		Students know the basic application areas of data collection, data storage, data analysis and data use in the context of business-related applications.	Professional-academic competences	MDS - Management for Data Science
		Students know the basic application areas of data collection, data storage, data analysis and data use in the context of scientific and technical applications.	Professional-academic competences	MDS - Management for Data Science
		Students are familiar with further ethical and legal requirements for data processing.	Personal/social skills	ETHR - Ethics & Law
		Students are familiar with advanced methods and tools for project management and managing data-driven products.	Personal/social skills	MDS - Management for Data Science

Occupational Field Title	Task	Competence description	Assignment of competencies	Curriculum modules
		Students can compare the methods and tools of project management that were dealt with, with regard to their suitability in specific projects.	Personal/social skills	MDS - Management for Data Science
		Students can apply the methods and tools of project management in projects.	Personal/social skills	MDS - Management for Data Science
		Students can apply these rules based on a specific project.	Professional-academic competences	MWA - Master Thesis & Academic Methods
		Students can structure and manage a data-centric project.	Professional-academic competences	MDS - Management for Data Science
		Students can write an exposé and coordinate the problem definition, research question and methodological approach.	Professional-academic competences	MWA - Master Thesis & Academic Methods
		Students can apply their knowledge from the first two semesters in a data-centric project.	Professional-academic competences	MDS - Management for Data Science
		Students can independently set up and carry out a scientific project.	Professional-academic competences	MWA - Master Thesis & Academic Methods
		Students can independently write a Master thesis in the field of Data Science.	Professional-academic competences	MWA - Master Thesis & Academic Methods
		Students can critically question scientific findings.	Professional-academic competences	MWA - Master Thesis & Academic Methods
		Students are able to apply specific creative techniques to generate innovations.	Professional-academic competences	MDS - Management for Data Science
		Students are able to analyze the use of large quantities of data and exploitation strategies based on these ethical and legal frameworks and to develop procedures based on them.	Professional-academic competences	ETHR - Ethics & Law
		This enables students to design and implement data-based applications in this area themselves, taking into account domain-specific requirements.	Professional-academic competences	MDS - Management for Data Science
		Students understand the special challenges of this field of application and are familiar with established best practice methods in this area.	Professional-academic competences	MDS - Management for Data Science
		Students understand how influential factors and discourse influence the discipline of data science in the foreign country concerned.	Personal/social skills	MDS - Management for Data Science
		Students are also aware of how to present results to a scientific community.	Personal/social skills	MWA - Master Thesis & Academic Methods
		Students are aware of how scientific reviews are conducted.	Professional-academic competences	MWA - Master Thesis & Academic Methods

2 CURRICULUM

2.1 Curriculum Data

Dimension	PT	Comment if applicable
First year of study (YYY/YY_{+1})	2021/2022	
Standard duration of study (number of semesters)	4	
Obligatory WSH (Total number for all sem.)	47	
Course weeks per semester (number of weeks)	15	
Obligatory course hours (Total for all sem.)	825	
Obligatory ECTS (Total for all sem.)	120	

WS start (Date, comm.: poss. CW)	CW 40	
WS end (Date, comm.: poss. CW)	CW 5	
SS start (Date, comm.: poss. CW)	CW 11	
SS end (Date, comm.: poss. CW)	CW 28	
WS weeks	15	
SS weeks	15	

Obligatory semester abroad (semester specification)	No	

Language of instruction (specify)	German/English	The proportion of English-language courses amounts to 28.7% of the WSH
Internship (semester information, duration in weeks per semester)	no	

2.2 Curriculummatrix

Assignment of courses to the modules

Module	Module Title	Course title	WSH	ECTS	Sem.
DPR	Data processing	Artificial Intelligence (E)	2	4	3
		Big Data Processing (E)	2	4	3
ETHR	Ethics & Law	Business Ethics, Compliance and Law	1.5	3	4
MDS	Management for Data Science	Data Science for Business & Commerce (E)	1.75	4	3
		Data Science for Engineering & Natural Sciences (E)	1.75	4	3
		Leadership in the Team and Project Management	1	2	1
		Practical Project	2	4	3
		Study Trip (E)	2	3	2
		Systemic Innovation	1	2	1
MLAL	Machine Learning & Algorithmics	Machine Learning & Deep Learning (E)	4	10	2
		Statistical Learning 1	3	6	1
		Statistical Learning 1 Lab	1	2.5	1
		Statistical Learning 2	3	6	2
		Statistical Learning 2 Lab	1	2.5	2
MWA	Master Thesis & Academic Methods	Master thesis	0	22	4
		Colloquium for the Master thesis	1	2	4
		Academic Methods	1	2	3
SDDE	Software Development & Data Engineering	Data Engineering	2	4	1
		Data Engineering Lab	2	5	1
		Software Development 1	3	6	1
		Software Development 1 Lab	1	2.5	1
		Software Development 2	3	6	2
		Software Development 2 Lab	1	2.5	2
WPF	Elective courses	Agile Product Development (elective)*	2	4	3
		Application-oriented Analysis Platforms (elective)*	2	4	3
		Business Platforms & Cloud Computing (elective)*	2	4	3
		Data Visualization & Visual Analytics (elective)*	2	4	3
		Internet of Things (elective)*	2	4	3
		Human-Computer Interaction (HCI)*	2	4	3
		Process automation (elective)*	2	4	3
		Quantitative Process & Quality Management (Six Sigma) (elective)*	2	4	3
		Trends in Data Science (elective)*	2	3	4
		Trends in ERP (elective)*	2	3	4
		Trends in Smart Products (elective)*	2	3	4
		Trends in Web Technologies (elective)*	2	3	4
Totals			**47.0**	**120**	

The following description of the courses does not include the work involved in supervising Master theses. For each supervised work, an effort of 0.6 WSH is planned, i.e. with 25 accredited study places an additional AWSH expenditure of 15 AWSH. In total, an AWSH sum of 70 AWSH over all 4 semesters is achieved including the Master thesis supervision.

1st semester

Course no.	Course title	Course type	T	E	eLV	WSH	No. of groups	AWSH	ALVS	MODULE	ECTS
MDS.1	Leadership in the Team and Project Management	ILV			0%	1	1	1	15	MDS	2
MDS.3	Systemic Innovation	ILV			0%	1	1	1	15	MDS	2
MLAL.1	Statistical Learning 1	ILV	X		33%	3	1	3	45	MLAL	6
MLAL.2	Statistical Learning 1 Lab	UE	X		0%	1	2	2	30	MLAL	2.5
SDDE.1	Data Engineering	ILV	X		50%	2	1	2	30	SDDE	4
SDDE.2	Software Development 1	ILV	X		33%	3	1	3	45	SDDE	6
SDDE.3	Data Engineering Lab	UE	X		0%	2	1	2	30	SDDE	5
SDDE.4	Software Development 1 Lab	UE	X		0%	1	2	2	30	SDDE	2.5
Total line:						14		16	240		30.0
Course hours = Total WSH x course weeks						210					

2nd semester

Course no.	Course title	Course type	T	E	eLV	WSH	No. of groups	AWSH	ALVS	MODULE	ECTS
MDS.2	Study Trip (E)	ILV		X	0%	2	1	2	30	MDS	3
MLAL.3	Machine Learning & Deep Learning (E)	ILV	X	X	25%	4	1	4	60	MLAL	10
MLAL.5	Statistical Learning 2	ILV	X		33%	3	1	3	45	MLAL	6
MLAL.6	Statistical Learning 2 Lab	UE	X		0%	1	2	2	30	MLAL	2.5
SDDE.5	Software Development 2	ILV	X		33%	3	1	3	45	SDDE	6
SDDE.6	Software Development 2 Lab	UE	X		0%	1	2	2	30	SDDE	2.5
Total line:						14		16	240		30.0
Course hours = Total WSH x course weeks						210					

3rd semester

Course no.	Course title	Course type	T	E	eLV	WSH	No. of groups	AWSH	ALVS	MODULE	ECTS
DPR.1	Big Data Processing (E)	ILV	X	X	25%	2	1	2	30	DPR	4
DPR.9	Artificial Intelligence (E)	ILV	X	X	25%	2	1	2	30	DPR	4
MDS.4	Practical Project	PT	X		0%	2	3	6	90	MDS	4
MDS.5	Data Science for Business & Commerce (E)	ILV		X	30%	1.75	1	1.75	26.25	MDS	4
MDS.6	Data Science for Engineering & Natural Sciences (E)	ILV		X	30%	1.75	1	1.75	26.25	MDS	4
MWA.1	Academic Methods	SE			50%	1	1	1	15	MWA	2
WPF.2	Data Visualization & Visual Analytics (elective)*	ILV			15%	2	1	2	30	WPF	4
WPF.2	Application-oriented Analysis Platforms (elective)*	ILV	X		15%	2	1	2	30	WPF	4
WPF.3	Internet of Things (elective)*	ILV	X		15%	2	1	2	30	WPF	4
WPF.4	Agile Product Development (elective)*	ILV			15%	2	1	2	30	WPF	4
WPF.5	Process Automation (elective)'	ILV	X		15%	2	1	2	30	WPF	4
WPF.6	Quantitative Process & Quality Management (Six Sigma) (elective)*	ILV			15%	2	1	2	30	WPF	4
WPF.7	Business Platforms & Cloud Computing (elective)*	ILV	X		15%	2	1	2	30	WPF	4
WPF.8	Human-Computer Interaction (elective)*	ILV			15%	2	1	2	30	WPF	4
Total line:						14.50		18.50	277.50		30
Course hours = Total WSH x course weeks						217.50					

*) This course is offered as an elective course together with the "Web Communication and Information Systems", "Smart Products and Solutions" and "ERP-Systems and Business Process Management" Master's courses. Students choose 1 of the 4 electives with a technical component and 1 of the 4 electives without a technical component, which they then complete as a compulsory subject.

4th semester

Course no.	Course title	Course type	T	E	eLV	WSH	No. of groups	AWSH	ALVS	MODULE	ECTS
ETHR.1	Business Ethics, Compliance and Law	ILV			0%	1.5	1	1.5	22.5	ETHR	3
MWA.2	Master thesis	SE	X		0%	0	1	0	0	MWA	22
MWA.2	Colloquium for the Master thesis	SE			0%	1	1	1	15	MWA	2
WPF.10	Trends in ERP (elective)	ILV			0%	2	1	2	30	WPF	3
WPF.11	Trends in Smart Products (elective)*	ILV			0%	2	1	2	30	WPF	3
WPF.12	Trends in Web Technologies (elective)*	ILV			0%	2	1	2	30	WPF	3
WPF.9	Trends in Data Science (elective)*	ILV			0%	2	1	2	30	WPF	3
Total line:						4.5		4.5	67.5		30
Course hours = Total WSH x course weeks						67.5					

*) This course is offered as an elective course together with the "Web Communication and Information Systems", "Smart Products and Solutions" and "ERP-Systems and Business Process Management" Master's courses. Students select 1 Trends course, which they then complete as a compulsory subject.

**) The 22 ECTS for Master thesis are divided into 20 ECTS for the Master thesis and 2 ECTS for the final Commission examination.

Abbreviations	
eLV	E-learning proportion of course in percent
E	Lecture in English language
ECTS	ECTS – Credit points
Course	Course
LVS	Course hour(s)
WSH	Weekly semester hour(s)
T	Lecture with technical background
WP	Elective subject

Summary of curriculum data

Description	WSH	AWSH	ALVS	ECTS
Total number of courses over all semesters	47	55	825	120
Total number of courses in 1st year of study	28	32	480	60
Total number of courses in 2nd year of study	19	23	345	60
Total number of courses in 3rd year of study				
Total number of technical events over all semesters	32			91
Percentage of technical courses over all semesters based on WSH / ECTS	68.09%			75.83%
Total number of courses in English over all semesters	13.5			29
Proportion of courses in English over all semesters based on WSH / ECTS	28.72%			24.17%
Proportion of eLearning units over all semesters based on WSH / ECTS	19.38%			15.85%

2.3 Module descriptions

Module details for Software Development & Data Engineering

Module number:	**Software Development & Data Engineering**	**Scope:**	
SDDE		**26.0**	**ECTS**
Degree program	University of Applied Sciences Master's Course - Data Science & Intelligent Analytics Part-time		
Level	1st semester: Master's course / 2nd semester: Master's course		
Previous knowledge	1st semester: Students will have previous knowledge in the field of information technologies to the extent of 6 ECTS and therefore know the concept of the relational database and can read simple SQL queries. / 1st semester: Students will have previous knowledge in the field of information technologies to the extent of 6 ECTS and therefore know simple programming concepts (e.g. variables, branches, loops) as well as typical programming approaches (e.g. functional programming). / 2nd semester: SDDE.A1 module examination (Software Development 1)		
Blocked	no		
Participant group	Bachelor graduates, beginners		
Literature recommendation	Data Engineering /ILV / Course no.: SDDE.1 / 1st semester / ECTS: 4		
	PRIMARY LITERATURE: - 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) SECONDARY LITERATURE: - Celko, J. (2013): Joe Celko's Complete Guide to NoSQL: What Every SQL Professional Needs to Know about Non-Relational Databases (Ed. 1), Morgan Kaufmann, Waltham (ISBN: 978-0124071926)		
	Software development 1 /ILV / Course no.: SDDE.2 / 1st semester / ECTS: 6		
	PRIMARY LITERATURE: - Lutz, M (2013): Learning Python (Ed. 1), O'Reilly Media, Farnham (ISBN: 978-1449355739) SECONDARY LITERATURE: - Sommerville, I. (2015): Software Engineering, Global Edition (Ed. 10), Pearson Education, London (ISBN: 978-1292096131) - Williams, L.; Zimmermann, T. (2016): Perspectives on Data Science for Software Engineering (Ed. 1), Morgan Kaufmann, Burlington (ISBN: 978-0128042069) - Crawley, M. J. (2012): The R Book (Ed. 2), John Wiley and Sons Ltd, Chichester (ISBN: 978-0-470-51024-7)		
	Data Engineering Lab /UE / Course no.: SDDE.3 / 1st semester / ECTS: 5		
	PRIMARY LITERATURE: - 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) SECONDARY LITERATURE: - Celko, J. (2013): Joe Celko's Complete Guide to NoSQL: What Every SQL Professional Needs to Know about Non-Relational Databases (Ed. 1), Morgan Kaufmann, Waltham (ISBN: 978-0124071926)		
	Software development 1 Lab /UE / Course no.: SDDE.4 / 1st semester / ECTS: 2.5		
	PRIMARY LITERATURE: - Lutz, M (2013): Learning Python (Ed. 1), O'Reilly Media, Farnham (ISBN: 978-1449355739) SECONDARY LITERATURE: - Sommerville, I. (2015): Software Engineering, Global Edition (Ed. 10), Pearson Education, London (ISBN: 978-1292096131) - Williams, L.; Zimmermann, T. (2016): Perspectives on Data Science for Software Engineering (Ed. 1), Morgan Kaufmann, Burlington (ISBN: 978-0128042069) - Crawley, M. J. (2012): The R Book (Ed. 2), John Wiley and Sons Ltd, Chichester (ISBN: 978-0-470-51024-7)		
	Software development 2 /ILV / Course no.: SDDE.5 / 2nd semester / ECTS: 6		
	PRIMARY LITERATURE: - Lutz, M (2013): Learning Python (Ed. 1), O'Reilly Media, Farnham (ISBN: 978-1449355739) SECONDARY LITERATURE: - Sommerville, I. (2015): Software Engineering, Global Edition (Ed. 10), Pearson Education, London (ISBN: 978-1292096131) - Williams, L.; Zimmermann, T. (2016): Perspectives on Data Science for Software Engineering (Ed. 1), Morgan Kaufmann, Burlington (ISBN: 978-0128042069) - Crawley, M. J. (2007): The R Book (Ed. 1), John Wiley and Sons Ltd, Chichester (ISBN: 978-0-470-51024-7)		
	Software development 2 Lab /UE / Course no.: SDDE.6 / 2nd semester / ECTS: 2.5		

	PRIMARY LITERATURE: - Lutz, M (2013): Learning Python (Ed. 1), O'Reilly Media, Farnham (ISBN: 978-1449355739) SECONDARY LITERATURE: - Sommerville, I. (2015): Software Engineering, Global Edition (Ed. 10), Pearson Education, London (ISBN: 978-1292096131) - Williams, L.; Zimmermann, T. (2016): Perspectives on Data Science for Software Engineering (Ed. 1), Morgan Kaufmann, Burlington (ISBN: 978-0128042069) - Crawley, M. J. (2007): The R Book (Ed. 1), John Wiley and Sons Ltd, Chichester (ISBN: 978-0-470-51024-7)
Skills acquisition	Data Engineering /ILV / Course no.: SDDE.1 / 1st semester / ECTS: 4
	The following skills are developed in the course: - Students are familiar with various advanced data storage concepts (e.g. NoSQL databases, distributed databases, etc.). - Students can compare and select data storage concepts with regard to their suitability for projects. - Students understand the special requirements for data storage resulting from the use of very quantities amounts of data (Big Data).
	Software development 1 /ILV / Course no.: SDDE.2 / 1st semester / ECTS: 6
	The following skills are developed in the course: - Students are familiar with the basic concepts of software development (e.g. object orientation, functional programming etc.) which are frequently applied in the field of data science. - Students are familiar with the application of the concepts developed in frequently-used software development environments in the field of data analysis (e.g. in Python, MATLAB or R). - Students are familiar with the common tools used in the field of software development in Data Science. - Students can design basic applications to automate basic functionalities. - Students can implement designed applications independently.
	Data Engineering Lab /UE / Course no.: SDDE.3 / 1st semester / ECTS: 5
	The following skills are developed in the course: - Students can implement storage concepts themselves in the context of a specific problem. - Students are also able to design the implementation of these systems with regard to scalability and operational requirements.
	Software development 1 Lab /UE / Course no.: SDDE.4 / 1st semester / ECTS: 2.5
	The following skills are developed in the course: - Students can implement basic application concepts independently. - Students can develop basic application concepts and put them into an implementable form.
	Software development 2 /ILV / Course no.: SDDE.5 / 2nd semester / ECTS: 6
	The following skills are developed in the course: - Students are familiar with advanced concepts of software development (e.g. pipelines, testing, etc.) which are frequently applied in the field of data science. - Students are familiar with the application of the concepts developed in frequently-used software development environments in the field of data analysis (e.g. in Python, MATLAB or R). - Students can design advanced applications to automate basic functionalities. - Students can implement designed applications independently.
	Software development 2 Lab /UE / Course no.: SDDE.6 / 2nd semester / ECTS: 2.5
	The following skills are developed in the course: - Students can implement advanced application concepts independently. - Students can develop advanced application concepts and bring them into an implementable form.
Course contents	Data Engineering /ILV / Course no.: SDDE.1 / 1st semester / ECTS: 4
	The following content is discussed in the course: - Properties of high-performance data systems (scalability, maintainability, reliability) - Established concepts of data storage (Relational Model) - Historical concepts of data storage (Hierarchical Model, Network Model) - Modern concepts of data storage (Wide-Column Model, Graph Model, Key-Value Model, Document Model, Column-Oriented Model) - Database systems, matching the models discussed - Scaling of data systems (replication and partitioning) - Writing and reading in data systems (index structures, write strategies)
	Software development 1 /ILV / Course no.: SDDE.2 / 1st semester / ECTS: 6
	The following content is discussed in the course: - The process of software engineering and project management for data-intensive applications - Programming paradigms for use in data science - Effective and efficient data structures for data-intensive applications - Tools and software ecosystems for the development and testing of data-intensive software systems

	Data Engineering Lab /UE / Course no.: SDDE.3 / 1st semester / ECTS: 5
	The following content is discussed in the course: - Design and implementation of problem-centred NoSQL databases (e.g. key-value stores, document stores, column-oriented data stores, etc.) - Design and implementation of storage solutions for large quantities of data (big data)
	Software development 1 Lab /UE / Course no.: SDDE.4 / 1st semester / ECTS: 2.5
	In the lab, the contents of the ILV "Software Development 1" are advanced with the aid of practical exercises. The knowledge gained will be discussed in the group and thus allow a deep insight into the material and consolidation of the knowledge, which was theoretically dealt with in the ILV.
	Software development 2 /ILV / Course no.: SDDE.5 / 2nd semester / ECTS: 6
	The following content is discussed in the course: - Architecture models for data-driven software development and systems - Integration models and paradigms for implementing complex, process-oriented software ecosystems for analytical and data-driven systems - Application of proven design patterns for data-driven applications - Design and implementation of efficient and scalable software systems for data-driven applications - Testing of software applications (e.g. unit tests, integration tests, etc.)
	Software development 2 Lab /UE / Course no.: SDDE.6 / 2nd semester / ECTS: 2.5
	In the lab, the contents of the ILV "Software Development 2" are advanced with the aid of practical exercises. The knowledge gained will be discussed in the group and thus allow a deep insight into the material and consolidation of the knowledge, which was theoretically dealt with in the ILV.
Teaching and learning methods	Data Engineering /ILV / Course no.: SDDE.1 / 1st semester / ECTS: 4
	The following methods are used: - Lecture with discussion - Processing of exercises - Interactive workshop
	Software development 1 /ILV / Course no.: SDDE.2 / 1st semester / ECTS: 6
	The following methods are used: - Lecture with discussion - Processing of exercises - Interactive workshop
	Data Engineering Lab /UE / Course no.: SDDE.3 / 1st semester / ECTS: 5
	The following methods are used: - Processing of exercises - Lecture with discussion
	Software development 1 Lab /UE / Course no.: SDDE.4 / 1st semester / ECTS: 2.5
	The following methods are used: - Lecture with discussion - Processing of exercises
	Software development 2 /ILV / Course no.: SDDE.5 / 2nd semester / ECTS: 6
	The following methods are used: - Lecture with discussion - Processing of exercises - Interactive workshop
	Software development 2 Lab /UE / Course no.: SDDE.6 / 2nd semester / ECTS: 2.5
	The following methods are used: - Processing of exercises - Interactive workshop
Evaluation Methods Criteria	Data Engineering /ILV / Course no.: SDDE.1 / 1st semester / ECTS: 4
	Written exam
	Software development 1 /ILV / Course no.: SDDE.2 / 1st semester / ECTS: 6
	Written exam
	Data Engineering Lab /UE / Course no.: SDDE.3 / 1st semester / ECTS: 5
	The following examination methods are used in the course:

	- Project work - term paper
	Software development 1 Lab /UE / Course no.: SDDE.4 / 1st semester / ECTS: 2.5
	The following examination methods are used in the course: - Project work - term paper
	Software development 2 /ILV / Course no.: SDDE.5 / 2nd semester / ECTS: 6
	Written exam
	Software development 2 Lab /UE / Course no.: SDDE.6 / 2nd semester / ECTS: 2.5
	The following examination methods are used in the course: - Project work - term paper

Module details for Machine Learning & Algorithmics

Module number:	**Machine Learning & Algorithmics**	**Scope:**	
MLAL		**27.0**	**ECTS**
Degree program	University of Applied Sciences Master's Course - Data Science & Intelligent Analytics Part-time		
Level	1st semester: Master's course / 2nd semester: Master's course		
Previous knowledge	1st semester: Students have previous knowledge of mathematics/statistics up to 8 ECTS and therefore know simple statistical measures as well as basic statistical test procedures (e.g. t-test). / 2nd semester: No prerequisites / 2nd semester: Module examination MLAL.A1 (Algorithmic 1)		
Blocked	no		
Participant group	Bachelor graduates, beginners		
Literature recommendation	Statistical learning 1 /ILV / Course no.: MLAL.1 / 1st semester / ECTS: 6		
	PRIMARY LITERATURE: - Murphy, K. P. (2012): Machine Learning: A Probabilistic Perspective (Ed. 1), MIT Press, Cambridge (ISBN: 978-0-262-01802-9) - Bishop, C. (2006): Pattern Recognition and Machine Learning (Ed. 1), Springer-Verlag, New York (ISBN: 978-0-387-31073-2) SECONDARY LITERATURE: - James, G.; Witten, D; Hastie, T.; Tibshirani, R. (2013): An Introduction to Statistical Learning: with Applications in R (Ed. 1), Springer Science and Business Media, New York (ISBN: 978-1-461-471387) - Steele, B.; Chandler, J.; Reddy, S. (2016): Algorithms for Data Science (Ed. 1), Springer, Berlin (ISBN: 978-3319457956)		
	Statistical learning 1 Lab /UE / Course no.: MLAL.2 / 1st semester / ECTS: 2.5		
	PRIMARY LITERATURE: - Murphy, K. P. (2012): Machine Learning: A Probabilistic Perspective (Ed. 1), MIT Press, Cambridge (ISBN: 978-0-262-01802-9) - Bishop, C. (2006): Pattern Recognition and Machine Learning (Ed. 1), Springer-Verlag, New York (ISBN: 978-0-387-31073-2) SECONDARY LITERATURE: - James, G.; Witten, D; Hastie, T.; Tibshirani, R. (2013): An Introduction to Statistical Learning: with Applications in R (Ed. 1), Springer Science and Business Media, New York (ISBN: 978-1-461-471387) - Steele, B.; Chandler, J.; Reddy, S. (2016): Algorithms for Data Science (Ed. 1), Springer, Berlin (ISBN: 978-3319457956)		
	Machine Learning & Deep Learning (E) /ILV / Course no.: MLAL.3 / 2nd semester / ECTS: 10		
	PRIMARY LITERATURE: - Géron, A. (2017): Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques for Building Intelligent Systems (Ed. 1), O´Reilly, Farnham (ISBN: 978-1491962299)		
	Statistical learning 2 /ILV / Course no.: MLAL.5 / 2nd semester / ECTS: 6		
	PRIMARY LITERATURE: - Murphy, K. P. (2012): Machine Learning: A Probabilistic Perspective (Ed. 1), MIT Press, Cambridge (ISBN: 978-0-262-01802-9) - Bishop, C. (2006): Pattern Recognition and Machine Learning (Ed. 1), Springer-Verlag, New York (ISBN: 978-0-387-31073-2) SECONDARY LITERATURE: - James, G.; Witten, D; Hastie, T.; Tibshirani, R. (2013): An Introduction to Statistical Learning: with Applications in R (Ed. 1), Springer Science and Business Media, New York (ISBN: 978-1-461-471387) - Steele, B.; Chandler, J.; Reddy, S. (2016): Algorithms for Data Science (Ed. 1), Springer, Berlin (ISBN: 978-3319457956)		
	Statistical learning 2 Lab /UE / Course no.: MLAL.6 / 2nd semester / ECTS: 2.5		
	PRIMARY LITERATURE: - Murphy, K. P. (2012): Machine Learning: A Probabilistic Perspective (Ed. 1), MIT Press, Cambridge (ISBN: 978-0-262-01802-9) - Bishop, C. (2006): Pattern Recognition and Machine Learning (Ed. 1), Springer-Verlag, New York (ISBN: 978-0-387-31073-2) SECONDARY LITERATURE: - James, G.; Witten, D; Hastie, T.; Tibshirani, R. (2013): An Introduction to Statistical Learning: with Applications in R (Ed. 1), Springer Science and Business Media, New York (ISBN: 978-1-461-471387) - Steele, B.; Chandler, J.; Reddy, S. (2016): Algorithms for Data Science (Ed. 1), Springer, Berlin (ISBN: 978-3319457956)		
Skills acquisition	Statistical learning 1 /ILV / Course no.: MLAL.1 / 1st semester / ECTS: 6		
	The following skills are developed in the course: - Students are familiar with the functionality of basic algorithms in the field of data science. - Students understand the statistical concepts and working methods behind the algorithms covered. - Students are able to select suitable algorithms for given problems.		

	- Students are familiar with the data structures, runtime specifics and complexity classes required by the algorithms covered. - Students can apply the algorithms in isolated problems.
	Statistical learning 1 Lab /UE / Course no.: MLAL.2 / 1st semester / ECTS: 2.5
	The following skills are developed in the course: - Students can practically understand basic algorithms of data science. - Students can configure basic algorithms of data science for specific purposes. - Students can apply the algorithms in isolated problems.
	Machine Learning & Deep Learning (E) /ILV / Course no.: MLAL.3 / 2nd semester / ECTS: 10
	The following skills are developed in the course: - Students are familiar with tools (e.g. libraries, cloud platforms or software tools), with which machine learning can be supported. - Students can compare the tools developed with regard to their suitability for specific problems. - Students can design end-to-end machine learning projects. - Students can carry out end-to-end machine learning projects independently
	Statistical learning 2 /ILV / Course no.: MLAL.5 / 2nd semester / ECTS: 6
	The following skills are developed in the course: - Students can practically understand advanced algorithms of data science. - Students can configure advanced algorithms of data science for specific purposes. - Students can apply the algorithms in isolated problems.
	Statistical learning 2 Lab /UE / Course no.: MLAL.6 / 2nd semester / ECTS: 2.5
	The following skills are developed in the course: - Students can practically understand advanced algorithms of data science. - Students can configure advanced algorithms of data science for specific purposes. - Students can apply the algorithms in isolated problems.
Course contents	Statistical learning 1 /ILV / Course no.: MLAL.1 / 1st semester / ECTS: 6
	The following content is discussed in the course: - Statistical measures (point and interval estimators) - Statistical test procedures - Grouping algorithms (classification trees, agglomerative hierarchical clustering, etc.) - Regression algorithms (regression trees, random forests, etc.) - Associative algorithms - Procedures for preprocessing data (e.g. principal component analysis)
	Statistical learning 1 Lab /UE / Course no.: MLAL.2 / 1st semester / ECTS: 2.5
	In the lab, the contents of the ILV "Statistical Learning 1" are advanced with the aid of practical exercises. The knowledge gained will be discussed in the group and thus allow a deep insight into the material and consolidation of the knowledge, which was theoretically dealt with in the ILV.
	Machine Learning & Deep Learning (E) /ILV / Course no.: MLAL.3 / 2nd semester / ECTS: 10
	The following content is discussed in the course: - Classical neural networks as a supplement to classical algorithms of data science (e.g. Random Forests, SCM, etc.) - Fallen, artificial neural networks (CNN) - Recursive, artificial neural networks (RNN, LSTM) - Continuing, artificial neural networks (GAN, FARM, BERT, CGAN, etc.) The network types discussed are subject to constant change. For this reason, only a few network types are mentioned here as examples. Current network types are also discussed and applied in the course.
	Statistical learning 2 /ILV / Course no.: MLAL.5 / 2nd semester / ECTS: 6
	The following content is discussed in the course: - Advanced modelling techniques - Ensemble methods - Optimization of models
	Statistical learning 2 Lab /UE / Course no.: MLAL.6 / 2nd semester / ECTS: 2.5
	In the lab, the contents of the ILV "Statistical Learning 2" are advanced with the aid of practical exercises. The knowledge gained will be discussed in the group and thus allow a deep insight into the material and consolidation of the knowledge, which was theoretically dealt with in the ILV.
Teaching and learning methods	Statistical learning 1 /ILV / Course no.: MLAL.1 / 1st semester / ECTS: 6
	The following methods are used: - Lecture with discussion - Processing of exercises - Interactive workshop

	Statistical learning 1 Lab /UE / Course no.: MLAL.2 / 1st semester / ECTS: 2.5
	The following methods are used: - Processing of exercises - Interactive workshop
	Machine Learning & Deep Learning (E) /ILV / Course no.: MLAL.3 / 2nd semester / ECTS: 10
	The following methods are used: - Processing of exercises - Interactive workshop
	Statistical learning 2 /ILV / Course no.: MLAL.5 / 2nd semester / ECTS: 6
	The following methods are used: - Lecture with discussion - Processing of exercises - Interactive workshop
	Statistical learning 2 Lab /UE / Course no.: MLAL.6 / 2nd semester / ECTS: 2.5
	The following methods are used: - Processing of exercises - Interactive workshop
Evaluation Methods Criteria	Statistical learning 1 /ILV / Course no.: MLAL.1 / 1st semester / ECTS: 6
	Written exam
	Statistical learning 1 Lab /UE / Course no.: MLAL.2 / 1st semester / ECTS: 2.5
	The following examination methods are used in the course: - Project work - term paper
	Machine Learning & Deep Learning (E) /ILV / Course no.: MLAL.3 / 2nd semester / ECTS: 10
	Project documentation and presentation
	Statistical learning 2 /ILV / Course no.: MLAL.5 / 2nd semester / ECTS: 6
	Written exam
	Statistical learning 2 Lab /UE / Course no.: MLAL.6 / 2nd semester / ECTS: 2.5
	The following examination methods are used in the course: - Project work - term paper

Management for Data Science module details

Module number:	Management for Data Science	Scope:	
MDS		19	ECTS
Degree program	University of Applied Sciences Master's Course - Data Science & Intelligent Analytics Part-time		
Level	1st semester: Master's course / 2nd semester: Master's course / 3rd semester: Master's course		
Previous knowledge	1st semester: No prerequisites / 2nd semester: No prerequisites / 3rd semester: No prerequisites		
Blocked	no		
Participant group	Bachelor graduates, beginners		
Literature recommendation	Team Leadership & Project Management /ILV / Course no.: MDS.1 / 1st semester / ECTS: 2		
	PRIMARY LITERATURE: - Michels, B. (2017): Projektmanagement Handbuch (Ed. 3), CreateSpace Independent Publishing Platform, online (ISBN: 978-1545335482) SECONDARY LITERATURE: - 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) - Kerzner, H. (2017): Project Management: A Systems Approach to Planning, Scheduling, and Controlling (Ed. 12), Wiley, Weinheim (ISBN: 978-1119165354) - Klose, B. (2008): Projektabwicklung: Arbeitshilfen, Fallbeispiele und Checklisten im Projektmanagement (Ed. 5), mi-Wirtschaftsbuch, München (ISBN: 978-3636031648) - Litke, H-D. (2007): Project management: Methoden, Techniken, Verhaltensweisen (Ed. 5), Carl Hanser Verlag, Munich (ISBN: 978-3446409972)		
	Study Trip (E) /ILV / Course no.: MDS.2 / 2nd semester / ECTS: 3		
	PRIMARY LITERATURE: - 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) SECONDARY LITERATURE: - Beise, M. (2013): Lead Markets. Country-Specific Success Factors of the Global Diffusion of Innovations (Ed.), Physica-Verlag, Heidelberg (ISBN: 978-3790814309) - Thomas, A.; Kinast, E.; Schroll-Machl, S. (2003): Handbuch Interkulturelle Kommunikation und Kooperation: Grundlagen und Praxistransfer (Band 1) (Ed. 2), Vandenhoeck and Ruprecht, Göttingen (ISBN: 978-3525461723) - Thomas, D. C. (2014): Cross-Cultural Management: Essential Concepts (Ed. 4), SAGE Publishing, Thousand Oaks (ISBN: 978-14112939560) - Jones, E. (2006): Cultures Merging: A Historical and Economic Critique of Culture (Ed. 1), Princeton University Press, New Jersey (ISBN: 978-0691171043)		
	Systemic Innovation /ILV / Course no.: MDS.3 / 1st semester / ECTS: 2		
	PRIMARY LITERATURE: - Brenner, W.; Uebernickel, F. (2016): Design Thinking for Innovation: Research and Practice (Ed. 1), Springer, Berlin (ISBN: 978-3319260983) - Brown, T. (2012): Change by Design: how design thinking transforms organizations and inspires innovation (Ed. 2), Harper Business, New York (ISBN: 978-3319260983) SECONDARY LITERATURE: - Achouri C. (2011): Wenn Sie wollen, nennen Sie es Fühung: Systemisches Management im 21. Jahrhundert (Ed. 1), Gabal, Offenbach (ISBN: 978-3-86936-174-1) - Achouri C. (2015): Systemisches Management. In: Human Resources Management: Eine praxisbasierte Einführung (Ed. 2), Gabler, Wiesbaden (ISBN: 978-3834947390) - Bergmann, G.; Daub, J. (2008): Systemisches Innovations- und Kompetenzmanagement: Grundlagen - Prozesse - Perspektiven (Ed. 2), Gabler, Wiesbaden (ISBN: 978-3834910592) - Kearney, E. (2013): Diversity und Innovation, page 175 in Krause D. E. (publisher) Kreativität, Innovation, Entrepreneurship (ed. 1), Springer Gabler, Wiesbaden (ISBN: 978-3658025502) - Orloff, M. A. (2010): Inventive Thinking through TRIZ: A Practical Guide (Ed. 1), Springer, Berlin (ISBN: 978-3642069802) - Orloff, M. A. (2012): Modern TRIZ: A Practical Course with EASyTRIZ Technology (Ed. 1), Springer, Berlin (ISBN: 978-3642252174) - Tidd, J.; Bessant, J. (2013): Managing Innovation: Integrating Technological, Market and Organizational Change (Ed. 5), Wiley, Chichester (ISBN: 978-1118360637)		
	Practical Project /PT / Course no.: MDS.4 / 3rd semester / ECTS: 4		
	PRIMARY LITERATURE: - Patzak, G.; Rattay, G. (2017): Project management: Projekte, Projektportfolios, Programme und projektorientierte Unternehmen (Ed. 7), Linde Verlag, Vienna (ISBN: 978-3714303216) SECONDARY LITERATURE: - Schöneck, N. M.; Voß, W. (2013): Das Forschungsprojekt: Planung, Durchführung und Auswertung einer quantitativen Studie (Ed. 2), Springer VS, Wiesbaden (ISBN: 978-3531195018)		
	Data Science for Business & Commerce (E) /ILV / Course no.: MDS.5 / 3rd semester / ECTS: 4		
	PRIMARY LITERATURE: - Cady, F. (2017): The Data Science Handbook (Ed. 2), Wiley, Hoboken (ISBN: 978-1119092940)		

	SECONDARY LITERATURE: - Meier, A.; Stormer, H. (2012): eBusiness and eCommerce: Management der digitalen Wertschöpfungskette (Ed. 3), Springer, Berlin (ISBN: 978-3-642-29801-1)
	- Tamm, G. (2003): Konzepte in eCommerce Anwendungen (Ed. 1), SPC TEIA Lehrbuch, Kelkheim (ISBN: 978-3935539661)
	Data Science for Engineering & Natural Sciences (E) /ILV / Course no.: MDS.6 / 3rd semester / ECTS: 4
	PRIMARY LITERATURE: - Cady, F. (2017): The Data Science Handbook (Ed. 2), Wiley, Hoboken (ISBN: 978-1119092940) SECONDARY LITERATURE: - Heinrich, B.; Linke, P.; Glöckler, M. (2017): Grundlagen Automatisierung: Sensorik, Regelung, Steuerung (Ed. 2), Springer Vieweg, Wiesbaden (ISBN: 978-3658175818) - Tränkler, H.-R.; Reindl, L. M. (2015): Sensortechnik: Handbuch für Praxis und Wissenschaft (Ed. 2), Springer Vieweg, Wiesbaden (ISBN: 978-3642299414) - Serpanos, D.; Wolf, M. (2017): Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies (Ed. 1), Springer, Berlin (ISBN: 978-3319697147)
Skills acquisition	Team Leadership & Project Management /ILV / Course no.: MDS.1 / 1st semester / ECTS: 2
	The following skills are developed in the course: - Students are familiar with advanced methods and tools for project management and managing data-driven products. - Students can compare the methods and tools of project management that were dealt with, with regard to their suitability in specific projects. - Students can apply the methods and tools of project management in projects.
	Study Trip (E) /ILV / Course no.: MDS.2 / 2nd semester / ECTS: 3
	The following skills are developed in the course: - Students are familiar with the discourse relevant to their subject in the foreign country concerned. - Students are familiar the cultural factors influencing the discipline of Data Science in the foreign country concerned. - Students understand how influential factors and discourse influence the discipline of data science in the foreign country concerned.
	Systemic Innovation /ILV / Course no.: MDS.3 / 1st semester / ECTS: 2
	The following skills are developed in the course: - Students are familiar with basic concepts and methods from the subject areas of Systematic Innovative Thinking, Systemic Management and Innovation Management. - Students are able to apply specific creative techniques to generate innovations.
	Practical Project /PT / Course no.: MDS.4 / 3rd semester / ECTS: 4
	The following skills are developed in the course: - Students can apply their knowledge from the first two semesters in a data-centric project. - Students can structure and manage a data-centric project.
	Data Science for Business & Commerce (E) /ILV / Course no.: MDS.5 / 3rd semester / ECTS: 4
	The following skills are developed in the course: - Students know the basic application areas of data collection, data storage, data analysis and data use in the context of business-related applications. - Students understand the special challenges of this field of application and are familiar with established best practice methods in this area. - Students are also able to design and implement data-based applications in this area themselves, taking into account domain-specific requirements.
	Data Science for Engineering & Natural Sciences (E) /ILV / Course no.: MDS.6 / 3rd semester / ECTS: 4
	The following skills are developed in the course: - Students know the basic application areas of data collection, data storage, data analysis and data use in the context of scientific and technical applications. - Students understand the special challenges of this field of application and are familiar with established best practice methods in this area. - This enables students to design and implement data-based applications in this area themselves, taking into account domain-specific requirements.
Course contents	Team Leadership & Project Management /ILV / Course no.: MDS.1 / 1st semester / ECTS: 2
	The following content is discussed in the course: - Project management techniques (e.g. SCRUM) - Project management tools in the field of data science (e.g. GitLab) - Techniques for documenting requirements (e.g. Sophist)
	Study Trip (E) /ILV / Course no.: MDS.2 / 2nd semester / ECTS: 3

	The following content is discussed in the course: - Intercultural competence - Discussion with representatives from the field
	Systemic Innovation /ILV / Course no.: MDS.3 / 1st semester / ECTS: 2
	The following content is discussed in the course: - Developing a holistic understanding of the subject areas (systemic management)
	- Methods for generating innovative ideas (e.g. Systematic Inventive Thinking, Design Thinking) - Project structures and management methods for the practical implementation of innovations (e.g. change management, conflict management) - IT-supported project documentation
	Practical Project /PT / Course no.: MDS.4 / 3rd semester / ECTS: 4
	In this course, students work on a real, data-centred project along the entire data value chain (from data collection, integration and storage to analysis and utilization of the data). This allows them to try out the skills they have built up in the first two semesters in a real setting and gain new insights.
	Data Science for Business & Commerce (E) /ILV / Course no.: MDS.5 / 3rd semester / ECTS: 4
	The following content is discussed in the course: - CRM on the strategic level - CRM in process management - CRM on the operative level (CRM software systems) - Operative CRM - Analytical CRM - Communicative CRM This course is offered as an elective course together with the Master's Course in Web Communication and Information Systems.
	Data Science for Engineering & Natural Sciences (E) /ILV / Course no.: MDS.6 / 3rd semester / ECTS: 4
	The following exemplary contents are discussed 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.) - Data-driven maintenance (e.g. predictive maintenance, Digital Twin) - Data-optimized product design (e.g. design of product properties by KNN) - Evaluation of sensor data (e.g. obstacle detection, obstacle avoidance, prediction, etc.) - Cloud-based IoT systems (data storage and collection) - sensor evaluation via Raspberry Pi, Arduino, radio systems
Teaching and learning methods	Team Leadership & Project Management /ILV / Course no.: MDS.1 / 1st semester / ECTS: 2
	The following methods are used: - Lecture with discussion - Interactive workshop - Case studies
	Study Trip (E) /ILV / Course no.: MDS.2 / 2nd semester / ECTS: 3
	The following methods are used: - Interactive workshop - On-site visits with discussion
	Systemic Innovation /ILV / Course no.: MDS.3 / 1st semester / ECTS: 2
	The following methods are used: - Lecture with discussion - Case studies
	Practical Project /PT / Course no.: MDS.4 / 3rd semester / ECTS: 4
	Coaching within the framework of project implementation
	Data Science for Business & Commerce (E) /ILV / Course no.: MDS.5 / 3rd semester / ECTS: 4
	The following methods are used: - Lecture with discussion - Interactive workshop - Case studies
	Data Science for Engineering & Natural Sciences (E) /ILV / Course no.: MDS.6 / 3rd semester / ECTS: 4
	The following methods are used: - Lecture with discussion - Interactive workshop - Case studies

Evaluation Methods Criteria	Team Leadership & Project Management /ILV / Course no.: MDS.1 / 1st semester / ECTS: 2
	Seminar thesis
	Study Trip (E) /ILV / Course no.: MDS.2 / 2nd semester / ECTS: 3
	Final report
	Systemic Innovation /ILV / Course no.: MDS.3 / 1st semester / ECTS: 2
	Seminar thesis
	Practical Project /PT / Course no.: MDS.4 / 3rd semester / ECTS: 4
	Project documentation
	Data Science for Business & Commerce (E) /ILV / Course no.: MDS.5 / 3rd semester / ECTS: 4
	Seminar thesis
	Data Science for Engineering & Natural Sciences (E) /ILV / Course no.: MDS.6 / 3rd semester / ECTS: 4
	Seminar thesis

Module details for data processing

Module number:	**Data processing**	**Scope:**	
DPR		**8**	**ECTS**
Degree program	University of Applied Sciences Master's Course - Data Science & Intelligent Analytics Part-time		
Level	3rd semester: Master's course		
Previous knowledge	3rd semester: No prerequisites		
Blocked	no		
Participant group	Bachelor graduates, beginners		
Literature recommendation	Big Data Processing (E) /ILV / Course no.: DPR.1 / 3rd semester / ECTS: 4		
	PRIMARY LITERATURE: - Jain, V. K. (2017): Big Data and Hadoop (Ed. 1), Khanna Book Publishing, New Delhi (ISBN: 978-9382609131) - Karau, H.; Warren, R. (2017): High Performance Spark: Best Practices for Scaling and Optimizing Apache Spark (Ed. 1), O'Reilly Media, Farnham (ISBN: 978-1491943205) SECONDARY LITERATURE: - O'Neil, C.; Schutt, R. (2013): Doing Data Science. Straight Talk from the Frontline (Ed. 1), O'Reilly Media, Sebastopol (ISBN: 978-1449358655) - Narkhede, N.; Shapira, G.; Palino, T. (2017): Kafka: The Definitive Guide: Real-Time Data and Stream Processing at Scale (Ed. 1), O'Reilly Media, Farnham (ISBN: 978-1491936160)		
	Artificial Intelligence (E) /ILV / Course no.: DPR.9 / 3rd semester / ECTS: 4		
	PRIMARY LITERATURE: - Winson, P. H. (1992): Artificial Intelligence (Ed. 3), Pearson, (ISBN: 978-0201533774) SECONDARY LITERATURE: - Russell, S.; Norvig, P. (2016): Artificial Intelligence: A Modern Approach, Global Edition (Ed. 3), Addison Wesley, Boston (ISBN: 978-1292153964)		
Skills acquisition	Big Data Processing (E) /ILV / Course no.: DPR.1 / 3rd semester / ECTS: 4		
	The following skills are developed in the course: - The students are familiar with the special challenges involved in storing and processing large quantities of data (V-model: Volume, Variety, Velocity, Veracity). - Students know the options for meeting these challenges (exemplary systems from the respective areas of the V-model are discussed). - Students can develop and apply appropriate solutions to a specific problem.		
	Artificial Intelligence (E) /ILV / Course no.: DPR.9 / 3rd semester / ECTS: 4		
	The following skills are developed in the course: - Students are familiar with different strategies for the implementation of artificially intelligent systems. - Students understand the advantages and disadvantages of the strategies developed and are aware of their challenges. - Students can develop strategies to design artificially intelligent systems for practical use.		
Course contents	Big Data Processing (E) /ILV / Course no.: DPR.1 / 3rd semester / ECTS: 4		
	Students are introduced to the basic features of Big Data. Special attention is paid to the handling of this data and the knowledge acquired is consolidated with examples. Suitable frameworks for solving Big Data problems are presented and worked on in interactive workshops with case studies. Examples of this are as follows: - Apache Hadoop - Apache Spark - Apache Flink		

	- Apache Storm - Apache Samza - Apache Kafka These frameworks will be explained and used with case studies. For this purpose, the centrally-provided Data Labs can be accessed.
	Artificial Intelligence (E) /ILV / Course no.: DPR.9 / 3rd semester / ECTS: 4
	The following content is discussed in the course: - Reasoning approaches (Roal trees, rule-based expert systems) - Search approaches (depth-first, hill climbing, beam, optimal, branch and bound, A*, games, minimax, and alpha-beta) - Constraint approaches (search, domain reduction, visual object recognition) - Learning approaches (neural nets, back propagation, genetic algorithms, sparse spaces, phonology, near misses, felicity conditions, support vector machines, boosting) - Representation approaches (classes, trajectories, transitions) - Possible applications of artificial intelligence in different contexts - Weak versus strong, artificial intelligence This course is offered together with the Web Communication and Information Systems Master program as an elective course.
Teaching and learning methods	Big Data Processing (E) /ILV / Course no.: DPR.1 / 3rd semester / ECTS: 4
	The following methods are used: - Lecture with discussion - Group work - Interactive workshop
	Artificial Intelligence (E) /ILV / Course no.: DPR.9 / 3rd semester / ECTS: 4
	The following methods are used: - Lecture with discussion - Interactive workshop
Evaluation Methods Criteria	Big Data Processing (E) /ILV / Course no.: DPR.1 / 3rd semester / ECTS: 4
	Written exam
	Artificial Intelligence (E) /ILV / Course no.: DPR.9 / 3rd semester / ECTS: 4
	Written exam

Module details for Master Thesis & Academic Methods

Module number:	**Master Thesis & Academic Methods**	**Scope:**	
MWA		**26**	**ECTS**
Degree program	University of Applied Sciences Master's Course - Data Science & Intelligent Analytics Part-time		
Level	3rd semester: Master's course / 4th semester: Master's course		
Previous knowledge	3rd semester: No prerequisites / 4th semester: No prerequisites		
Blocked	no		
Participant group	Bachelor graduates, beginners		
Literature recommendation	Academic Methods /SE / Course no.: MWA.1 / 3rd semester / ECTS: 2		
	PRIMARY LITERATURE: - Poser, H. (2001): Wissenschaftstheorie. Eine philosophische Einführung (Ed. 1), Reclam, Dithingen (ISBN: 978-3150181256) SECONDARY LITERATURE: - Franck, N. (2017): Handbuch Wissenschaftliches Arbeiten (Ed. 3), Fischer Taschenbuch Verlag, Frankfurt am Main (ISBN: 978-3825247485)		
	Master thesis /SE / Course no.: MWA.2 / 4th semester / ECTS: 22		
	PRIMARY LITERATURE: - Franck, N. (2007): Handbuch Wissenschaftliches Arbeiten (Ed. 2), Fischer Taschenbuch Verlag, Frankfurt am Main (ISBN: 978-3596151868)		
	Master Thesis Seminar /SE / Course no.: MWA.2 / 4th semester / ECTS: 2		

	PRIMARY LITERATURE: - Franck, N. (2007): Handbuch Wissenschaftliches Arbeiten (Ed. 2), Fischer Taschenbuch Verlag, Frankfurt am Main (ISBN: 978-3596151868)
Skills acquisition	Academic Methods /SE / Course no.: MWA.1 / 3rd semester / ECTS: 2
	The following skills are developed in the course: - Students know the rules through which academic methods function. - Students can apply these rules on the basis of a specific project. - Students can write an exposé, coordinating problem definition, research question and methodological approach.
	Master thesis /SE / Course no.: MWA.2 / 4th semester / ECTS: 22
	The following skills are developed in the course: - Students can independently write a Master thesis in the field of Data Science. - Students can independently set up and carry out a scientific project.
	Master Thesis Seminar /SE / Course no.: MWA.2 / 4th semester / ECTS: 2
	The following skills are developed in the course: - Students are aware of how scientific reviews are conducted. - Students are also aware of how to present results to a scientific community. - Students can critically question scientific findings.
Course contents	Academic Methods /SE / Course no.: MWA.1 / 3rd semester / ECTS: 2
	Students are introduced to the theory of science and academic methods. The goals of academic methods are discussed and applied to the students' own problems. During the course, the students will therefore develop a first draft exposé for a Master thesis.
	Master thesis /SE / Course no.: MWA.2 / 4th semester / ECTS: 22
	Students independently draft a project idea for their own Master thesis, describe it in the form of an exposé and submit it to the program management for approval. Students then work on the topic and write a Master thesis, which is submitted for review.
	Master Thesis Seminar /SE / Course no.: MWA.2 / 4th semester / ECTS: 2
	The course accompanies the students while they draft and write their master thesis. The colloquium will therefore present and discuss the question/hypothesis and structure of the Master thesis. In addition, the scientific methodology of the Master thesis is discussed and questioned and advice is given on the formal design of the Master thesis.
Teaching and learning methods	Academic Methods /SE / Course no.: MWA.1 / 3rd semester / ECTS: 2
	The following methods are used: - Lecture with discussion - Interactive workshop
	Master thesis /SE / Course no.: MWA.2 / 4th semester / ECTS: 22
	The following methods are used: - Coaching within the scope of the Master thesis preparation
	Master Thesis Seminar /SE / Course no.: MWA.2 / 4th semester / ECTS: 2
	The following methods are used: - Interactive workshop - Lecture with discussion
Evaluation Methods Criteria	Academic Methods /SE / Course no.: MWA.1 / 3rd semester / ECTS: 2
	Exposé on the Master thesis
	Master thesis /SE / Course no.: MWA.2 / 4th semester / ECTS: 22
	Master thesis
	Master Thesis Seminar /SE / Course no.: MWA.2 / 4th semester / ECTS: 2
	Final presentation

Module details for Ethics & Law

Module number:	**Ethics & Law**	**Scope:**	
ETHR		**3**	**ECTS**
Degree program	University of Applied Sciences Master's Course - Data Science & Intelligent Analytics Part-time		
Level	4th semester: Master's course		
Previous knowledge	4th semester: No prerequisites		
Blocked	no		
Participant group	Bachelor graduates, beginners		
Literature recommendation	Business Ethics, Compliance and Law /ILV / Course no.: ETHR.1 / 4th semester / ECTS: 3		
	PRIMARY LITERATURE: - Gola, P.; Reif, Y. (2016): Praxisfälle Datenschutzrecht: Juristische Sachverhalte Schritt für Schritt prüfen, bewerten und lösen (Ed. 2), DATAKONTEXT, Frechen (ISBN: 978-3895777677) SECONDARY LITERATURE: - Floridi, L. (2015): The Ethic of Information (Ed. 1), Oxford University Press, Oxford (ISBN: 978-0198748052) - Lynskey, O. (2016): The Foundations of EU Data Protection Law (Ed. 1), Oxford University Press, Oxford (ISBN: 978-0-19-871823-9) - Taeger, J. (2014): Datenschutzrecht: Einführung (Ed. 1), Deutscher Fachverlag, Frankfurt am Main (ISBN: 978-3800515370) - Worms, N. (2010): Informationsethik und Online-Netzwerke: Im Spannungsfeld zwischen strukturellen Bedingtheit und Privatsphäre (Ed. 1), VDM Verlag Dr. Müller, Saarbrücken (ISBN: 978-3639320602)		
Skills acquisition	Business Ethics, Compliance and Law /ILV / Course no.: ETHR.1 / 4th semester / ECTS: 3		
	The following skills are developed in the course: - Students are familiar with further ethical and legal requirements for data processing. - Students can apply these advanced requirements to data-driven projects. - Students are able to analyze the use of large quantities of data and exploitation strategies based on these ethical and legal frameworks and to develop procedures based on them.		
Course contents	Business Ethics, Compliance and Law /ILV / Course no.: ETHR.1 / 4th semester / ECTS: 3		
	The following content is discussed in the course: - Data protection (e.g. DSGVO) - Privacy (e-Privacy Regulation) - Handling of data from an ethical/moral point of view - Compliance		
Teaching and learning methods	Business Ethics, Compliance and Law /ILV / Course no.: ETHR.1 / 4th semester / ECTS: 3		
	The following methods are used: - Lecture with discussion		
Evaluation Methods Criteria	Business Ethics, Compliance and Law /ILV / Course no.: ETHR.1 / 4th semester / ECTS: 3		
	Written exam		

Module details for elective courses

Module number:	**Elective courses**	**Scope:**	
WPF		**11**	**ECTS**
Degree program	University of Applied Sciences Master's Course - Data Science & Intelligent Analytics Part-time		
Position in the curriculum	3rd semester		
	4th semester		
Level	3rd semester: 2nd Study cycle, Master / 3rd semester: Master's course / 4th semester: Master's course / 4th semester: Master's course		
Previous knowledge	3rd semester: none / 3rd semester: no prerequisites / 3rd semester: No prerequisites / 3rd semester: not applicable / 4th semester: not specified / 4th semester: no prerequisites / 4th semester: No prerequisites		
Blocked	no		
Participant group	Bachelor graduates, beginners		
Literature recommendation	Trends in ERP (elective) /ILV / Course no.: WPF.10 / 4th semester / ECTS: 3 not specified		
	Trends in Smart Products (elective) /ILV / Course no.: WPF.11 / 4th semester / ECTS: 3 - Huber W.; Industrie 4.0 kompakt – Wie Technologien unsere Wirtschaft und unsere Unternehmen verändern: Transformation und Veränderung des gesamten Unternehmens; Wiesbaden; 2018 - Iyer B., Venkatraman V.; "What comes after smart products?", Havard Business Review; 2015 - Roth A.; Einführung und Umsetzung von Industrie 4.0: Grundlagen, Vorgehensmodell und Use Cases aus der Praxis; Wiesbaden; 2016		
	Trends in Web Technologies (elective) /ILV / Course no.: WPF.12 / 4th semester / ECTS: 3 PRIMARY LITERATURE: - European Journal of Information Systems - Information Systems Journal - Information Systems Research - Journal of AIS - Journal of Information Technology - Journal of MIS - Journal of Strategic Information Systems - MIS Quarterly		
	Application-oriented analysis platforms (elective) /ILV / Course no.: WPF.2 / 3rd semester / ECTS: 4 PRIMARY LITERATURE: - 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) - Klinkenberg, R., Hofmann, M. (2016): RapidMiner (Ed. 1), Chapman and Hall, Farnham (ISBN: 978-1482205503) SECONDARY LITERATURE: - Lakshmanan, V. (2017): Data Science on the Google Cloud Platform: Implementing End-to-End Real-Time Data Pipelines: From Ingest to Machine Learning (Ed. 1), O'Reilly Media, Farnham (ISBN: 978-1491974537)		
	Data Visualization & Visual Analytics (elective) /ILV / Course no.: WPF.2 / 3rd semester / ECTS: 4 PRIMARY LITERATURE: - Chang, W. (2013): R Graphics Cookbook: Practical Recipes for Visualizing Data (Ed. 1), O'Reilly, Farnham (ISBN: 978-1449316952) - Chen, C.; Härdle, W. K.; Unwin, A. (2008): Handbook of Data Visualization (Ed. 1), Springer, Berlin (ISBN: 978-3-662-50074-3) SECONDARY LITERATURE: - Dale, K. (2016): Data Visualization with Python and Javascript: Scrape, Clean, Explore and Transform Your Data (Ed. 1), O'Reilly, Farnham (ISBN: 978-1491920510) - Murray, S. (2017): Interactive Data Visualization for the Web: An Introduction to Designing with D3 (Ed. 2), O'Reilly, Farnham (ISBN: 978-1491921289)		
	Internet of Things (elective) /ILV / Course no.: WPF.3 / 3rd semester / ECTS: 4		

	Perry L.; Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security; Birmingham; 2018 Sinclair B.; IoT Inc: How Your Company Can Use the Internet of Things to Win in the Outcome Economy; 2017 Thomas O., Nüttgens M., Fellmann M. (editor); Smart Service Engineering: Konzepte und Anwendungsszenarien für die digitale Transformation; Wiesbaden; 2017
	Agile Product Development (elective) /ILV / Course no.: WPF.4 / 3rd semester / ECTS: 4 * Pfeffer J.; Produkt-Entwicklung: Lean & Agile; München; 2019 * Schröder A.; Agile Produktentwicklung: Schneller zur Innovation – erfolgreicher am Markt; 2018
	Process automation (elective) /ILV / Course no.: WPF.5 / 3rd semester / ECTS: 4 * Rich M., Weber B.: Enabling Flexibility in Process-aware Information Systems, Springer 2012, chapters 2-4 * Quarre, F.: Robotic Process Automation, O'Reilly, 2019 * Critchley, S.; Dynamics 365 CE Essentials: Administering and Configuring Solutions, Apress; 2018 * Yapa, S.; Customizing Dynamics 365: Implementing and Releasing Business Solutions, Apress; 2019 * Salatino, M., Aliverti, E.: jBPM 6 Developer Guide; Packt Publishing, 2014 * Allweyer, Thomas: BPMN 2.0 - Business Process Model and Notation: Einfuehrung in den Standard fu?r die Geschaeftsprozessmodellierung.- Books on Demand, 2015
	Quantitative Process & Quality Management (Six Sigma) (elective) /ILV / Course no.: WPF.6 / 3rd semester / ECTS: 4 Töpferer, A.; Six Sigma Konzeption und Erfolgsbeispiele für praktizierende Null-Fehler-Qualität; Berlin/Heidelberg/New York 2007; 4th edition George M.; Rowlands D.; Price M.; Maxey J.; The Lean Six Sigma Pocket Toolbook; New York; 2005 Lunau St. (publisher); Six Sigma + Lean Toolset; 5th edition; Heidelberg; 2014
	Business Platforms & Cloud Computing (elective) /ILV / Course no.: WPF.7 / 3rd semester / ECTS: 4 PRIMARY LITERATURE: - Erl, T., Puttini, R., Mahmood, Z: Cloud Computing: Concepts, Technology and Architecture. 2013 - Jackson, K., Goessling, S.: Architecting Cloud Computing Solutions: Build cloud strategies that align technology and economics while effectively managing risk. 2018 - Evans, D., Schmalensee, R.: Matchmakers: The New Economics of Multisided Platforms. 2016
	Human-Computer Interaction (elective) /ILV / Course no.: WPF.8 / 3rd semester / ECTS: 4 - A. Dix, J. Finlay, G.D. Abowd, R. Beale: Human-Computer Interaction.Third Edition, Prentice Hall 2003, ISBN 978-0130461094 - Cooper, Reimann, and Cronin; About Face 3: The Essentials of Interaction Design; Wiley, 2007. ISBN 0470084111 - Lazar, Feng, and Hochheiser; Research Methods in Human-Computer Interaction; Wiley, 2010. ISBN 0470723378 - Stone, Jarrett, Woodruffe, and Minocha; User Interface Design and Evaluation; Morgan Kaufmann, March 2005. ISBN 0120884364 - A. Kerren, A. Ebert, J. Meyer: Human-Centered Visualization Environments.Springer 2007, ISBN 978-3540719489 - Sarodnick, F., & Brau, H.: Methoden der Usability-Evaluation. Bern: Hans Huber, 2011. - Shneiderman, B., and Plaisant, C.: Designing the user interface (5th ed.). Boston: Addison-Wesley, 2009. - Nielsen, Jakob: Designing Web Usability, engl. Issue, Market and Technology, 2004
	Trends in Data Science (elective) /ILV / Course no.: WPF.9 / 4th semester / ECTS: 3 Due to the changeability of the content, only a few web sources are listed here as examples, which are currently strongly represented in the area of Data Science Trends: - Medium (2020): Towards Data Science (Ed. 1), online, https://towardsdatascience.com/. - KDNuggets (2020): Knowledge Discovery Nuggets (Ed. 1), online, https://www.kdnuggets.com/.
Skills acquisition	Trends in ERP (elective) /ILV / Course no.: WPF.10 / 4th semester / ECTS: 3 Knows current trends in the field of ERP systems
	Trends in Smart Products (elective) /ILV / Course no.: WPF.11 / 4th semester / ECTS: 3 The following learning outcomes are developed in the course: - Students will understand the concepts of smart applications such as Smart House, Smart City, Smart Production, Connected Vehicles etc.- Students know and understand the latest trends in the field of these applications.
	Trends in Web Technologies (elective) /ILV / Course no.: WPF.12 / 4th semester / ECTS: 3 The following learning outcomes are developed in the course: - Students will be aware of current thematic trends in the field of web technologies and applications. - Students are familiar with current technological developments in the field of web technologies and applications. - Students are familiar with current practical issues in the field of web technologies and applications.

Application-oriented analysis platforms (elective) /ILV / Course no.: WPF.2 / 3rd semester / ECTS: 4 The following learning outcomes are developed in the course: - Students are familiar with different, application-oriented analysis platforms (e.g. KNIME, RapidMiner, Grafana) - Students can compare the analysis platforms they have learned with regard to their suitability for a specific application. - Students have gained first application experience with the platforms presented.
Data Visualization & Visual Analytics (elective) /ILV / Course no.: WPF.2 / 3rd semester / ECTS: 4 The following learning outcomes are developed in the course: - Students will have basic knowledge of data visualization and visual communication. - Students will be able to develop visualizations independently and use them for communication purposes. - Students can work with different presentation tools and presentation libraries to present data and analysis results in a meaningful way.
Internet of Things (elective) /ILV / Course no.: WPF.3 / 3rd semester / ECTS: 4 Students: - know basic IOT architectures. - know methods of data generation. - know the basics of data transmission. - know the options of data storage. - know the forms of data visualization. - understand challenges of data security.
Agile Product Development (elective) /ILV / Course no.: WPF.4 / 3rd semester / ECTS: 4 Students: - know agile procedure methods.
- know organizational roles in the agile process. - know the process of an agile project (sprints, dailies, demos, retros). - know how to coach an agile project (e.g. question techniques). - know the experiences of agile projects from software development. - know the challenges of developing smart products. - know methods of product development (e.g. FMEA, TRIZ). - know the advantages of hybrid procedure methods. - know the role of management in the agile process.
Process automation (elective) /ILV / Course no.: WPF.5 / 3rd semester / ECTS: 4 Students: - know the challenges of process automation. - know how to select processes for automation. - know the procedure and factors for successful process automation. - know how to create process automations in selected software. - know interfaces to ERP and CRM systems. - know the procedures of interprocess communication and can implement them. - know the basic structure of cloud-based IT applications for process automation in the operational environment using the example of Microsoft Dynamics 365. - know basic and advanced functionalities of process automation under Microsoft Dynamics 365. - can implement UIs for process automation based on browser and apps using Microsoft technologies.
Quantitative Process & Quality Management (Six Sigma) (elective) /ILV / Course no.: WPF.6 / 3rd semester / ECTS: 4 Students: - know the basics of descriptive and conclusive statistics. - know how to examine measuring arrangements for repeatability and reproducibility. - know how to calculate sample sizes. - know how to monitor the stability of process results using statistical monitoring methods. - know how to evaluate the ability of processes to meet customer requirements. - know methods to search for the deviation causes in results using test procedures. - know basic functionalities of the "Minitab" statistics software. - know how to use "Minitab" in the context of process analysis.
Business Platforms & Cloud Computing (elective) /ILV / Course no.: WPF.7 / 3rd semester / ECTS: 4

	The following learning outcomes are developed in the course: - Students will know common business platforms. - Students will know the advantages and disadvantages of business platforms and can select suitable platforms. - Students will know the basics of cloud computing and cloud platforms. - Students will become aware of the options. Defining interfaces and using them.
	Human-Computer Interaction (elective) /ILV / Course no.: WPF.8 / 3rd semester / ECTS: 4 Graduates know the basics of designing web-based or mobile interaction interfaces and are able to apply them independently in the context of interactive systems. In this context, graduates acquire knowledge of the basic concepts of the work and research field of human-computer interaction: Usability, user experience and user interface design. Graduates acquire the basic knowledge to design interactive applications according to a human-centred design process and to analyze and evaluate user interfaces with usability evaluation methods.
	Trends in Data Science (elective) /ILV / Course no.: WPF.9 / 4th semester / ECTS: 3 The following learning outcomes are developed in the course: - Students are familiar with current thematic trends in the field of data science. - Students are familiar with current technological developments in the field of data science. - Students are familiar with current practical issues in the field of data science.
Course contents	Trends in ERP (elective) /ILV / Course no.: WPF.10 / 4th semester / ECTS: 3 - Current developments in the field of business application systems with special reference to ERP systems and business process management - Models, examples, best practice cases
	Trends in Smart Products (elective) /ILV / Course no.: WPF.11 / 4th semester / ECTS: 3 The contents of this course are not set, but will be adapted to the current prevailing trends. Content examples may include: - Current best practice approaches and concepts in application areas (e.g. Smart Home, Smart City, Smart Production, Connected Vehicles etc.) - Current best practice approaches with regard to development processes and tools - Current research and development activities or research and development results
	Trends in Web Technologies (elective) /ILV / Course no.: WPF.12 / 4th semester / ECTS: 3 The contents of this course are not set, but will be adapted to the current prevailing trends. Content examples may include: - New technologies in the field of web architectures - Trends in the field of programming languages on the web - New design concepts in the field of web applications - New questions in the field of research in web technologies and applications - New questions in the field of web development practice
	Application-oriented analysis platforms (elective) /ILV / Course no.: WPF.2 / 3rd semester / ECTS: 4 The following content is discussed in the course: - Presentation of different user-oriented analysis platforms (e.g. KNIME, RapidMiner, Grafana) - Presentation of different cloud solutions for data analysis (e.g. Google Cloud, AWS, Azure) - Application of the platforms presented using the example of analysis data sets - Discussion of the different approaches
	Data Visualization & Visual Analytics (elective) /ILV / Course no.: WPF.2 / 3rd semester / ECTS: 4 The following content is discussed in the course: - Evaluation tools with visual orientation, e.g. Bl tools such as MS PowerBl, Tableau, QlikView - Display libraries, e.g. matplotlib.pyplot, gglot2 - Rules of visual communication, e.g. Hichert SUCCESSSS
	Internet of Things (elective) /ILV / Course no.: WPF.3 / 3rd semester / ECTS: 4

Introduction
- IoT architecture (e.g. reference models)
- Requirements for IOT systems
- IOT data transmission protocols
- Use of IOT in an industrial context (examples)
- Basics of sensor technology
- Basics of embedded systems

Implementation
- Procedure for implementing IOT
- Prototypical implementation of IOT
- Selection of sensors
- Data collection, visualization and evaluation
- Challenges in implementation

Agile Product Development (elective) /ILV / Course no.: WPF.4 / 3rd semester / ECTS: 4

- Overview of agile process methods
- Roles in the agile process
- Flow of an agile project (Sprins, Dailies, Demos, Retros)
- Coaching of an agile project (e.g. question techniques)
- Experiences with agile projects from software development
- Challenges in developing smart products
- Methods of product development (e.g. FMEA, TRIZ)
- Advantages of hybrid process methods
- Role of management in the agile process

Process automation (elective) /ILV / Course no.: WPF.5 / 3rd semester / ECTS: 4

- Basic terms: Business process, workflow, BPMS, WFMS, RPA, etc.
- Selection criteria for workflow engines for process automation
- Architecture and integration of workflows for process automation
- Overview of interprocess communication
- Transactional properties of processes, simulation and code generation
- Basics of Microsoft Dynamics 365: Modules and navigation, basic entities and standard workflows
- Organizational and technical implementation with configuration and declarative programming

Quantitative Process & Quality Management (Six Sigma) (elective) /ILV / Course no.: WPF.6 / 3rd semester / ECTS: 4

The following content is discussed in the course:

- Basics of descriptive statistics
- Measurement system analysis
- Sample determination
- Statistical process monitoring
- Process monitoring charts
- Process capability analysis
- Components of Variants Analysis (COV)
- Repetition Basics of inferential statistics
- Failure cause determination via hypothesis testing (T-test, Chi-Sq, ANOVA)
- Multiple regression analysis

Business Platforms & Cloud Computing (elective) /ILV / Course no.: WPF.7 / 3rd semester / ECTS: 4

Students are given an overview of common business platforms and cloud computing. In addition, the advantages and disadvantages of the respective platforms are discussed. Students are therefore able to select suitable platforms for a given problem. Students gain practical experience with selected platforms using case studies. In addition, methods for defining interfaces are discussed with the students.

Human-Computer Interaction (elective) /ILV / Course no.: WPF.8 / 3rd semester / ECTS: 4

The lecture teaches basic concepts from the field of human-computer interaction (usability, user experience, user interface design) and information visualization. This includes the following focal points: User interface architectures; design criteria, guidelines and standards for the creation and modelling of user interfaces of interactive systems; approaches and methods (quantitative and qualitative) for the evaluation of user interfaces of interactive systems; web style guides and evaluation criteria for websites (e.g. with regard to accessibility); basics of information presentation and data visualization; interactive information visualization;

the theoretical lecture contents are prepared in the exercise using practical examples and implemented in a small project (usability evaluation) in a team.

Trends in Data Science (elective) /ILV / Course no.: WPF.9 / 4th semester / ECTS: 3

	The contents of this course are not set, but will be adapted to the current prevailing trends. Content examples may include: - New technologies in the field of Big Data Processing - Trends in programming languages in data analysis - New concepts of data processing (e.g. Data Lake) - New questions in the field of data science research - New questions in data science practice
Teaching and learning methods	Trends in ERP (elective) /ILV / Course no.: WPF.10 / 4th semester / ECTS: 3 Lecture, group work, presentation and discussion of tasks
	Trends in Smart Products (elective) /ILV / Course no.: WPF.11 / 4th semester / ECTS: 3 Lecture, exercise
	Trends in Web Technologies (elective) /ILV / Course no.: WPF.12 / 4th semester / ECTS: 3 The following methods are used: - Lecture with discussion - Interactive workshop
	Application-oriented analysis platforms (elective) /ILV / Course no.: WPF.2 / 3rd semester / ECTS: 4 The following methods are used: - Lecture with discussion - Processing of exercises - Interactive workshop
	Data Visualization & Visual Analytics (elective) /ILV / Course no.: WPF.2 / 3rd semester / ECTS: 4 The following methods are used: - Lecture with discussion - Interactive workshop - Case studies
	Internet of Things (elective) /ILV / Course no.: WPF.3 / 3rd semester / ECTS: 4 Lecture, individual work with software, group work, presentation and discussion of tasks
	Agile Product Development (elective) /ILV / Course no.: WPF.4 / 3rd semester / ECTS: 4 Lecture, group work, presentation and discussion of tasks
	Process automation (elective) /ILV / Course no.: WPF.5 / 3rd semester / ECTS: 4 Lecture, discussions, practical examples, PC exercises
	Quantitative Process & Quality Management (Six Sigma) (elective) /ILV / Course no.: WPF.6 / 3rd semester / ECTS: 4 Lecture, individual work with software, group work, presentation and discussion of tasks
	Business Platforms & Cloud Computing (elective) /ILV / Course no.: WPF.7 / 3rd semester / ECTS: 4 Lecture, group work, presentation and discussion of tasks
	Human-Computer Interaction (elective) /ILV / Course no.: WPF.8 / 3rd semester / ECTS: 4 Lecture, group work (project), presentation and discussion of tasks
	Trends in Data Science (elective) /ILV / Course no.: WPF.9 / 4th semester / ECTS: 3 The following methods are used: - Lecture with discussion - Interactive workshop
Evaluation Methods Criteria	Trends in ERP (elective) /ILV / Course no.: WPF.10 / 4th semester / ECTS: 3 Seminar thesis
	Trends in Smart Products (elective) /ILV / Course no.: WPF.11 / 4th semester / ECTS: 3 Seminar thesis
	Trends in Web Technologies (elective) /ILV / Course no.: WPF.12 / 4th semester / ECTS: 3 Seminar thesis
	Application-oriented analysis platforms (elective) /ILV / Course no.: WPF.2 / 3rd semester / ECTS: 4

	Seminar thesis
	Data Visualization & Visual Analytics (elective) /ILV / Course no.: WPF.2 / 3rd semester / ECTS: 4 Seminar thesis
	Internet of Things (elective) /ILV / Course no.: WPF.3 / 3rd semester / ECTS: 4 Seminar thesis
	Agile Product Development (elective) /ILV / Course no.: WPF.4 / 3rd semester / ECTS: 4 Seminar thesis
	Process automation (elective) /ILV / Course no.: WPF.5 / 3rd semester / ECTS: 4 Seminar thesis
	Quantitative Process & Quality Management (Six Sigma) (elective) /ILV / Course no.: WPF.6 / 3rd semester / ECTS: 4 Seminar thesis
	Business Platforms & Cloud Computing (elective) /ILV / Course no.: WPF.7 / 3rd semester / ECTS: 4 Seminar thesis
	Human-Computer Interaction (elective) /ILV / Course no.: WPF.8 / 3rd semester / ECTS: 4 Seminar thesis
	Trends in Data Science (elective) /ILV / Course no.: WPF.9 / 4th semester / ECTS: 3 Seminar thesis

2.4 Internship

Internship (semester information, duration in weeks per semester)	no

2.5 Semester Abroad

Obligatory semester abroad (semester specification)	No

3 ADMISSION REQUIREMENTS

The general admission requirements are regulated by section 4 of the FHG (Fachhochschule Studies Act) as amended, according to which the subject-related admission requirement for a Fachhochschule Master's course is a completed University of Applied Sciences Bachelor degree program relevant to the subject or the completion of an equivalent degree program at a recognized domestic or foreign post-secondary educational institution.

1. For the present course of studies, Bachelor's studies or equivalent post-secondary educational qualifications from the field **of information technologies**[2]are considered relevant to the subject, which cover the core subjects (a) use of computers, (b) database design and management and (c) software and application development[3], summarily in a total amount of **at least 6 ECTS**. In addition, these Bachelor programs or equivalent post-secondary educational qualifications should have dealt summarily with topics from the fields of natural sciences, **mathematics and statistics**[4], which comprise the core subject areas (d) mathematics and (e) statistics[5], in a total amount of **at least 8 ECTS** . As part of the part-time mode of the present degree program, proven professional qualifications can be included in the examination of the relevant previous work.

Those who are unable to prove these subject-relevant requirements during their first degree course can prove their subject-relevant qualification for admission to the Master's Course using subject-related external further training in the above-mentioned areas (e.g. certificate courses) or subject-specific qualification (e.g. using a qualified service record). The examinations of the above-mentioned relevant qualifications are checked and documented during the admission procedure.

2. The FH Kufstein Tirol provides in its course architecture for a networking of the Bachelor and Master programs in the sense of the Bologna process. Following successful completion of a Bachelor program, graduates have several options for a Master's degree course at and outside the FH Kufstein Tirol. Graduates of the following FH Kufstein Tirol degree programs would be admitted to the present Master's course based on the above-mentioned professional qualifications

- Web Business and Technology
- Industrial Engineering and Management

3. The languages of instruction and examination at the FH Kufstein Tirol are German and English across all degree programs. Students from non-German speaking countries must therefore provide appropriate evidence of their German language skills.

4. The examination of the fulfilment of the admission requirements is the responsibility of the course director of the Data Science and Intelligent Analytics Master's course.

[2] based on ISCED 2013, Fields of Education and Training No. 061 (Information and Communication Technologies (ICTs))
[3] 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)
[4] based on ISCED 2013, Fields of Education and Training No. 05 (Natural sciences, mathematics and statistics)
[5] based on ISCED 2013, Fields of Education and Training No. 0541 (Mathematics) and 0542 (Statistics)