Study Regulations of the
FH Master Degree Program

Data Science & Intelligent Analytics

leading to the award of the academic title

Master of Science in Engineering, abbreviated MSc

as an appendix of the statutes of FH Kufstein Tirol

Organizational form: part-time
Duration: 4 semesters
Scope: 120 ECTS
Number of places per academic year: 25

Version 1
Accredited by AQ Austria on 25/07/2018
Content based on the accreditation application

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 JOB PROFILES

1.1 Fields of employment

Graduates of the master degree program "Data Science & Intelligent Analytics" can principally be employed in all sectors that deal with data acquisition, data storage, data analysis and data utilization. However, on account of their broad studies, graduates are especially in high demand as employees and executives in the following core employment fields:

- IT in area of data analysis and usage
- IT consulting in the area of data analysis and usage
- Predictive analysis in various areas including
    - Consumption and process-oriented data processing within companies
    - Data processing in the area of sensor data (e.g. Internet of Things)
    - Data assessment in the environment of natural science topics
- Data preparation and presentation as well as analysis results
- Development of strategic options for data usage
- Interpretation of data analysis and usage including ethics, compliance and law

Graduates can be hired by various institutions and various types of companies due to the increasing importance of data in the age of digitization and the concomitantly rising demand for specialists in data acquisition, storage, evaluation and usage. Potential employers include both large-scale companies in the national and international environment as well as small and medium-sized enterprises and organizations within the government and NGO environment.

Essential characteristics of the fields of employment:

1. **Advanced understanding of technical backgrounds, methods and tools**
   for data analysis that potentially exhibit a high degree of complexity

2. A **high degree of flexibility in applying these methods and tools** in various organizational contexts, achieved through broadly structured knowledge in the subject-specific and application context

In addition to operational activity, graduates of this study program are also able to take on executive functions in the area of data acquisition, storage, analysis and utilization after an induction phase. A few typical and exemplary occupational profiles are stated in the following. These occupational profiles purposely cover a broad spectrum in order to elucidate that graduates of the master degree program can establish themselves in very different areas depending on their specialization and prior experience. The master degree program itself provides a well-founded education, focused on activities along the data lifecycle.

Occupational profiles are listed with English functional designations according to common practice in the area of data science and IT-related domains.

1.1.1 Occupational profile: Data application developer

Data application developers are competent in the development of data-driven systems and toolchains and understand how these processes work. The focus is on practical development work. In their work, they usually build on already defined software interfaces and focus on the data pipeline between output and input interfaces of respective software systems, which allows them to concentrate on performance and scalability of these applications. They primarily work at the operational level, usually independently of specific application domains. However, in some circumstances they may specialize in specific methods/techniques of data evaluation.

This occupational profile includes the following tasks:

- Development of data-driven systems
- Development of toolchains
- Development of data-driven components for existing systems
- Development of analysis pipelines based on existing interfaces (API)

1.1.2 Occupational profile: Data engineer

Data engineers are competent in software engineering – i.e. software conceptualization – in the area of data-driven systems. They conceptualize data-processing architectures such as toolchains and storage systems and are mindful of the architecture as well as of the scalability of applications for the processing of larger data volumes. The focus of their work is on the implementation of methods and techniques for the holistic integration of data and its usage within the system landscape. They predominantly work at the operational level, often independently of certain subject domains. However, in some circumstances they specialize in specific methods/techniques of data evaluation.

This occupational profile includes the following tasks:

- Strategy conceptualization for data integration within an organization
- Strategy conceptualization for the implementation of data evaluation in systems
- Conceptualization of scalable analysis systems and system landscapes
- Accompaniment of data-driven applications in the topical fields of requirements management (change-control) and operations

1.1.3 Occupational profile: Big data & business intelligence consultant

Big data & business intelligence consultants provide consultation services that especially focus on data acquisition, storage, analysis and/or usage. These persons are especially active at the middle and upper (strategic) management level. They have comprehensive knowledge in the areas of tools and methods as well as a good overview of common data-science practices.

This occupational profile includes the following tasks:

- Consultation for customers for the conceptualization of data-driven strategies
- Accompaniment of customers during the implementation of data-driven strategies
- Consultation for customers for the acquisition of new systems
- Consultation for customers for the development of data-driven business models
- Execution of an initial analysis within the sense of a "data value check"

1.1.4 Occupational profile: Data scientist

Data scientists work on company tasks within the context of data analysis, business intelligence and data-driven applications, which also includes data acquisition, storage, analysis and/or usage. They have a strong relationship to the respective application domain within this field of activity. Therefore, these persons achieve a higher technical pervasion than, e.g., classic data application developers (occupational profile 1) or data engineers (occupational profile 2). Their core task lies at the operational and management level. They also prepare data-related decisions for representatives at the strategic level. Data scientists have a very broad knowledge spectrum in the area of data-driven applications. They also act as technology scouts in the area of data-driven applications and thus advance this topic within their company.

This occupational profile includes the following tasks:

- Preparation of strategic decisions and development of strategic options
- Development of data-driven business models including application domains
- Analysis of company data for various subject areas
- Consultation for subject areas with respect to data handling
- Technology and method scouting
- Consultation for subject areas with respect to product/project compliance including data protection

1.1.5 Occupational profile: Manager for data science teams

Managers for data science teams coordinate internal company projects or organizational units, concentrating on data acquisition, storage, analysis and/or usage. Their daily work focuses on combining technical knowledge in the area of data science with management and leadership skills. In this role they

predominantly work at the management and strategic level and often form an interface to other subject areas. Some of these tasks require skills that can be developed after an induction phase.

This occupational profile includes the following tasks:

- Management tasks for the execution of data-driven projects
- Management tasks for the operation of data-driven products
- Management of employees within the context of subject-specific teams
- Conceptualization of the strategic usage of data analysis
- Recruitment of specialists in the area of data science
- Establishing an interface to other company areas
- Performing expenditure estimations for project resources
- Evaluation of product/project compliance also with respect to data protection

1.2 Qualification profile

The qualification targets of the master degree program "Data Science & Intelligent Analytics" comply with subject-specific scientific and professional requirements and the requirements of the International Standard Classification of Education (ISCED) 0688[1].

Conveyed content within the master degree program "Data Science & Intelligent Analytics" qualifies graduates for the occupational fields stated above. The desired learning outcome is the ability to develop and implement data-driven products and solutions, which is achieved through practical education focused on the areas of data acquisition & storage, data analysis, data usage and business-related fundamentals.

Within the context of their studies, students gain skills along the entire data lifecycle from data acquisition to data usage. Phases A through E of the lifecycle (acquisition, integration, storage, analysis and usage) represent actual processing phases in typical order and are supported by the cross-sectional functions F and G (Innovation & Management as well as Business Ethics, Compliance & Law).

The modules of the master degree program "Data Science & Intelligent Analytics" focus on the development of skills along the entire data lifecycle as stated in the comparison of occupational profiles, key skills and data-lifecycle phases in Table 1.

1.2.1 Skill emphases for the fields of employment

The abovementioned occupational fields were used in the conception phase of the study program "Data Science & Intelligent Analytics" as the starting point for the development of required skill profiles for graduates. In further consequence, tasks that graduates are required to take on in their professional contexts have been derived from these occupational profiles. These tasks, which can be assigned to one of the phases A - G in the data lifecycle, in turn require key skills that are necessary for performing the tasks. Table 1 illustrates the developed connections between occupational profiles, tasks, skills and lifecycle phases.

Table 1: Fields of employment and required skill emphases

Field of employment	Task	Skill description	Data lifecycle
Big data application developer	Development of data-driven systems	Ability to independently implement data storage strategies	C Data Storage
		Ability to independently integrate data for a data science project	B Data Integration
		Ability to independently develop an implementation strategy for a developed evaluation model	E Data Usage
		Ability to independently implement developed toolchains	D Data Analysis

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[1] A classification according to 0688 ("Interdisciplinary programs and qualifications involving Information and Communication Technologies") is suggested, since the modules of the master degree program Data Science & Intelligent Analytics focus on the ISCED area 06 ("Information and Communication Technologies") and only encompass the ISCED areas 054 ("Mathematics and Statistics") and 0413 ("Management and Administration") to a subordinate extent.

Field of employment	Task	Skill description	Data lifecycle
		Ability to utilize management methods for requirements management within the context of data-driven systems	F Innovation & Management
		Ability to utilize management methods for system quality assurance	F Innovation & Management
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Ability to formulate documents with technical content (e.g. instructions)	F Innovation & Management
	Development of analysis pipelines based on existing interfaces (API)	Ability to independently and practically implement data storage strategies	C Data Storage
		Ability to independently integrate data for a data science project	B Data Integration
		Ability to independently develop an implementation strategy for an evaluation model	E Data Usage
		Ability to independently implement developed toolchains	D Data Analysis
		Ability to utilize management methods for requirements management within the context of data-driven systems	F Innovation & Management
		Ability to utilize management methods for system quality assurance	F Innovation & Management
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Ability to formulate documents with technical content (e.g. instructions)	F Innovation & Management
	Development of toolchains	Familiar with various tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to independently implement developed toolchains	D Data Analysis
		Ability to utilize management methods for requirements management within the context of data-driven systems	F Innovation & Management
		Ability to utilize management methods for system quality assurance	F Innovation & Management
		Ability to combine tools for data provision/data preparation/data analysis/data illustration for a specific analysis scenario with respect to a performant toolchain	D Data Analysis
		Ability to compare and evaluate tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Ability to formulate documents with technical content (e.g. instructions)	F Innovation & Management
	Development of data-driven components for existing systems	Ability to independently and practically implement data storage strategies	C Data Storage
		Ability to independently integrate data for a data science project	B Data Integration
		Ability to independently develop an implementation strategy for developed evaluation models	E Data Usage
		Ability to independently implement developed toolchains	D Data Analysis
		Ability to utilize management methods for requirements management within the context of data-driven systems	F Innovation & Management
		Ability to utilize management methods for system quality assurance	F Innovation & Management
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Ability to formulate documents with technical content (e.g. instructions)	F Innovation & Management
Manager for data science teams	Management of employees within the context of data-driven strategies	Ability to discuss analysis results on an equal technical footing with specialist colleagues	E Data Usage
		Ability to work with other persons on a problem	F Innovation & Management
	Conceptualization of the strategic usage of data analysis	Overview of business-related decisions and processes	E Data Usage
		Ability to describe, analyze and develop business-related decisions and processes	E Data Usage
		Ability to discuss analysis results on an equal technical footing with specialist colleagues	E Data Usage
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Familiar with the implementation options of developed evaluation models in applications	E Data Usage

Field of employment	Task	Skill description	Data lifecycle
	Operational management of data-driven products	Familiar with various approaches for data analysis (e.g. descriptive and inferential statistical procedures, procedures for data mining and machine learning)	D Data Analysis
		Familiar with various tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to develop a data storage strategy	C Data Storage
		Ability to compare and evaluate heuristics and strategies for problem-solving	F Innovation & Management
		Ability to combine tools for data provision/data preparation/data analysis/data illustration for a specific analysis scenario with respect to a performant toolchain	D Data Analysis
		Ability to compare and evaluate tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
	Execution management for a data-driven project	Familiar with established methods and approaches of project management	F Innovation & Management
		Ability to apply established methods and approaches of project management	F Innovation & Management
		Ability to compare established methods and approaches of project management	F Innovation & Management
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
	Performing expenditure estimations for data-driven projects	Familiar with established methods and approaches of project management	F Innovation & Management
		Familiar with the implementation options of developed evaluation models in applications	E Data Usage
		Familiar with various approaches for data analysis (e.g. descriptive and inferential statistical procedures, procedures for data mining and machine learning)	D Data Analysis
		Familiar with various tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Familiar with various options for data storage (e.g. relational DBs, multi-dimensional DBs, NoSQL DBs, etc.)	C Data Storage
	Recruitment of specialists in the area of data-driven projects/products	Overview of business-related decisions and processes	E Data Usage
		Familiar with various approaches for data analysis (e.g. descriptive and inferential statistical procedures, procedures for data mining and machine learning)	D Data Analysis
		Ability to work with other persons on a problem	F Innovation & Management
	Establishing an interface to other areas	Overview of business-related decisions and processes	E Data Usage
		Ability to present results and discuss these with colleagues	F Innovation & Management
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
	Compliance assessment for products/projects	Ability to work with other persons on a problem	F Innovation & Management
		Ability to assess the ethical compliance of a product or project	G Business Ethics, Compliance & Law
		Ability to assess the legal compliance of a product or project	G Business ethics, compliance & law
		Ability to independently structure and process complex tasks	F Innovation & Management
Data engineer	Development of concepts for data integration	Familiar with methods for integrating existing databases	B Data Integration
		Ability to develop a data storage strategy	C Data Storage
		Ability to utilize management methods for requirements management within the context of data-driven systems	F Innovation & Management
		Ability to compare methods for integrating existing databases	B Data Integration
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Ability to formulate documents with technical content (e.g. instructions)	F Innovation & Management

Field of employment	Task	Skill description	Data lifecycle
	Conceptualization of the software landscape for data-driven applications	Familiar with the implementation options of developed evaluation models in applications	E Data Usage
		Familiar with various tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to independently develop an implementation strategy for a developed evaluation model	E Data Usage
		Ability to utilize management methods for requirements management within the context of data-driven systems	F Innovation & Management
		Ability to compare and evaluate various options for data storage	C Data Storage
		Ability to compare and evaluate tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Ability to formulate documents with technical content (e.g. instructions)	F Innovation & Management
		Ability to compare and evaluate options for implementing developed evaluation models	E Data Usage
		Familiar with various options for data storage (e.g. relational DBs, multi-dimensional DBs, NoSQL DBs, etc.)	C Data Storage
	Conceptualization of safety concepts for data applications	Ability to work with other persons on a problem	F Innovation & Management
		Familiar with strategies for data protection	G Business Ethics, Compliance & Law
		Ability to assess the conformity of a product or project according to the corporate philosophy	G Business Ethics, Compliance & Law
		Ability to independently structure and process complex tasks	F Innovation & Management
	Strategy conceptualization for implementing data analysis in existing systems	Familiar with various tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to illustrate (i.e. model) the structure of data storage strategies	C Data Storage
		Ability to utilize management methods for requirements management within the context of data-driven systems	F Innovation & Management
		Ability to compare methods for integrating existing databases	B Data Integration
		Ability to compare and evaluate illustration options for analysis results	D Data Analysis
		Ability to compare and evaluate various options for data storage	C Data Storage
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Ability to formulate documents with technical content (e.g. instructions)	F Innovation & Management
Data scientist	Analysis of data-driven strategies/business models with respect to content embedding	Overview of business-related decisions and processes	E Data Usage
		Recognizing the importance and dependencies between various tools for data provision/data preparation/data analysis/data illustration with respect to the specific usage scenario	D Data Analysis
		Familiar with established methods and approaches of project management	F Innovation & Management
		Familiar with methods for acquiring empirical data	A Data Acquisition
		Familiar with methods for integrating existing databases	B Data Integration
		Familiar with illustration options for data analysis results	D Data Analysis
		Familiar with various approaches for data analysis (e.g. descriptive and inferential statistical procedures, procedures for data mining and machine learning)	D Data Analysis
		Familiar with various heuristics and strategies for problem-solving	F Innovation & Management
		Familiar with various tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to describe, analyze and develop business-related decisions and processes	E Data Usage
		Ability to apply established methods and approaches of project management	F Innovation & Management
		Ability to compare established methods and approaches of project management	F Innovation & Management
		Ability to compare and evaluate heuristics and strategies for problem-solving	F Innovation & Management

Field of employment	Task	Skill description	Data lifecycle
		Ability to discuss analysis results on an equal technical footing with specialist colleagues	E Data Usage
		Ability to compare methods for integrating existing databases	B Data Integration
		Ability to compare and evaluate illustration options for analysis results	D Data Analysis
		Ability to compare and evaluate various options for data storage	C Data Storage
		Ability to compare and evaluate tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Knowing how to access existing databases for data science projects	B Data Integration
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Ability to compare and evaluate various data analysis approaches and the ability to independently develop and implement analysis strategies	D Data Analysis
		Ability to compare and evaluate options for implementing developed evaluation models	E Data Usage
		Familiar with various options for data storage (e.g. relational DBs, multi-dimensional DBs, NoSQL DBs, etc.)	C Data Storage
	Management of data-driven strategies with a technical background	Overview of business-related decisions and processes	E Data Usage
		Recognizing the importance and dependencies between various tools for data provision/data preparation/data analysis/data illustration with respect to the specific usage scenario	D Data Analysis
		Familiar with established methods and approaches of project management	F Innovation & Management
		Familiar with methods for acquiring empirical data	A Data Acquisition
		Familiar with methods for integrating existing databases	B Data Integration
		Familiar with illustration options for data analysis results	D Data Analysis
		Familiar with various approaches for data analysis (e.g. descriptive and inferential statistical procedures, procedures for data mining and machine learning)	D Data Analysis
		Familiar with various heuristics and strategies for problem-solving	F Innovation & Management
		Familiar with various tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to describe, analyze and develop business-related decisions and processes	E Data Usage
		Ability to apply established methods and approaches of project management	F Innovation & Management
		Ability to compare established methods and approaches of project management	F Innovation & Management
		Ability to compare and evaluate heuristics and strategies for problem-solving	F Innovation & Management
		Ability to discuss analysis results on an equal technical footing with specialist colleagues	E Data Usage
		Ability to compare methods for integrating existing databases	B Data Integration
		Ability to compare and evaluate illustration options for analysis results	D Data Analysis
		Ability to compare and evaluate various options for data storage	C Data Storage
		Ability to compare and evaluate tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Knowing how to access existing databases for data science projects	B Data Integration
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Ability to compare and evaluate various data analysis approaches and the ability to independently develop and implement analysis strategies	D Data Analysis
		Ability to compare and evaluate options for implementing developed evaluation models	E Data Usage
		Familiar with various options for data storage (e.g. relational DBs, multi-dimensional DBs, NoSQL DBs, etc.)	C Data Storage
	Conceptualization of data-driven strategies	Overview of business-related decisions and processes	E Data Usage

Field of employment	Task	Skill description	Data lifecycle
	with a profound technical background	Recognizing the importance and dependencies between various tools for data provision/data preparation/data analysis/data illustration with respect to the specific usage scenario	D Data Analysis
		Familiar with established methods and approaches of project management	F Innovation & Management
		Familiar with methods for acquiring empirical data	A Data Acquisition
		Familiar with methods for integrating existing databases	B Data integration
		Familiar with illustration options for data analysis results	D Data Analysis
		Familiar with various approaches for data analysis (e.g. descriptive and inferential statistical procedures, procedures for data mining and machine learning)	D Data Analysis
		Familiar with various heuristics and strategies for problem-solving	F Innovation & Management
		Familiar with various tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to describe, analyze and develop business-related decisions and processes	E Data Usage
		Ability to apply established methods and approaches of project management	F Innovation & Management
		Ability to compare established methods and approaches of project management	F Innovation & Management
		Ability to compare and evaluate heuristics and strategies for problem-solving	F Innovation & Management
		Ability to discuss analysis results on an equal technical footing with specialist colleagues	E Data Usage
		Ability to utilize management methods for requirements management within the context of data-driven systems	F Innovation & Management
		Ability to compare methods for integrating existing databases	B Data Integration
		Ability to compare and evaluate illustration options for analysis results	D Data Analysis
		Ability to compare and evaluate various options for data storage	C Data Storage
		Ability to compare and evaluate tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Knowing how to access existing databases for data science projects	B Data Integration
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Ability to formulate documents with technical content (e.g. instructions)	F Innovation & Management
		Ability to compare and evaluate various data analysis approaches and the ability to independently develop and implement analysis strategies	D Data Analysis
		Ability to compare and evaluate options for implementing developed evaluation models	E Data Usage
		Familiar with various options for data storage (e.g. relational DBs, multi-dimensional DBs, NoSQL DBs, etc.)	C Data Storage
	Performing technology/method scouting in the area of data science	Familiar with methods for integrating existing databases	B Data Integration
		Familiar with illustration options for data analysis results	D Data Analysis
		Familiar with various approaches for data analysis (e.g. descriptive and inferential statistical procedures, procedures for data mining and machine learning)	D Data Analysis
		Familiar with various tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Familiar with various options for data storage (e.g. relational DBs, multi-dimensional DBs, NoSQL DBs, etc.)	C Data Storage
	Combining specialist departments with the data science domain	Overview of business-related decisions and processes	E Data Usage
		Ability to work with other persons on a problem	F Innovation & Management
	Compliance assessment for products/projects	Ability to work with other persons on a problem	F Innovation & Management
		Ability to assess the ethical compliance of a product or project	G Business Ethics, Compliance & Law
		Ability to assess the legal compliance of a product or project	G Business ethics, compliance & law
		Ability to independently structure and process complex tasks	F Innovation & management

Field of employment	Task	Skill description	Data lifecycle
Big data & BI consultant	Customer accompaniment during the execution of data-driven strategies	Recognizing the importance and dependencies between various tools for data provision/data preparation/data analysis/data illustration with respect to the specific usage scenario	D Data analysis
		Familiar with established methods and approaches of project management	F Innovation & Management
		Familiar with methods for acquiring empirical data	A Data Acquisition
		Familiar with methods for integrating existing databases	B Data integration
		Familiar with illustration options for data analysis results	D Data analysis
		Familiar with various approaches for data analysis (e.g. descriptive and inferential statistical procedures, procedures for data mining and machine learning)	D Data Analysis
		Familiar with various heuristics and strategies for problem-solving	F Innovation & Management
		Familiar with various tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to apply established methods and approaches of project management	F Innovation & Management
		Ability to compare established methods and approaches of project management	F Innovation & Management
		Ability to compare and evaluate heuristics and strategies for problem-solving	F Innovation & Management
		Ability to discuss analysis results on an equal technical footing with specialist colleagues	E Data Usage
		Ability to utilize management methods for requirements management within the context of data-driven systems	F Innovation & Management
		Ability to compare methods for integrating existing databases	B Data Integration
		Ability to compare and evaluate illustration options for analysis results	D Data Analysis
		Ability to compare and evaluate various options for data storage	C Data Storage
		Ability to compare and evaluate tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Knowing how to access existing databases for data science projects	B Data Integration
		Ability to present results and discuss these with colleagues	F Innovation & Management
		Ability to communicate in English about technical matters	F Innovation & Management
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Ability to compare and evaluate various data analysis approaches and the ability to independently develop and implement analysis strategies	D Data Analysis
		Ability to compare and evaluate options for implementing developed evaluation models	E Data Usage
		Familiar with various options for data storage (e.g. relational DBs, multi-dimensional DBs, NoSQL DBs, etc.)	C Data Storage
	Customer consultation for system acquisition	Recognizing the importance and dependencies between various tools for data provision/data preparation/data analysis/data illustration with respect to the specific usage scenario	D Data Analysis
		Familiar with established methods and approaches of project management	F Innovation & Management
		Familiar with methods for acquiring empirical data	A Data Acquisition
		Familiar with methods for integrating existing databases	B Data Integration
		Familiar with illustration options for data analysis results	D Data Analysis
		Familiar with various approaches for data analysis (e.g. descriptive and inferential statistical procedures, procedures for data mining and machine learning)	D Data Analysis
		Familiar with various heuristics and strategies for problem-solving	F Innovation & Management
		Familiar with various tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to apply established methods and approaches of project management	F Innovation & Management
		Ability to compare established methods and approaches of project management	F Innovation & Management
		Ability to compare and evaluate heuristics and strategies for problem-solving	F Innovation & Management
		Ability to discuss analysis results on an equal technical footing with specialist colleagues	E Data Usage
		Ability to utilize management methods for requirements management within the context of data-driven systems	F Innovation & Management

Field of employment	Task	Skill description	Data lifecycle
		Ability to compare methods for integrating existing data-bases	B Data Integration
		Ability to compare and evaluate illustration options for analysis results	D Data Analysis
		Ability to compare and evaluate various options for data storage	C Data Storage
		Ability to compare and evaluate tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Knowing how to access existing databases for data science projects	B Data Integration
		Ability to present results and discuss these with colleagues	F Innovation & Management
		Ability to communicate in English about technical matters	F Innovation & Management
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Ability to compare and evaluate various data analysis approaches and the ability to independently develop and implement analysis strategies	D Data Analysis
		Ability to compare and evaluate options for implementing developed evaluation models	E Data Usage
		Familiar with various options for data storage (e.g. relational DBs, multi-dimensional DBs, NoSQL DBs, etc.)	C Data Storage
	Customer consultation for the development of data-driven business models	Recognizing the importance and dependencies between various tools for data provision/data preparation/data analysis/data illustration with respect to the specific usage scenario	D Data Analysis
		Familiar with established methods and approaches of project management	F Innovation & Management
		Familiar with methods for acquiring empirical data	A Data Acquisition
		Familiar with methods for integrating existing databases	B Data Integration
		Familiar with illustration options for data analysis results	D Data Analysis
		Familiar with various approaches for data analysis (e.g. descriptive and inferential statistical procedures, procedures for data mining and machine learning)	D Data Analysis
		Familiar with various heuristics and strategies for problem-solving	F Innovation & Management
		Familiar with various tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to apply established methods and approaches of project management	F Innovation & Management
		Ability to compare established methods and approaches of project management	F Innovation & Management
		Ability to compare and evaluate heuristics and strategies for problem-solving	F Innovation & Management
		Ability to discuss analysis results on an equal technical footing with specialist colleagues	E Data Usage
		Ability to utilize management methods for requirements management within the context of data-driven systems	F Innovation & Management
		Ability to compare methods for integrating existing data-bases	B Data Integration
		Ability to compare and evaluate illustration options for analysis results	D Data Analysis
		Ability to compare and evaluate various options for data storage	C Data Storage
		Ability to compare and evaluate tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Knowing how to access existing databases for data science projects	B Data Integration
		Ability to present results and discuss these with colleagues	F Innovation & Management
		Ability to communicate in English about technical matters	F Innovation & Management
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Ability to compare and evaluate various data analysis approaches and the ability to independently develop and implement analysis strategies	D Data Analysis
		Ability to compare and evaluate options for implementing developed evaluation models	E Data Usage
		Familiar with various options for data storage (e.g. relational DBs, multi-dimensional DBs, NoSQL DBs, etc.)	C Data Storage
	Customer consultation for the conception of data-driven strategies	Recognizing the importance and dependencies between various tools for data provision/data preparation/data	D Data Analysis

Field of employment	Task	Skill description	Data lifecycle
		analysis/data illustration with respect to the specific usage scenario	
		Familiar with established methods and approaches of project management	F Innovation & Management
		Familiar with methods for acquiring empirical data	A Data Acquisition
		Familiar with methods for integrating existing databases	B Data Integration
		Familiar with illustration options for data analysis results	D Data Analysis
		Familiar with various approaches for data analysis (e.g. descriptive and inferential statistical procedures, procedures for data mining and machine learning)	D Data Analysis
		Familiar with various heuristics and strategies for problem-solving	F Innovation & Management
		Familiar with various tools for data provision/data preparation/data analysis/data illustration	D Data analysis
		Ability to apply established methods and approaches of project management	F Innovation & Management
		Ability to compare established methods and approaches of project management	F Innovation & Management
		Ability to compare and evaluate heuristics and strategies for problem-solving	F Innovation & Management
		Ability to discuss analysis results on an equal technical footing with specialist colleagues	E Data usage
		Ability to utilize management methods for requirements management within the context of data-driven systems	F Innovation & Management
		Ability to compare methods for integrating existing databases	B Data Integration
		Ability to compare and evaluate illustration options for analysis results	D Data Analysis
		Ability to compare and evaluate various options for data storage	C Data Storage
		Ability to compare and evaluate tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Knowing how to access existing databases for data science projects	B Data Integration
		Ability to present results and discuss these with colleagues	F Innovation & Management
		Ability to communicate in English about technical matters	F Innovation & Management
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Ability to compare and evaluate various data analysis approaches and the ability to independently develop and implement analysis strategies	D Data Analysis
		Ability to compare and evaluate options for implementing developed evaluation models	E Data Usage
		Familiar with various options for data storage (e.g. relational DBs, multi-dimensional DBs, NoSQL DBs, etc.)	C Data storage
	Performing an initial analysis within the sense of a data value check	Familiar with various tools for data provision/data preparation/data analysis/data illustration	D Data Analysis
		Ability to develop a data analysis strategy and perform an analysis based on this	F Innovation & Management
		Ability to present results and discuss these with colleagues	F Innovation & Management
		Ability to work with other persons on a problem	F Innovation & Management
		Ability to independently structure and process complex tasks	F Innovation & Management
		Ability to compare and evaluate various data analysis approaches and the ability to independently develop and implement analysis strategies	D Data Analysis

2 CURRICULUM

2.1 Curriculum data

Table 2: Curriculum data for the study program "Data Science & Intelligent Analytics"

Dimension	Full-time	Extra-occupational	Comments
First academic year (YYYY/YY+1)		2018/19	
Normal duration of studies (Number of semesters)		4	
Compulsory course hours per week (Total of all semesters)		61.6	
Course teaching weeks per semester (Number of weeks)		15	
Compulsory course hours (Total of all semesters)		1448	
Compulsory ECTS (Total of all semesters)		120	

Dimension	Full-time	Extra-occupational	Comments
Start of winter semester (Date, note: poss. CW)		CW 40	
End of winter semester (Date, note: poss. CW)		CW 6	
Start of summer semester (Date, note: poss. CW)		CW 10	
End of summer semester (Date, note: poss. CW)		CW 26	
Weeks in winter semester		15	
Weeks in summer semester		15	

Dimension	Full-time	Extra-occupational	Comments
Compulsory semester abroad (Semester)		No	

Dimension	Full-time	Extra-occupational	Comments
Teaching language (Indication)		German/English	The proportion of English-language courses amounts to 35 % (according to course hours per

Dimension	Full-time	Extra-occupational	Comments
Internship (Semester, duration in weeks per semester)		No	

Result of the merging of study programs or split-off from the study program (Study-program code, only to be indicated for merging or split-off)	

2.2 Curriculum matrix

The curriculum for the study program is presented in the following according to individual semesters.

Table 3: Curriculum for Semester 1

LV no.	LV designation	T	E	LV type	SWS	Number of grou	ASWS	ALVS	Module	ECTS
DPR.1	Data Engineering for Data Science	x		**ILV**	2.0	1	2.0	30.0	DPR	**3.0**
DPR.2	Data Engineering for Data Science Lab	x		**UE**	2.0	2	4.0	60.0	DPR	**4.0**
ETHR.1	Business Ethics, Compliance & Law 1	x		**ILV**	2.0	1	2.0	30.0	ETHR	**3.0**
SEW.1	Software Development for Data Science 1	x		**ILV**	2.0	1	2.0	30.0	SEW	**3.0**
SEW.2	Software Development for Data Science 1 Lab	x		**UE**	2.5	2	5.0	75.0	SEW	**5.0**
PMS.1	Leadership in Team & Project Management			**ILV**	2.0	1	2.0	30.0	PMS	**3.0**
THAL.1	Algorithmics & Statistics for Data Science 1	x		**ILV**	2.0	1	2.0	30.0	THAL	**3.0**
THAL.2	Algorithmics & Statistics for Data Science 1 Lab	x		**UE**	3.0	2	6.0	90.0	THAL	**6.0**
Total **Total (SWS * 15 LV weeks)**					**17.5** **262.5**		**25.0**	**375.0**		**30.0**

Table 4: Curriculum for semester 2

LV no.	LV designation	T	E	LV type	SWS	Number of group	ASWS	ALVS	Module	ECTS
DPR.3	Machine Learning for Data Science	x		**ILV**	2.0	1	2.0	30.0	DPR	**3.0**
DPR.4	Machine Learning for Data Science Lab	x		**UE**	3.0	2	6.0	90.0	DPR	**6.0**
PMS.2	Study Trip		x	**ILV**	2.0	1	2.0	30.0	PMS	**3.0**
SEW.3	Software Development for Data Science 2	x		**ILV**	2.0	1	2.0	30.0	SEW	**3.0**
SEW.4	Software Development for Data Science 2 Lab	x		**UE**	3.0	2	6.0	90.0	SEW	**6.0**
THAL.3	Algorithmics & Statistics for Data Science 2	x		**ILV**	2.0	1	2.0	30.0	THAL	**3.0**
THAL.4	Algorithmics & Statistics for Data Science 2 Lab	x		**UE**	3.0	2	6.0	90.0	THAL	**6.0**
Total **Total (SWS * 15 LV weeks)**					**17.0** **255.0**		**26.0**	**390.0**		**30.0**

Table 5: Curriculum for Semester 3

LV no.	LV designation	T	E	LV type	SWS	Number of group	ASWS	ALVS	Module	ECTS
DPR.5	Big Data Processing	x	x	**ILV**	2.0	1	2.0	30.0	DPR	**3.0**
DPR.6	Problem-Centered Data Pre-Processing	x		**ILV**	2.0	1	2.0	30.0	DPR	**3.0**
DPR.7	Visual Analytics for Data Science	x		**ILV**	2.0	1	2.0	30.0	DPR	**3.0**
ELE.1	Elective I (FH-wide compulsory elective subject)		x	**ILV**	2.0	1	2.0	30.0	ELE	**3.0**
PMS.3	Systemic Innovation		x	**SE**	1.5	1	1.5	22.5	PMS	**3.0**
MPA.1	Scientific Work			**SE**	1.0	1	1.0	15.0	MPA	**2.0**
PMS.4	Practical Pro-	x		**PT**	2.0	3	6.0	90.0	PMS	**4.0**
VT.1	Data Science for the Natural Sciences	x	x	**ILV**	2.0	1	2.0	30.0	VT	**3.0**
VT.2	Data Science for Business & Commerce	x	x	**ILV**	2.0	1	2.0	30.0	VT	**3.0**
VT.3	Data Science for Engineering	x	x	**ILV**	2.0	1	2.0	30.0	VT	**3.0**
Total **Total (SWS * 15 LV weeks)**					**18.5** **277.5**		**22.5**	**337.5**		**30.0**

Table 6: Curriculum for Semester 4

LV no.	LV designation	T	E	LV type	SWS	Number of group	ASWS	ALVS	Module	ECTS
DPR.8	Trends in Data Science	x		**SE**	1.0	1	1.0	15.0	DPR	**2.0**
DPR.9	Intelligent Analytics & Artificial Intelligence	x	x	**ILV**	2.0	1	2.0	30.0	DPR	**3.0**
ELE.2	Elective II (FH-wide compulsory elective subject)		x	**ILV**	2.0	1	2.0	30.0	ELE	**3.0**
ETHR.2	Business Ethics, Compliance & Law 2			**VO**	2.0	1	2.0	30.0	ETHR	**2.0**
MPA.3	Master Thesis			**MA**	0.6	25	15.0	225.0	MPA	**18.0[2]**
MPA.4	Colloquium for the Master Thesis			**SE**	1.0	1	1.0	15.0	MPA	**2.0**
Total **Total (SWS * 15 LV weeks)**					**8.6** **129.0**		**23.0**	**345.0**		**30.0**

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[2] The 18 ECTS credits for the Master Thesis are divided into 16 ECTS for the Master Thesis and 2 ECTS for the final examination before the examination board.

Curriculum data is summarized in Table 7. The focus is on data aggregation at the annual level as well as on the illustration of absolute and relative proportions of English-language and technical courses.

Table 7: Summary of curriculum data

Description	SWS	ASWS	ALVS	ECTS
Total courses for all semesters	61.6	96.5	1448	120.0
Total courses in the 1st academic year	34.5	51.0	765	60.0
Total courses in the 2nd academic year	27.1	45.5	683	60.0
Total **technical courses** for all semesters	38.5			65.0
Proportion of technical courses for all semesters based on SWS / ECTS	62.5%			54%
Total **English-language courses** for all semesters	16.0			24
Proportion of English-language courses for all semesters based on SWS / ECTS	26.0%			20%
Proportion of courses with **blended learning** parts	38.1%			29%

2.3 Module descriptions

Data is grouped and summarized according to the modules in Table 8. The absolute and relative proportions of ECTS credits and weekly course hours are used as a basis.

Table 8: Aggregating overview of ECTS credits and SWS for all modules

Abbrevia-	Module title	ECTS abs.	SWS abs.	ECTS rel.	SWS rel.
DPR	Data Processing	30	18.0	25.0 %	29.2 %
ELE	Elective	6	4.0	5.0 %	6.5 %
ETHR	Business Ethics, Compliance & Law	5	4.0	4.2 %	6.5 %
PMS	Practice, Management & Strategy	13	7.5	10.8 %	12.2 %
MPA	Master Thesis & Scientific Work	22	2.6	18.3 %	4.2 %
SEW	Software Development	17	9.5	14.2 %	15.4 %
THAL	Algorithmics & Statistics	18	10.0	15.0 %	16.2 %
VT	Consolidation in DS application domains	9	6.0	7.5 %	9.7 %
Total		**120.0**	**61.6**	**100.0 %**	**100.0 %**

The following illustration of module shares results from this list, measured according to the module's relative proportions of ECTS credits for the total ECTS number of all modules.

Illustration 1: Relative proportion of modules according to ECTS credits
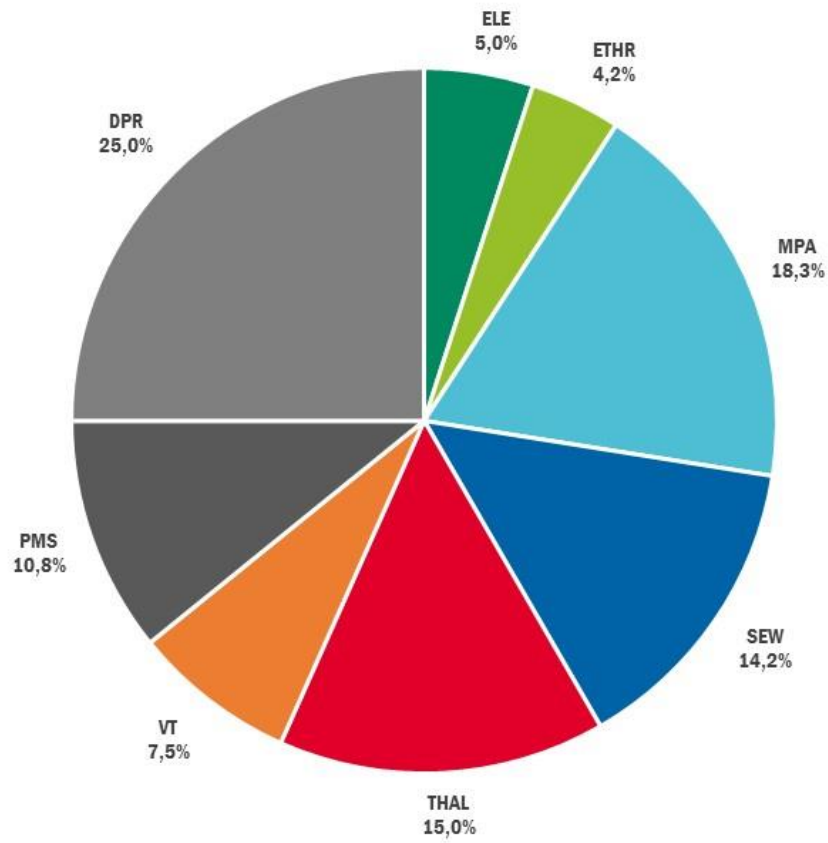
The modules of the master degree program "Data Science & Intelligent Analytics" are presented in detail in the following.

2.3.1 Data processing (DPR)

Module: DPR	Data processing	29	ECTS
Study program	University of applied sciences master degree program Data Science & Intelligent Analytics extra-occupational		
Position in curriculum	Semester 1		
	Semester 2		
	Semester 3		
	Semester 4		
Level	Semester 1: Master degree program / Semester 2: Master degree program / Semester 3: Master degree program / Semester 4: Master degree		
Previous knowledge	Semester 1: Relational data modeling, implementation of relational databases, SQL / Semester 2: Algorithmics & Statistics 1 Software Development 1 / Semester 2: No prerequisites / Semester 3: No prerequisites / Semester 3: Software Development for Data Science 1 and 2 Data Engineering for Data Science / Semester 4: No prerequisites		
Block course	No		
Group of participants	Bachelor graduates, beginning students		
Literature recommendations	Data Engineering for Data Science /ILV / LV no.: DPR.1/Semester: 1 / ECTS: 3		
	- Edlich, S; Friedland A.; Hampe, J.; Brauer, B.; Brückner, M. (2011) NoSQL: Einstieg in die Welt nichtrelationaler Web 2.0 Datenbanken. 2. Auflage, Hanser, Carl Gmbh + Co., München (ISBN: 978-3446427532). - Freiknecht, J. (2014) Big Data in der Praxis: Lösungen mit Hadoop, HBase und Hive. Daten speichern, aufbereiten, visualisieren. 1. Auflage, Hanser, Carl Gmbh + Co., München (ISBN: 978-3446439597). - Kleppmann, M. (2017) Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems. 1. Auflage, O'Reilly Media, Farnham (ISBN: 978-1449373320).		

Module: DPR	Data processing	29	ECTS

- Carpenter, J.; Hewitt, E. (2016) Cassandra: The Definitive Guide: Distributed Data at Web Scale. 2. Auflage, O'Reilly Media, Farnham (ISBN: 978-1491933664).
- Celko, J. (2013) Joe Celko's Complete Guide to NoSQL: What Every SQL Professional Needs to Know about Non-Relational Databases. 1. Auflage, Morgan Kaufmann, Waltham (ISBN: 978-0124071926).
- Edlich, S; Friedland A.; Hampe, J.; Brauer, B.; Brückner, M. (2011) NoSQL: Einstieg in die Welt nichtrelationaler Web 2.0 Datenbanken. 2. Auflage, Hanser, Carl Gmbh + Co., München (ISBN: 978-3446423558).

Data Engineering for Data Science Lab /UE / LV no.: DPR.2/Semester: 1 / ECTS: 4

- Edlich, S; Friedland A.; Hampe, J.; Brauer, B.; Brückner, M. (2011) NoSQL: Einstieg in die Welt nichtrelationaler Web 2.0 Datenbanken. 2. Auflage, Hanser, Carl Gmbh + Co., München (ISBN: 978-3446427532).
- Freiknecht, J. (2014) Big Data in der Praxis: Lösungen mit Hadoop, HBase und Hive. Daten speichern, aufbereiten, visualisieren. 1. Auflage, Hanser, Carl Gmbh + Co., München (ISBN: 978-3446439597).
- Kleppmann, M. (2017) Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems. 1. Auflage, O'Reilly Media, Farnham (ISBN: 978-1449373320).
- Carpenter, J.; Hewitt, E. (2016) Cassandra: The Definitive Guide: Distributed Data at Web Scale. 2. Auflage, O'Reilly Media, Farnham (ISBN: 978-1491933664).
- Celko, J. (2013) Joe Celko's Complete Guide to NoSQL: What Every SQL Professional Needs to Know about Non-Relational Databases. 1. Auflage, Morgan Kaufmann, Waltham (ISBN: 978-0124071926).
- Edlich, S; Friedland A.; Hampe, J.; Brauer, B.; Brückner, M. (2011) NoSQL: Einstieg in die Welt nichtrelationaler Web 2.0 Datenbanken. 2. Auflage, Hanser, Carl Gmbh + Co., München (ISBN: 978-3446423558).

Machine Learning for Data Science /VO / LV no.: DPR.3/Semester: 2 / ECTS: 3

- Bishop, C. (2006) Pattern Recognition and Machine Learning. 1. Auflage, Springer-Verlag, New York (ISBN: 978-0-387-31073-2).
- Géron, A. (2017) Hands-On Machine Learning with Scikit-Learn and Ten- sor-Flow: Concepts, Tools, and Techniques for Building Intelligent Systems. 1. Auflage, O´Reilly, Farnham (ISBN: 978-1491962299).
- McKinney, W. (2017) Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython. 2. Auflage, O´Reilly, Farnham (ISBN: 978- 1491957660).
- Raschka, S.; Mirjalili, V. (2017) Python Machine Learning - Second Edition: Machine Learning and Deep Learning with Python, scikit-learn, and Tensor- Flow. 2. Auflage, Packt Publishing, Birmingham (ISBN: 978-1787125933).
- Shalev-Shwartz, S.; Ben-David, S. (2014) Understanding Machine Learning: From Theory to Algorithms. 1. Auflage, Cambridge University Press, Cambridge (ISBN: 978-1107057135).
- Zheng, A.; Casari, A. (2018) Feature Engineering for Machine Learning Models: Principles and Techniques for Data Scientists. 1. Auflage, O´Reilly, Farnham (ISBN: 978-1491953242).

Machine Learning for Data Science Lab /UE / LV no.: DPR.4/Semester: 2 / ECTS: 6

- Bishop, C. (2006) Pattern Recognition and Machine Learning. 1. Auflage, Springer-Verlag, New York (ISBN: 978-0-387-31073-2).

Module: DPR	Data processing	29	ECTS

- Géron, A. (2017) Hands-On Machine Learning with Scikit-Learn and Ten- sor-Flow: Concepts, Tools, and Techniques for Building Intelligent Systems.
1. Auflage, O´Reilly, Farnham (ISBN: 978-1491962299).
- McKinney, W. (2017) Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython. 2. Auflage, O´Reilly, Farnham (ISBN: 978- 1491957660).
- Raschka, S.; Mirjalili, V. (2017) Python Machine Learning - Second Edition: Machine Learning and Deep Learning with Python, scikit-learn, and Tensor- Flow. 2. Auflage, Packt Publishing, Birmingham (ISBN: 978-1787125933).
- Shalev-Shwartz, S.; Ben-David, S. (2014) Understanding Machine Learning: From Theory to Algorithms. 1. Auflage, Cambridge University Press, Cam- bridge (ISBN: 978-1107057135).
- Zheng, A.; Casari, A. (2018) Feature Engineering for Machine Learning Models: Principles and Techniques for Data Scientists. 1. Auflage, O´Reilly, Farnham (ISBN: 978-1491953242).

Big Data Processing /ILV / LV no.: DPR.5/Semester: 3 / ECTS: 3

- EMC Education Services (2015) Data Science and Big Data Analytics: Dis- cover-ing, Analyzing, Visualizing and Presenting Data. 1. Auflage, Wiley, Indianapolis (ISBN: 978-1118876138).
- O'Neil, C.; Schutt, R. (2013) Doing Data Science. Straight Talk from the Front-line. 1. Auflage, O'Reilly Media, Sebastopol (ISBN: 978-1449358655).
- Provost, F.; Fawcett, T. (2013) Data Science for Business: What you need to know about data mining and data-analytic thinking. 1. Auflage, O'Reilly Media, Se-bastopol (ISBN: 978-1449361327).
- Narkhede, N.; Shapira, G.; Palino, T. (2017) Kafka: The Definitive Guide: Real-Time Data and Stream Processing at Scale. 1. Auflage, O'Reilly Media, Farnham (ISBN: 978-1491936160).
- Jain, V. K. (2017) Big Data and Hadoop. 1. Auflage, Khanna Book Publishing, New Delhi (ISBN: 978-9382609131).
- Karau, H.; Warren, R. (2017) High Performance Spark: Best Practices for Scaling and Optimizing Apache Spark. 1. Auflage, O'Reilly Media, Farnham (ISBN: 978-1491943205).

Problem-Centered Data Pre-Processing /ILV / LV no.: DPR.6/Semester: 3 / ECTS: 2

- Runkler, T. A. (2015) Data Mining: Methoden und Algorithmen intelligenter Da-tenanalyse. 2. Auflage, Springer Vieweg, Wiesbaden (ISBN: 978- 3834816948).

Visual Analytics for Data Science /ILV / LV no.: DPR.7/Semester: 3 /ECTS: 3

- Chang, W. (2013) R Graphics Cookbook: Practical Recipes for Visualizing Data.
1. Auflage, O´Reilly, Farnham (ISBN: 978-1449316952).
- Chen, C.; Härdle, W. K.; Unwin, A. (2008) Handbook of Data Visualization.
1. Auflage, Springer, Berlin (ISBN: 978-3-662-50074-3).
- Dale, K. (2016) Data Visualization with Python and Javascript: Scrape, Clean, Ex-plore & Transform Your Data. 1. Auflage, O´Reilly, Farnham (ISBN: 978-1491920510).
- Murray, S. (2017) Interactive Data Visualization for the Web: An Introduction to Designing with D3. 2. Auflage, O´Reilly, Farnham (ISBN: 978- 1491921289).
- Rahlf, T. (2017) Data Visualisation with R: 100 Examples. 1. Auflage,
Springer, Wiesbaden (ISBN: 978-3319497501).

Trends in Data Science /SE / LV no.: DPR.8/Semester: 4 / ECTS: 2

According to offered content

Module: DPR	Data processing	29	ECTS

	Intelligent Analytics & Artificial Intelligence /ILV / LV no.: DPR.9/Semester: 4 / ECTS: 3
	- Runkler, T. A. (2016) Data Analytics: Models and Algorithms for Intelligent Data Analysis. 2. Auflage, Springer Vieweg, Wiesbaden (ISBN: 978-3658140748).
	- Russell, S.; Norvig, P. (2016) Artificial Intelligence: A Modern Approach, Global Edition. 3. Auflage, Addison Wesley, Boston (ISBN: 978-1292153964).
	- Winston, P. H. (1992) Artificial Intelligence. 3. Auflage, Pearson (ISBN: 978-0201533774).
Skill acquisition	Data Engineering for Data Science /ILV / LV no.: DPR.1/Semester: 1 /ECTS: 3
	Students are familiar with various further data storage concepts (e.g. NoSQL databases, distributed databases, etc.) and are able to compare and assess these in regard to their suitability for specific problem areas. Furthermore, students understand the special requirements for data storage resulting from the usage of very large data volumes (big data).
	Data Engineering for Data Science Lab /UE / LV no.: DPR.2/Semester: 1 /ECTS: 4
	Students are familiar with various further data storage concepts (e.g. NoSQL databases, distributed databases, etc.) and are able to select and implement these within the context of a specific problem area. Furthermore, they are able to design the implementation of these systems with respect to scalability and operational requirements.
	Machine Learning for Data Science /VO / LV no.: DPR.3/Semester: 2 /ECTS: 3
	Students are familiar with tools (e.g. libraries, cloud platforms or software tools) that support machine learning and are able to compare these tools in regard to their suitability for specific problem areas. Furthermore, they are familiar with available options for implementing developed prediction models in a scalable manner (big data).
	Machine Learning for Data Science Lab /UE / LV no.: DPR.4/Semester: 2 /ECTS: 6
	Students can compare, assess and independently apply tools for machine learning with respect to their possible deployment in specific problem areas. Furthermore, they are familiar with available options for implementing developed prediction models in a scalable manner and are able to apply these independently.
	Big Data Processing /ILV / LV no.: DPR.5/Semester: 3 /ECTS: 3
	Students are familiar with the special challenges associated with the storage and processing of large data volumes (5V model volume, variety, velocity, veracity, value). Furthermore, they are familiar with available options for countering these problems and able to independently develop and apply solutions with respect to a specific problem area.
	Problem-Centered Data Pre-Processing /ILV / LV no.: DPR.6/Semester: 3 /ECTS: 2

Module: DPR	Data processing	29	ECTS
	Students are familiar with various techniques for data pre-processing, preparation and integration and are able to evaluate which of these techniques is necessary and appropriate within the context of a specific problem area. Furthermore, they are able to independently use and embed these techniques in an existing toolchain.		
	Visual Analytics for Data Science /ILV / LV no.: DPR.7/Semester: 3 /ECTS: 3 Graduates have basic knowledge of data visualization and visual communication. They can independently develop visualizations and use these for communication purposes. Graduates can work with various illustration tools and illustration libraries in order to depict data and analysis results in a meaningful manner. They also know how to use visual analytics in order to test hypotheses and access data.		
	Trends in Data Science /SE / LV no.: DPR.8/Semester: 4 /ECTS: 2 Students are familiar with current trends within the context of data acquisition, data storage, data analysis and data usage. They are able to assess these trends with respect to a specific task and estimate their potential.		
	Intelligent Analytics & Artificial Intelligence /ILV / LV no.: DPR.9/Semester: 4 /ECTS: 3 Students understand the concept of artificial intelligence (AI). They are familiar with the basic underlying concepts and know/understand various implementation approaches for AI. Furthermore, they understand the significance of data and algorithms with respect to implementation and are able to independently implement simple applications.		
Course content	Data Engineering for Data Science /ILV / LV no.: DPR.1/Semester: 1 / ECTS: 3 Expertise in the area of further data storage concepts (e.g. key-value stores, document stores, column-oriented data stores, etc.) and their application are conveyed to students within the context of the course. Students learn about the special challenges associated with large data volumes (big data) within this context and know how to deal with these challenges in a practical manner (CAP Theorem).		
	Data Engineering for Data Science Lab /UE / LV no.: DPR.2/Semester: 1 / ECTS: 4 The content of the integrative course "Data Engineering for Data Science" is consolidated in the lab by means of practical exercises. Acquired knowledge is discussed within the group, which provides profound insights and the consolidation of material that was theoretically discussed in the integrative course. The focus is especially on the following exercise content: - Conceptualization and implementation of problem-centered NoSQL databases (e.g. key-value stores, document stores, column-oriented data stores, etc.) - Conceptualization and implementation of storage solutions for large data volumes (big data)		
	Machine Learning for Data Science /VO / LV no.: DPR.3/Semester: 2 / ECTS: 3		

Module: DPR	Data processing	29	ECTS

Students acquire applied knowledge in the area of machine learning within the context of the course, thus building on the content of the courses Algorithmics & Statistics 1 and Software Development 1. In this course students deal with the implementation of previously theoretically learned algorithms and associated specific technological support. The course specifically includes the following topics:

- Applied machine learning, e.g. with scikit-learn, Theano, Pylearn2, NuPIC (Python) or rpart, randomForest, party, gbm, kernlab, e1071 (R) or Rattle, RapidMiner (click-based software)
- Applied deep learning, e.g. with tensorflow (Python) or nnet (R) or Neuroph Studio (click-based software)
- Processing machine learning problems with cloud infrastructures, e.g. Azure Machine Learning Studio (Microsoft) or Machine Learning Web Services (Amazon)

Machine Learning for Data Science Lab /UE / LV no.: DPR.4/Semester: 2 / ECTS: 6

The content of the integrative course "Machine Learning for Data Science" is consolidated in the lab by means of practical exercises. Acquired knowledge is discussed within the group, which provides profound insights and the consolidation of material that was theoretically discussed in the integrative course.

Big Data Processing /ILV / LV no.: DPR.5/Semester: 3 / ECTS: 3

Students are introduced to the basic properties of big data. Special emphasis is placed on handling this data while acquired knowledge is consolidated with examples. Suitable frameworks are introduced for solving big data problems and processed within the context of interactive workshops. Applicable examples:

- Apache Hadoop
- Apache Spark
- Apache Flink
- Apache Storm
- Apache Samza
- Apache Kafka

These frameworks are to be explained and used based on case examples. Centrally provided data labs can be accessed for this purpose.

Problem-Centered Data Pre-Processing /ILV / LV no.: DPR.6/Semester: 3 / ECTS: 2

Students learn about the fundamental operations of data pre-processing, their usage and practical execution. Specifically in the following areas:

- Data integration
- Data scaling
- Data centering
- Data imputation
- Data recoding

Module: DPR	Data processing	29	ECTS

Students work on real examples and independently apply individual pre-processing techniques in interactive workshops.

Visual Analytics for Data Science /ILV / LV no.: DPR.7/Semester: 3 / ECTS: 3

Students learn how to deal with various illustration tools and illustration libraries. They also learn about the fundamentals of visual communication and visual analytics.

The course content specifically encompasses these topics:
- Evaluation tools with visual orientation, e.g. BI tools such as MS PowerBI, tableua, QlikView
- Illustration libraries, e.g. matplotlib.pyplot, gglot2
- Rules for visual communication, e.g. Hichert SUCCESSS

Trends in Data Science /SE / LV no.: DPR.8/Semester: 4 / ECTS: 2

Students learn about current topics in data science. Examples:

- Current research emphases within the topical field of data science
- Current solution approaches that have established themselves in practice (e.g. within the context of known companies)
- Trends that are becoming apparent within the topical field of data science (research/practice)

Intelligent Analytics & Artificial Intelligence /ILV / LV no.: DPR.9/Semester: 4 / ECTS: 3

Students learn about the fundamental techniques and concepts within the context of intelligent operating systems, specifically in the following areas:

- Reasoning (goal trees, rule-based expert systems)
- Search (depth-first, hill climbing, beam, optimal, branch and bound, A*, games, minimax and alpha-beta)
- Constraint (search, domain reduction, visual object recognition)
- Learn (neural nets, back propagation, genetic algorithms, sparse spaces, phonology, near misses, felicity conditions, support vector machines, boosting)
- Representation (classes, trajectories, transitions)
- Usage of AI within the context of business

Planned teaching and learning methods	Data Engineering for Data Science /ILV / LV no.: DPR.1/Semester: 1 / ECTS: 3
	Lecture with discussion

Data Engineering for Data Science Lab /UE / LV no.: DPR.2/Semester: 1 / ECTS: 4

- Lecture with discussion
- Group work
- Performing exercise tasks

Machine Learning for Data Science /VO / LV no.: DPR.3/Semester: 2 / ECTS: 3

- Lecture with discussion
- Performing exercise tasks
- Interactive workshop

Module: DPR	Data processing	29	ECTS
	Machine Learning for Data Science Lab /UE / LV no.: DPR.4/Semester: 2 / ECTS: 6 - Lecture with discussion - Group work - Performing exercise tasks		
	Big Data Processing /ILV / LV no.: DPR.5/Semester: 3 / ECTS: 3 - Lecture with discussion - Group work - Interactive workshop		
	Problem-Centered Data Pre-Processing /ILV / LV no.: DPR.6/Semester: 3 / ECTS: 2 - Lecture with discussion - Interactive workshop - Case studies		
	Visual Analytics for Data Science /ILV / LV no.: DPR.7/Semester: 3 / ECTS: 3 - Lecture with discussion - Interactive workshop - Case studies		
	Trends in Data Science /SE / LV no.: DPR.8/Semester: 4 / ECTS: 2 - Lecture with discussion - Interactive workshop - Case studies		
	Intelligent Analytics & Artificial Intelligence /ILV / LV no.: DPR.9/Semester: 4 / ECTS: 3 - Lecture with discussion - Interactive workshop - Case studies		
Testing methods	Data Engineering for Data Science /ILV / LV no.: DPR.1/Semester: 1 / ECTS: 3 – Final examination		
	Data Engineering for Data Science Lab /UE / LV no.: DPR.2/Semester: 1 / ECTS: 4 - Seminar thesis - Seminar papers		
	Machine Learning for Data Science /VO / LV no.: DPR.3/Semester: 2 / ECTS: 3 – Final examination		
	Machine Learning for Data Science Lab /UE / LV no.: DPR.4/Semester: 2 / ECTS: 6 - Seminar papers - Final examination		
	Big Data Processing /ILV / LV no.: DPR.5/Semester: 3 / ECTS: 3 – Final examination		
	Problem-Centered Data Pre-Processing /ILV / LV no.: DPR.6/Semester: 3 / ECTS: 2 – Final examination		
	Visual Analytics for Data Science /ILV / LV no.: DPR.7/Semester: 3 / ECTS: 3		

Module: DPR	Data processing	29	ECTS
	– Final examination		
	Trends in Data Science /SE / LV no.: DPR.8/Semester: 4 / ECTS: 2		
	– Final examination		
	Intelligent Analytics & Artificial Intelligence /ILV / LV no.: DPR.9/Semester: 4 / ECTS: 3		
	- Final examination		

2.3.2 Elective – Compulsory elective subject (ELE)

Module: ELE	Elective – Compulsory elective subject	6	ECTS
Study program	University of applied sciences master degree program Data Science & Intelligent Analytics extra-occupational		
Position in curriculum	Semester 3		
	Semester 4		
Level	Semester 3: Master degree program / Semester 4: Master degree program		
Previous knowledge	Semester 3: Not applicable / Semester 4: No prerequisites		
Block course	No		
Group of partici-pants	Bachelor graduates, beginning students		
Literature recom-mendations	Elective I (FH-wide compulsory elective subject) /ILV / LV no.: ELE.1/Semester: 3 / 3		
	Depending on the offered course		
	Elective II (FH-wide compulsory elective subject) /ILV / LV no.: ELE.2/Semes-ter: 4 / ECTS: 3		
	Depending on the offered course		
Skill acquisition	Elective I (FH-wide compulsory elective subject) /ILV / LV no.: ELE.1/Semester: 3 /ECTS: 3		
	At least 1 to 2 optional courses are to be offered at the University of Applied Sciences Kufstein Tirol in each master degree program. These English-language courses are principally open to all students from all fields of study. A canon is established from these as well as from expanded foreign language offers with varied additional consolidation and complementary course options for students. The associated skill acquisition results from specifically selected courses.		
	Elective II (FH-wide compulsory elective subject) /ILV / LV no.: ELE.2/Semester: 4 /ECTS: 3		
	At least 1 to 2 optional courses are to be offered at the University of Applied Sciences Kufstein Tirol in each master degree program. These English-language courses are principally open to all students from all fields of study. A canon is established from these as well as from expanded foreign language offers with varied additional consolidation and complementary course options for students. The associated skill acquisition results from specifically selected courses.		
Course content	Elective I (FH-wide compulsory elective subject) /ILV / LV no.: ELE.1/Semester: 3 / ECTS: 3		

Module: ELE	Elective – Compulsory elective subject	6	ECTS
	Offers from the canon of optional courses include the following courses: - Media Competence - Crisis Communication - Global Marketing - Business Process Management - Knowledge Management - International Corporate Identity - Diversity Management - Cross-Cultural Management - Business Continuity & Risk Management - Event Management - International Real Estate Management - Change Management Changing offers are provided from DSIA such as: - Data Security and Data Protection - Forensic Data Analysis - Business Intelligence - Autonomous Systems		
	Elective II (FH-wide compulsory elective subject) /ILV / LV no.: ELE.2/Semester: 4 / ECTS: 3		
	Offers from the canon of optional courses include the following courses: - Media Competence - Crisis communication - Global Marketing - Business Process Management - Knowledge Management - International Corporate Identity - Diversity Management - Cross-Cultural Management - Business Continuity & Risk Management - Event Management - International Real Estate Management - Change Management Changing offers are provided from DSIA such as: - Data Security and Data Protection - Forensic Data Analysis - Business Intelligence - Autonomous Systems		
Planned teaching and learning methods	Elective I (FH-wide compulsory elective subject) /ILV / LV no.: ELE.1/Semester: 3 / ECTS: 3		
	- Lecture with discussion - Group work - Interactive workshop		
	Elective II (FH-wide compulsory elective subject) /ILV / LV no.: ELE.2/Semester: 4 / ECTS: 3		
	- Lecture with discussion - Interactive workshop - Case studies		

Module: ELE	Elective – Compulsory elective subject	6	ECTS
Testing methods	Elective I (FH-wide compulsory elective subject) /ILV / LV no.: ELE.1/Semester: 3 / 3 - Final examination		
	Elective II (FH-wide compulsory elective subject) /ILV / LV no.: ELE.2/Semester: 4 / ECTS: 3 - Final examination		

2.3.3 Business Ethics, Compliance & Law (ETHR)

Module: ETHR	Business Ethics, Compliance & Law	4	ECTS
Study program	University of applied sciences master degree program Data Science & Intelligent Analytics extra-occupational		
Position in curriculum	Semester 1		
	Semester 4		
Level	Semester 1: Master degree program / Semester 4: Master degree program		
Previous knowledge	Semester 1: No prerequisites / Semester 4: Business Ethics, Compliance & Law 1		
Block course	No		
Group of participants	Bachelor graduates, beginning students		
Literature recommendations	Business Ethics, Compliance & Law 1 /ILV / LV no.: ETHR.1/Semester: 1 / ECTS: 2 - Floridi, L. (2015) The Ethic of Information. 1. Auflage, Oxford University Press, Oxford (ISBN: 978-0198748052). - Gola, P.; Reif, Y. (2016) Praxisfälle Datenschutzrecht: Juristische Sachverhalte Schritt für Schritt prüfen, bewerten und lösen. 2. Auflage, DATA- KONTEXT, Frechen (ISBN: 978-3895777677). - Lynskey, O. (2016) The Foundations of EU Data Protection Law. 1. Auflage, Oxford University Press, Oxford (ISBN: 978-0-19-871823-9). - Taeger, J. (2014) Datenschutzrecht: Einführung. 1. Auflage, Deutscher Fachverlag, Frankfurt am Main (ISBN: 978-3800515370). - Worms, N. (2010) Informationsethik und Online-Netzwerke: Im Spannungsfeld zwischen struktureller Bedingtheit und Privatsphäre. 1. Auflage, VDM Verlag Dr. Müller, Saarbrücken (ISBN: 978-3639320602).		
	Business Ethics, Compliance & Law 2 /ILV / LV no.: ETHR.2/Semester: 4 / ECTS: 2 - Floridi, L. (2015) The Ethic of Information. 1. Auflage, Oxford University Press, Oxford (ISBN: 978-0198748052). - Gola, P.; Reif, Y. (2016) Praxisfälle Datenschutzrecht: Juristische Sachverhalte Schritt für Schritt prüfen, bewerten und lösen. 2. Auflage, DATA- KONTEXT, Frechen (ISBN: 978-3895777677). - Lynskey, O. (2016) The Foundations of EU Data Protection Law. 1. Auflage, Oxford University Press, Oxford (ISBN: 978-0-19-871823-9). - Taeger, J. (2014) Datenschutzrecht: Einführung. 1. Auflage, Deutscher Fachverlag, Frankfurt am Main (ISBN: 978-3800515370). - Worms, N. (2010) Informationsethik und Online-Netzwerke: Im Spannungsfeld zwischen struktureller Bedingtheit und Privatsphäre. 1. Auflage, VDM Verlag Dr. Müller, Saarbrücken (ISBN: 978-3639320602).		

Module: ETHR	Business Ethics, Compliance & Law	4	ECTS
Skill acquisition	Business Ethics, Compliance & Law 1 /ILV / LV no.: ETHR.1/Semester: 1 /ECTS: 2		
	Graduates are familiar with fundamental ethical and legal requirements for data processing and are able to discuss these with respect to data-driven projects. On the one hand, they are familiar with personal rights of individuals and, on the other hand, with applicable national and international legal bases with respect to data utilization (big data).		
	Business Ethics, Compliance & Law 2 /ILV / LV no.: ETHR.2/Semester: 4 /ECTS: 2		
	Graduates are familiar with further ethical and legal requirements for data processing and are able to discuss these with respect to data-driven projects. They are able to analyze the usage of large data volumes and utilization strategies based on these ethical and legal framework conditions and develop procedures.		
Course content	Business Ethics, Compliance & Law 1 /ILV / LV no.: ETHR.1/Semester: 1 / ECTS: 2		
	This lecture focuses on applicable national and international law with respect to data processing (big data) and specifically deals with the rights of individuals in regard to personal data. Basic ethical and legal skills for dealing with personal data are conveyed in this part of the two-part course. Students, e.g., apply these learned skills in the Practical Project in Semester 3. The course content predominantly encompasses the following topics: - Definition of terms: personal data, data separation, technical and organizational measures, anonymization, pseudonymization - Fundamentals of ethics and data protection (e.g. the basic right for informational self-determination, consent requirements, purpose limitation principle)		
	Business Ethics, Compliance & Law 2 /ILV / LV no.: ETHR.2/Semester: 4 / ECTS: 2		
	This lecture focuses on applicable national and international law with respect to big data and specifically deals with the rights of individuals in regard to personal data. Content from the first part is consolidated in this second part of the two-part course. Furthermore, the topic of company compliance is discussed within the context of data processing, e.g. based on the example of common reference process models for data-processing organizational units (such as ITIL, COBIT, etc.). The course content predominantly encompasses the following topics: - Data transfer within companies, nationally (e.g. Telecommunications Act, Data Protection Ordinance, Teleservices Act) and internationally (e.g. EU-US Data Protection Shield) - Reference process models (e.g. ITIL, COBIT)		
Planned teaching and learning methods	Business Ethics, Compliance & Law 1 /ILV / LV no.: ETHR.1/Semester: 1 / ECTS: 2		
	– Lecture with discussion		
	Business Ethics, Compliance & Law 2 /ILV / LV no.: ETHR.2/Semester: 4 / ECTS: 2		
	– Lecture with discussion		

Module: ETHR	Business Ethics, Compliance & Law	4	ECTS
Testing methods	Business Ethics, Compliance & Law 1 /ILV / LV no.: ETHR.1/Semester: 1 / ECTS: 2		
	– Final examination		
	Business Ethics, Compliance & Law 2 /ILV / LV no.: ETHR.2/Semester: 4 / ECTS: 2		
	– Final examination		

2.3.4 Master Thesis & Scientific Work (MPA)

Module: MPA	Master Thesis & Scientific Work	22	ECTS
Study program	University of applied sciences master degree program Data Science & Intelligent Analytics extra-occupational		
Position in curriculum	Semester 3		
	Semester 4		
Level	Semester 3: Master degree program / Semester 4: Master degree program		
Previous knowledge	3. Semester: No prerequisites / Semester 4: No prerequisites / 4. Semester: Scientific Work		
Block course	No		
Group of participants	Bachelor graduates, beginning students		
Literature recommendations	Scientific Work /SE /LV no.: MPA.1/Semester: 3 / ECTS: 2		
	- Ebster, C.; Stalzer, L. (2013) Wissenschaftliches Arbeiten für Wirtschafts- und Sozialwissenschaftler. 4. Auflage, UTB, Stuttgart (ISBN: 978- 3825238612). - Franck, N. (2007) Handbuch Wissenschaftliches Arbeiten. 2. Auflage, Fischer Taschenbuch Verlag, Frankfurt am Main (ISBN: 978-3596151868). - Schütz, M.; Röbken, H. (2016) Bachelor- und Masterarbeiten verfassen: Abschlussarbeiten in Organisationen. 1. Auflage, Springer Gabler, Wiesbaden (ISBN: 978-3658123451). - Theisen, M. R.; Theisen, M. (2017) Wissenschaftliches Arbeiten: Erfolgreich bei Bachelor- und Masterarbeit. 17. Auflage, Vahlen, München (ISBN: 978-3800653829).		
	Master Thesis Supervision (25 students) /MA / LV no.: MPA.2/Semester: 4 / ECTS: 0		
	- Atteslander, P. (2010) Methoden der empirischen Sozialforschung. 13. Auflage, Erich Schmidt Verlag, Berlin (ISBN: 978-3-503-12618-7). - Eco, U. (2010) Wie man eine wissenschaftliche Abschlußarbeit schreibt. 13. Auflage, UTB, Stuttgart (ISBN: 978-3825215125).		
	Master Thesis /MA / LV no.: MPA.3/Semester: 4 / ECTS: 18		
	- Atteslander, P. (2010) Methoden der empirischen Sozialforschung. 13. Auflage, Erich Schmidt Verlag, Berlin (ISBN: 978-3-503-12618-7). - Eco, U. (2010) Wie man eine wissenschaftliche Abschlußarbeit schreibt. 13. Auflage, UTB, Stuttgart (ISBN: 978-3825215125).		
	Colloquium for the Master Thesis /MA / LV no.: MPA.4/Semester: 4 / ECTS: 2		
	- Atteslander, P. (2010) Methoden der empirischen Sozialforschung. 13. Auflage, Erich Schmidt Verlag, Berlin (ISBN: 978-3-503-12618-7). - Eco, U. (2010) Wie man eine wissenschaftliche Abschlußarbeit schreibt. 13. Auflage, UTB, Stuttgart (ISBN: 978-3825215125).		

Module: MPA	Master Thesis & Scientific Work	22	ECTS
Skill acquisition	**Scientific Work /SE /LV no.: MPA.1/Semester: 3 /ECTS: 2** Students learn how to independently perform complex research. They also learn how to structure this research in a methodically correct manner and execute it properly. **Master Thesis /MA / LV no.: MPA.3/Semester: 4 /ECTS: 16 (master thesis) + 2 (examinations before the examination board)** Students learn how to properly perform their independently developed scientific research within the context of the master thesis and portray it in written form in a comprehensive scientific paper. **Colloquium for the Master Thesis /MA / LV no.: MPA.4/Semester: 4 /ECTS: 2** Students know how scientific reviews are performed. Furthermore, they know how to present results before a scientific community and are able to critically question gained scientific insights.		
Course content	**Scientific Work /SE /LV no.: MPA.1/Semester: 3 / ECTS: 2** Students acquire consolidating knowledge in scientific working based on a research project that is to be developed in small groups. Students are trained in the area of data analysis including inferential statistics building on the fundamental knowledge of techniques and rules of scientific work. Students are enabled to develop complex scientific problems and research designs, which implies an advanced level of structure and content as well as form and language. The practical development of the abovementioned knowledge prepares students both formally and methodically for the writing of a master thesis – the exposition and critical questioning of scientific methodology for a master thesis are also taken into account. Possible topics and hypotheses are discussed in order to support students in their search for relevant and highly qualitative problem areas. **Master Thesis /MA / LV no.: MPA.3/Semester: 4 / ECTS: 18** The master thesis topic is selected from the topical range of the study program. The developed problem area is prepared based on an academic paper – this, of course, is done independently and without the help of others (stating sources and means). This modus operandi ensures that students are able to work on a problem in a scientific and application-oriented manner. Students are to independently search for topics and develop an outline and time schedule – first and foremost by critically examining possible problems and hypotheses. The supervisor guides the student as scientific methodology, formal design and time management are discussed within the context of individual coaching. **Colloquium for the Master Thesis /MA / LV no.: MPA.4/Semester: 4 / ECTS: 2** The course accompanies students in the conception and creation of their master thesis. Issues/Hypothesis and the outline of the master thesis are presented and discussed in the colloquium.		

Module: MPA	Master Thesis & Scientific Work	22	ECTS
	Furthermore, the scientific methodology of the master thesis is debated and questioned. Students also receive instructions in regard to the formal structure of the master thesis.		
Planned teaching and learning methods	**Scientific Work /SE /LV no.: MPA.1/Semester: 3 / ECTS: 2** - Lecture with discussion - Group work - Interactive workshop		
	Master Thesis /MA / LV no.: MPA.3/Semester: 4 / ECTS: 18 – Writing a master thesis		
	Colloquium for the Master Thesis /MA / LV no.: MPA.4/Semester: 4 / ECTS: 2 - Lecture with discussion - Group work - Interactive workshop		
Testing methods	**Scientific Work /SE /LV no.: MPA.1/Semester: 3 / ECTS: 2** – Seminar thesis		
	Master Thesis /MA / LV no.: MPA.3/Semester: 4 / ECTS: 18 – Master thesis		
	Colloquium for the Master Thesis /MA / LV no.: MPA.4/Semester: 4 / ECTS: 2 - Seminar thesis - Final presentation		

2.3.5 Practice, Management & Strategy (PMS)

Module: PMS	Practice, Management & Strategy	14	ECTS
Study program	University of applied sciences master degree program Data Science & Intelligent Analytics extra-occupational		
Position in curriculum	Semester 1		
	Semester 2		
	Semester 3		
Level	Semester 1: Master degree program / Semester 2: Master degree program / Semester 3: Master degree program		
Previous knowledge	Semester 1: No prerequisites / Semester 2: No prerequisites / Semester 3: No prerequisites		
Block course	No		
Group of participants	Bachelor graduates, beginning students		
Literature recommen-	**Leadership in Team & Project Management /ILV / LV no.: PMS.1/Semester: 1 / ECTS: 3** – Gellert, M.; Nowak, C. (2010) Teamarbeit, Teamentwicklung, Teamberatung: Ein Praxisbuch für die Arbeit in und mit Teams. 4. Auflage, Limmer, C., Meezen (ISBN: 978-3928922135). – Kerzner, H. (2017) Project Management: A Systems Approach to Planning, Scheduling, and Controlling. 12. Auflage, Wiley, Weinheim (ISBN: 978-1119165354). – Klose, B. (2008) Projektabwicklung: Arbeitshilfen, Fallbeispiele und Checklisten im Projektmanagement. 5. Auflage, mi-Wirtschaftsbuch, München (ISBN: 978-3636031648).		

Module: PMS	Practice, Management & Strategy	14	ECTS

- Litke, H-D. (2007) Projektmanagement: Methoden, Techniken, Verhaltensweisen. 5. Auflage, Carl Hanser Verlag, München (ISBN: 978-3446409972).
- Patzak, G.; Rattay, G. (2017) Projektmanagement: Projekte, Projektportfolios, Programme und projektorientierte Unternehmen. 7. Auflage, Linde Verlag, Wien (ISBN: 978-3714303216).
- Ruckdäschel, S. (2015) Leadership of Networks and Performance: A Qualitative Analysis. 1. Auflage, Gabler, Wiesbaden (ISBN: 978-3-658-07032-8).
- Schulz von Thun, F. (2014) Miteinander reden 1-4: Störungen und Klärungen / Stile, Werte und Persönlichkeitsentwicklung / Das "Innere Team" und situationsgerechte Kommunikation / Fragen und Antworten. Rowohlt Taschenbuch Verlag, Reinbek (ISBN: 978-3499628757).
- Sendjaya, S. (2015) Personal and Organizational Excellence Through Servant Leadership: Learning to Serve, Serving to Lead, Leading to Transform. 1. Auflage, Springer International Publishing, Cham (ISBN: 978-3-319-16196-9).

Study Trip /ILV / LV no.: PMS.2/Semester: 2 / ECTS: 3

- Beise, M. (2013) Lead Markets. Country-Specific Success Factors of the Global Diffusion of Innovations. Physica-Verlag, Heidelberg (ISBN: 978- 3790814309).
- Thomas, D. C. (2014) Cross-Cultural Management: Essential Concepts. 4. Auflage, SAGE Publishing, Thousand Oaks (ISBN: 978-14112939560).
- Thomas, A.; Kinast, E.; Schroll-Machl, S. (2003) Handbuch Interkulturelle Kommunikation und Kooperation: Grundlagen und Praxistransfer (Band 1). 2. Auflage, Vandenhoeck & Ruprecht, Göttingen (ISBN: 978-3525461723).
- Thomas, A.; Kinast, E.; Schroll-Machl, S. (2003) Handbuch Interkulturelle Kommunikation und Kooperation: Länder, Kulturen und interkulturelle Berufstätigkeit (Band 2). 2. Auflage, Vandenhoeck & Ruprecht, Göttingen (ISBN: 978-3525461662).
- Jones, E. (2006) Cultures Merging: A Historical and Economic Critique of Culture. 1. Auflage, Princeton University Press, New Jersey (ISBN: 978- 0691171043).
- 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. 1. Auflage, CreateSpace Independent Publishing Platform, Delaware (ISBN: 978-1479159680).

Systemic Innovation /SE / LV no.: PMS.3/Semester: 3 / ECTS: 4

– Achouri C. (2011) Wenn Sie wollen, nennen Sie es Füßung: Systemisches Management im 21. Jahrhundert. 1. Auflage, Gabal, Offenbach (ISBN: 978-3-86936-174-1).

– Achouri C. (2015) Systemisches Management. In: Human Resources Management: Eine praxisbasierte Einführung. 2. Auflage, Gabler, Wiesbaden (ISBN: 978-3834947390).

- Bergmann, G.; Daub, J. (2008) Systemisches Innovations- und Kompetenzmanagement: Grundlagen - Prozesse - Perspektiven. 2. Auflage, Gabler, Wiesbaden (ISBN: 978-3834910592).

- Brenner, W.; Uebernickel, F. (2016) Design Thinking for Innovation: Research and Practice. 1. Auflage, Springer, Berlin (ISBN: 978-3319260983).

- Brown, T. (2012) Change by Design: how design thinking transforms organizations and inspires innovation. 2. Auflage, Harper Business, New York (ISBN: 978-3319260983).

- Kearney, E. (2013) Diversity und Innovation, Seite 175 in Krause D. E. (Hrsg.) Kreativität, Innovation, Entrepreneurship. 1. Auflage, Springer Gabler, Wiesbaden (ISBN: 978-3658025502).

Module: PMS	Practice, Management & Strategy	14	ECTS
	- Orloff, M. A. (2010) Inventive Thinking through TRIZ: A Practical Guide. 1. Auflage, Springer, Berlin (ISBN: 978-3642069802). - Orloff, M. A. (2012) Modern TRIZ: A Practical Course with EASyTRIZ Technology. 1. Auflage, Springer, Berlin (ISBN: 978-3642252174). - Tidd, J.; Bessant, J. (2013) Managing Innovation: Integrating Technological, Market and Organizational Change. 5. Auflage, Wiley, Chichester (ISBN: 978- 1118360637).		
	Practical Project /PT /LV no.: PMS.4/Semester: 3 / ECTS: 4		
	- Patzak, G.; Rattay, G. (2017) Projektmanagement: Projekte, Projektportfolios, Programme und projektorientierte Unternehmen. 7. Auflage, Linde Verlag, Wien (ISBN: 978-3714303216). - Schöneck, N. M.; Voß, W. (2013) Das Forschungsprojekt: Planung, Durchführung und Auswertung einer quantitativen Studie. 2. Auflage, Springer VS, Wiesbaden (ISBN: 978-3531195018).		
Skill acquisition	Leadership in Team & Project Management /ILV / LV no.: PMS.1/Semester: 1 /ECTS: 3		
	Students are competent in further methods and tools of project management and management of data-driven products. Furthermore, they are able to compare and evaluate these methods and tools within the context of a specific problem area. Building on this, they are able to develop a solution-oriented procedure by means of these methods and tools.		
	Study Trip /ILV / LV no.: PMS.2/Semester: 2 /ECTS: 3		
	Students understand the main cultural currents as well as the subject-relevant discourse and economic organization in the respective foreign country.		
	Systemic Innovation /SE / LV no.: PMS.3/Semester: 3 /ECTS: 4		
	Graduates are competent in the basic concepts and methods within the topical fields of systematic innovative thinking, systemic management and innovation management. They are able to apply specific creative techniques for generating innovations and oversee their practical implementation from a management perspective. Furthermore, they have a holistic understanding of the study program's topical areas and are thereby enabled to recognize comprehensive innovation potential across areas.		
	Practical Project /PT /LV no.: PMS.4/Semester: 3 /ECTS: 4		
	Students apply their theoretical and applied knowledge from the first two semesters and independently work on a complex data-centered project. They specifically apply acquired knowledge from "Leadership in Team & Project Management for Data Science" in order to organize and evaluate themselves.		
Course content	Leadership in Team & Project Management /ILV / LV no.: PMS.1/Semester: 1 / ECTS: 3		
	Students learn different methods and tools of project and product management, which specifically includes methods and tools in the following areas: - Risk management - Project controlling - Expenditure estimation		

Module: PMS	Practice, Management & Strategy	14	ECTS

- Requirements management
- IT-supported project documentation
- Process models in the area of IT and data processing

Furthermore, students gain a better understanding of interpersonal communication processes as they become aware of expectations and conditions and make these more transparent within a new context. They also learn to work more efficiently. As a complement, the complexity and structure of interdisciplinary projects (focus: technology/application) is developed and respective management methods are comprehensively taught at the master level across study programs. The course content also prepares students for an optional certification as project manager, which is offered as an extracurricular option.

Study Trip /ILV / LV no.: PMS.2/Semester: 2 / ECTS: 3

The study trip affords extra-occupational students the opportunity to acquire inter-cultural skills. Course leadership instructs students to learn about potential study trip destinations, research relevant data and facts about the target country and organize the program: The students spend a week in an international environment as they visit companies and attend lectures at partner universities as well as lectures and events relating to social skills. This ensures that students acquire an understanding of the main cultural currents of the respective country.
Discussions with specialists and executives, visits to foreign trade delegations as well as economic and social associations complement the international character-building experiences gained on the study trip.

Systemic Innovation /SE / LV no.: PMS.3/Semester: 3 / ECTS: 4

This course addresses the most important aspects of the study program's topical range and gives students an overview of options resulting from a holistic perspective of the topical field of data analytics with respect to innovation. Students learn creative techniques/methods for generating innovations and how to implement these innovations in a practical manner from a management perspective.

The course content predominantly encompasses the following topics:
- Development of a holistic understanding of the topical fields (systemic management)
- Methods for generating innovative ideas (e.g. systemic 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

The course content allows students to apply the data analysis tool in a structured manner, generate innovations and accompany their implementation.

Practical Project /PT /LV no.: PMS.4/Semester: 3 / ECTS: 4

Students gain skills in the application of acquired knowledge through independent implementation. They independently implement a complex project – which includes conceptualization, budgeting and execution as well as the evaluation and interpretation of results.

Module: PMS	Practice, Management & Strategy	14	ECTS
	Projects are performed in student teams with independent leadership and team formation so as to also enhance the students' social skills. Abilities such as the analysis of consumer behavior, economically responsible decision-making skills, risk management, intercultural competence, organizational and social skills, budgeting skills as well as sponsoring and project management are especially important. The above-mentioned learning and teaching goals are secured with the implementation of an actual solution.		
Planned teaching and learning methods	Leadership in Team & Project Management /ILV / LV no.: PMS.1/Semester: 1 / ECTS: 3 - Lecture with discussion - Interactive workshop		
	Study Trip /ILV / LV no.: PMS.2/Semester: 2 / ECTS: 3 - Lecture with discussion - Group work		
	Systemic Innovation /SE / LV no.: PMS.3/Semester: 3 / ECTS: 4 - Lecture with discussion - Interactive workshop		
	Practical Project /PT /LV no.: PMS.4/Semester: 3 / ECTS: 4 - Lecture with discussion - Group work		
Testing methods	Leadership in Team & Project Management /ILV / LV no.: PMS.1/Semester: 1 / ECTS: 3 – Seminar thesis		
	Study Trip /ILV / LV no.: PMS.2/Semester: 2 / ECTS: 3 – Final report		
	Systemic Innovation /SE / LV no.: PMS.3/Semester: 3 / ECTS: 4 – Seminar thesis		
	Practical Project /PT /LV no.: PMS.4/Semester: 3 / ECTS: 4 – Final report		

2.3.6 Software Development (SEW)

Module: SEW	Software Development	18	ECTS
Study program	University of applied sciences master degree program Data Science & Intelligent Analytics extra-occupational		
Position in curriculum	Semester 1 Semester 2		
Level	Semester 1: Master degree program / Semester 2: Master		
Previous knowledge	Semester 1: No prerequisites / Semester 2: Software Development for Data Science 1		
Block course	No		
Group of participants	Bachelor graduates, beginning students		
Literature recommendations	Software Development for Data Science 1 /ILV / LV no.: SEW.1/Semester: 1 / ECTS: 3		

Module: SEW	Software Development	18	ECTS

- Häberlein, T. (2016) Informatik: Eine praktische Einführung mit Bash und Python. 2. Auflage, De Gruyter Oldenbourg, Berlin (ISBN: 978-3110496864).
- Sommerville, I. (2015) Software Engineering, Global Edition. 10. Auflage, Pearson Education, London (ISBN: 978-1292096131).
- Williams, L.; Zimmermann, T. (2016) Perspectives on Data Science for Software Engineering. 1. Auflage, Morgan Kaufmann, Burlington (ISBN: 978-0128042069).
- Crawley, M. J. (2007) The R Book. 1. Auflage, John Wiley & Sons Ltd, Chichester (ISBN: 978-0-470-51024-7).
- Bowles, M. (2015) Machine Learning in Python: Essential Techniques for Predictive Analysis. 1. Auflage, John Wiley & Sons Ltd, Chichester (ISBN: 978-1118961742).
- Lutz, M (2013) Learning Python. 1. Auflage, O'Reilly Media, Farnham.

Software Development for Data Science 1 Lab /UE / LV no.: SEW.2/Semester: 1 / ECTS: 6

- Häberlein, T. (2016) Informatik: Eine praktische Einführung mit Bash und Python. 2. Auflage, De Gruyter Oldenbourg, Berlin (ISBN: 978-3110496864).
- Sommerville, I. (2015) Software Engineering, Global Edition. 10. Auflage, Pearson Education, London (ISBN: 978-1292096131).
- Williams, L.; Zimmermann, T. (2016) Perspectives on Data Science for Software Engineering. 1. Auflage, Morgan Kaufmann, Burlington (ISBN: 978-0128042069).
- Crawley, M. J. (2007) The R Book. 1. Auflage, John Wiley & Sons Ltd, Chichester (ISBN: 978-0-470-51024-7).
- Bowles, M. (2015) Machine Learning in Python: Essential Techniques for Predictive Analysis. 1. Auflage, John Wiley & Sons Ltd, Chichester (ISBN: 978-1118961742).
- Lutz, M (2013) Learning Python. 1. Auflage, O'Reilly Media, Farnham.

Software Development for Data Science 2 /ILV / LV no.: SEW.3/Semester: 2 / ECTS: 3

- Häberlein, T. (2016) Informatik: Eine praktische Einführung mit Bash und Python. 2. Auflage, De Gruyter Oldenbourg, Berlin (ISBN: 978-3110496864).
- Sommerville, I. (2015) Software Engineering, Global Edition. 10. Auflage, Pearson Education, London (ISBN: 978-1292096131).
- Williams, L.; Zimmermann, T. (2016) Perspectives on Data Science for Software Engineering. 1. Auflage, Morgan Kaufmann, Burlington (ISBN: 978-0128042069).
- Crawley, M. J. (2007) The R Book. 1. Auflage, John Wiley & Sons Ltd, Chichester (ISBN: 978-0-470-51024-7).
- Bowles, M. (2015) Machine Learning in Python: Essential Techniques for Predictive Analysis. 1. Auflage, John Wiley & Sons Ltd, Chichester (ISBN: 978-1118961742).
- Lutz, M (2013) Learning Python. 1. Auflage, O'Reilly Media, Farnham.

Software Development for Data Science 2 Lab /UE / LV no.: SEW.4/Semester: 2 / ECTS: 6

- Häberlein, T. (2016) Informatik: Eine praktische Einführung mit Bash und Python. 2. Auflage, De Gruyter Oldenbourg, Berlin (ISBN: 978-3110496864).
- Sommerville, I. (2015) Software Engineering, Global Edition. 10. Auflage, Pearson Education, London (ISBN: 978-1292096131).
- Williams, L.; Zimmermann, T. (2016) Perspectives on Data Science for Software Engineering. 1. Auflage, Morgan Kaufmann, Burlington (ISBN: 978-0128042069).

Module: SEW	Software Development	18	ECTS
	- Crawley, M. J. (2007) The R Book. 1. Auflage, John Wiley & Sons Ltd, Chichester (ISBN: 978-0-470-51024-7). - Bowles, M. (2015) Machine Learning in Python: Essential Techniques for Predictive Analysis. 1. Auflage, John Wiley & Sons Ltd, Chichester (ISBN: 978-1118961742). - Lutz, M (2013) Learning Python. 1. Auflage, O'Reilly Media, Farnham.		
Skill acquisition	Software Development for Data Science 1 /ILV / LV no.: SEW.1/Semester: 1 /ECTS: 3 Graduates are familiar with software development concepts that are frequently used in data science. Furthermore, they are familiar with the deployment of these concepts in frequently used software development environments in the area of data analysis (e.g. in Python, MathLab or R). Students are also aware of the tools and software systems that are necessary for software development.		
	Software Development for Data Science 1 Lab /UE / LV no.: SEW.2/Semester: 1 /ECTS: 6 Graduates consolidate their knowledge in the application of software development concepts in the area of data science. They have broad application knowledge in regard to usage of typical software development environments in the area of data science (e.g. Python, MathLab or R) and are able to apply these within the context of data-driven problem areas.		
	Software Development for Data Science 2 /ILV / LV no.: SEW.3/Semester: 2 /ECTS: 3 Graduates consolidate software development concepts that are frequently used in data science. Special emphasis is on integration in other software systems while the usage of web-based approaches constitutes a focal point. Another aspect is knowledge of design patterns that are frequently used in data-intensive applications or that are relevant for the structure of efficient data-driven application architectures. The course content is rounded off with expertise in efficient software systems that provide data scaling for the data to be analyzed even in case of increasing requirements.		
	Software Development for Data Science 2 Lab /UE / LV no.: SEW.4/Semester: 2 /ECTS: 6 Graduates consolidate their knowledge in the application of software development concepts in the area of data science. They have broad applicable knowledge in the area of integration with other software systems, the usage of design patterns and the structure of efficient and scalable data-driven application architectures.		

Course content	Software Development for Data Science 1 /ILV / LV no.: SEW.1/Semester: 1 / ECTS: 3
	The course deals with the software development process while important aspects of software engineering are addressed in an overview (e.g. requirements acquisition and documentation). The core aspect is the usage of software systems in data-intensive application contexts. The topical field is observed at the concept level (e.g. procedural, object-oriented and functional programming paradigms) as well as in various programming languages with respect to concept characteristics (e.g. Python, MathLab and R). Deployed software ecosystems are illustrated in an overview

Module: SEW	Software Development	18	ECTS

and their application is demonstrated in detail.
Special focus is on the usage of effective and efficient data structures and their implementation.

The teaching content encompasses the following topics:
- The process of software engineering and project management for data-intensive applications
- Programming paradigms for usage in the area of data science
- Comparative illustration of suitable programming languages within the context of data-intensive applications
- Effective and efficient data structures for data-intensive applications
- Tools and software ecosystems for the development and testing of data-intensive software systems

Software Development for Data Science 1 Lab /UE / LV no.: SEW.2/Semester: 1 / ECTS: 6

The content of the integrative course "Software Development for Data Science 1" is consolidated in the lab by means of practical exercises. Acquired knowledge is discussed within the group, thus providing profound insights and a consolidation of the material that was theoretically discussed in the integrative course.

Software Development for Data Science 2 /ILV / LV no.: SEW.3/Semester: 2 / ECTS: 3

Knowledge of software development for data-driven applications is consolidated in the course. The three topical fields of software architecture, system integration and sample-based design form the core of observations.

The teaching content encompasses the following topics:
- Architecture models for data-driven software development and systems
- Integration models and paradigms for the implementation of complex, process-oriented software ecosystems for analytical and data-driven systems
- Application of proven design patterns for data-driven applications
- Conceptualization and implementation of efficient and scalable software systems for data-driven applications

Software Development for Data Science 2 Lab /UE / LV no.: SEW.4/Semester: 2 / ECTS: 6

The content of the integrative course "Software Development for Data Science 2" is consolidated in the lab by means of practical exercises. Acquired knowledge is discussed within the group, thus providing profound insights and a consolidation of the material that was theoretically discussed in the integrative course.

Planned teaching and learning methods	Software Development for Data Science 1 /ILV / LV no.: SEW.1/Semester: 1 / ECTS: 3 - Lecture with discussion - Group work

	Software Development for Data Science 1 Lab /UE / LV no.: SEW.2/Semester: 1 / ECTS: 6
	- Group work - Performing exercise tasks

Module: SEW	Software Development	18	ECTS
	– Interactive workshop		
	Software Development for Data Science 2 Lab /ILV / LV no.: SEW.3/Semester: 2 / ECTS: 3 - Lecture with discussion - Group work		
	Software Development for Data Science 2 Lab /UE / LV no.: SEW.4/Semester: 2 / ECTS: 6 - Group work - Performing exercise tasks - Interactive workshop		
Testing methods	Software Development for Data Science 1 /ILV / LV no.: SEW.1/Semester: 1 / ECTS: 3 – Final examination		
	Software Development for Data Science 1 Lab /UE / LV no.: SEW.2/Semester: 1 / ECTS: 6 - Seminar thesis - Seminar papers		
	Software Development for Data Science 2 Lab /ILV / LV no.: SEW.3/Semester: 2 / ECTS: 3 – Final examination		
	Software Development for Data Science 2 Lab /UE / LV no.: SEW.4/Semester: 2 / ECTS: 6 - Seminar thesis - Seminar papers		

2.3.7 Theory & Algorithmics (THAL)

Module: THAL	Theory & Algorithmics (THAL)	18	ECTS
Study program	University of applied sciences master degree program Data Science & Intelligent Analytics extra-occupational		
Position in curriculum	Semester 1		
	Semester 2		
Level	Semester 1: Master degree program / Semester 2: Master degree program		
Previous knowledge	Semester 1: No prerequisites / Semester 2: Algorithmics & Statistics for Data Science 1		
Block course	No		
Group of participants	Bachelor graduates, beginning students		
Literature recommendations	Algorithmics & Statistics for Data Science 1 /ILV / LV no.: THAL.1/Semester: 1 / ECTS: 3 - Akerkar, R.; Sajja, P.S. (2016) Intelligent Techniques for Data Science. 1. Auflage, Springer, Berlin (ISBN: 978-3-319-29205-2). - Bramer, M. (2017) Principles of Data Mining: undergraduate topics in com- puter science. 2. Auflage, Springer, London (ISBN: 978-4471-4884-5). - Caffo, B. (2016) Statistical inference for data science. 1. Auflage, Lean-pub, Victoria. - Mahmood, Z. (2016) Data Science and Big Data Computing: Frameworks		

Module: THAL	Theory & Algorithmics (THAL)	18	ECTS

and Methodologies. 1. Auflage, Springer, Berlin (ISBN: 978-3319318592).
- Steele, B.; Chandler, J.; Reddy, S. (2016) Algorithms for Data Science. 1. Auflage, Springer, Berlin (ISBN: 978-3319457956).
- Witten, I.; Frank, E.; Hall, M.; Pal, C. (2016) Data Mining: Practical Machine Learning Tools and Techniques. 4. Auflage, Morgan Kaufmann, Burlington (ISBN: 978-0128042915).

Algorithmics & Statistics for Data Science 1 Lab /UE / LV no.: THAL.2/Semester: 1 / ECTS: 6

- Akerkar, R.; Sajja, P.S. (2016) Intelligent Techniques for Data Science. 1. Auflage, Springer, Berlin (ISBN: 978-3-319-29205-2).
- Bramer, M. (2017) Principles of Data Mining: undergraduate topics in computer science. 2. Auflage, Springer, London (ISBN: 978-4471-4884-5).
- Caffo, B. (2016) Statistical inference for data science. 1. Auflage, Leanpub, Victoria.
- Mahmood, Z. (2016) Data Science and Big Data Computing: Frameworks and Methodologies. 1. Auflage, Springer, Berlin (ISBN: 978-3319318592).
- Steele, B.; Chandler, J.; Reddy, S. (2016) Algorithms for Data Science. 1. Auflage, Springer, Berlin (ISBN: 978-3319457956).
- Witten, I.; Frank, E.; Hall, M.; Pal, C. (2016) Data Mining: Practical Machine Learning Tools and Techniques. 4. Auflage, Morgan Kaufmann, Burlington (ISBN: 978-0128042915).

Algorithmics & Statistics for Data Science 2 /ILV / LV no.: THAL.3/Semester: 2 / ECTS: 3

- Akerkar, R.; Sajja, P.S. (2016) Intelligent Techniques for Data Science. 1. Auflage, Springer, Berlin (ISBN: 978-3-319-29205-2).
- Bramer, M. (2017) Principles of Data Mining: undergraduate topics in computer science. 2. Auflage, Springer, London (ISBN: 978-4471-4884-5).
- Caffo, B. (2016) Statistical inference for data science. 1. Auflage, Leanpub, Victoria.
- Mahmood, Z. (2016) Data Science and Big Data Computing: Frameworks and Methodologies. 1. Auflage, Springer, Berlin (ISBN: 978-3319318592).
- Steele, B.; Chandler, J.; Reddy, S. (2016) Algorithms for Data Science. 1. Auflage, Springer, Berlin (ISBN: 978-3319457956).
- Witten, I.; Frank, E.; Hall, M.; Pal, C. (2016) Data Mining: Practical Machine Learning Tools and Techniques. 4. Auflage, Morgan Kaufmann, Burlington (ISBN: 978-0128042915).

Algorithmics & Statistics for Data Science 2 Lab /UE / LV no.: THAL.4/Semester: 2 / ECTS: 6

- Akerkar, R.; Sajja, P.S. (2016) Intelligent Techniques for Data Science. 1. Auflage, Springer, Berlin (ISBN: 978-3-319-29205-2).
- Bramer, M. (2017) Principles of Data Mining: undergraduate topics in computer science. 2. Auflage, Springer, London (ISBN: 978-4471-4884-5).
- Caffo, B. (2016) Statistical inference for data science. 1. Auflage, Leanpub, Victoria.
- Mahmood, Z. (2016) Data Science and Big Data Computing: Frameworks and Methodologies. 1. Auflage, Springer, Berlin (ISBN: 978-3319318592).
- Steele, B.; Chandler, J.; Reddy, S. (2016) Algorithms for Data Science. 1. Auflage, Springer, Berlin (ISBN: 978-3319457956).
- Witten, I.; Frank, E.; Hall, M.; Pal, C. (2016) Data Mining: Practical Machine Learning Tools and Techniques. 4. Auflage, Morgan Kaufmann, Burlington (ISBN: 978-0128042915).

Module: THAL	Theory & Algorithmics (THAL)	18	ECTS
Skill acquisition	Algorithmics & Statistics for Data Science 1 /ILV / LV no.: THAL.1/Semester: 1 /ECTS: 3		
	Graduates are familiar with the functionality of fundamental algorithms for data science and understand the statistical concepts and operating principles behind these algorithms. Furthermore, they are able to select suitable algorithms for given problem areas and understand their procedures. They are also familiar with the data structures, runtime specifications and complexity classes required by the algorithms.		
	Algorithmics & Statistics for Data Science 1 Lab /UE / LV no.: THAL.2/Semester: 1 /ECTS: 6		
	Graduates are familiar and competent in the functionality of fundamental algorithms for data science and understand the statistical concepts behind the algorithms. They are able to select and implement these algorithms within the context of a specific problem area.		
	Algorithmics & Statistics for Data Science 2 /ILV / LV no.: THAL.3/Semester: 2 /ECTS: 3		
	Graduates are familiar with the functionality of advanced algorithms for data science and understand the statistical concepts behind the algorithms. Furthermore, they are able to select suitable algorithms for given problem areas. They are also familiar with the data structures, runtime specifications and complexity classes required by the algorithms.		
	Algorithmics & Statistics for Data Science 2 Lab /UE / LV no.: THAL.4/Semester: 2 /ECTS: 6		
	Graduates are familiar and competent in the functionality of advanced algorithms for data science and understand the statistical concepts behind the algorithms. They are able to select and implement these algorithms within the context of a specific problem area.		
Course content	Algorithmics & Statistics for Data Science 1 /ILV / LV no.: THAL.1/Semester: 1 / ECTS: 3		
	Students learn about basic algorithms and the underlying statistical procedures. The following groups of algorithms are to be discussed: - Statistical measured values (point and interval estimator) - Statistical test procedures - Grouping algorithms - Decision trees - Random forests - Regression algorithms - Naive Bayes - Associative algorithms - Inductive logical programming - Algorithms for dimension reduction (e.g. PCA) Individual algorithms are presented by the respective groups or developed by students in group work.		
	Algorithmics & Statistics for Data Science 1 Lab /UE / LV no.: THAL.2/Semester: 1 / ECTS: 6		

Module: THAL	Theory & Algorithmics (THAL)	18	ECTS
	The content of the integrative course "Algorithmics & Statistics for Data Science 1" is consolidated in the exercise by means of practical exercises. Acquired knowledge is discussed within the group, providing profound insights and a consolidation of the material that was theoretically discussed in the integrative course.		
	Algorithmics & Statistics for Data Science 2 /ILV / LV no.: THAL.3/Semester: 2 / ECTS: 3 Students learn about advanced algorithms and underlying statistical procedures. The following groups of algorithms are to be discussed: - Neuronal networks - Support vector machines - Reinforced learning - Genetic algorithms - Representation learning - Deep learning (RNN, CNN, etc.) - Rule-based learning Individual algorithms are presented by the respective groups or developed by students in group work.		
	Algorithmics & Statistics for Data Science 2 Lab /UE / LV no.: THAL.4/Semester: 2 / ECTS: 6 The content of the integrative course "Algorithmics & Statistics for Data Science 2" is consolidated in the exercise by means of practical exercises. The acquired knowledge is discussed within the group, providing profound insights and a consolidation of the material that was theoretically discussed in the integrative course.		
Planned teaching and learning methods	Algorithmics & Statistics for Data Science 1 /ILV / LV no.: THAL.1/Semester: 1 / ECTS: 3 - Lecture with discussion - Interactive workshop		
	Algorithmics & Statistics for Data Science 1 Lab /UE / LV no.: THAL.2/Semester: 1 / ECTS: 6 - Lecture with discussion - Group work - Performing exercise tasks		
	Algorithmics & Statistics for Data Science 2 /ILV / LV no.: THAL.3/Semester: 2 / ECTS: 3 - Lecture with discussion - Interactive workshop		
	Algorithmics & Statistics for Data Science 2 Lab /UE / LV no.: THAL.4/Semester: 2 / ECTS: 6 - Lecture with discussion - Group work - Performing exercise tasks		
Testing methods	Algorithmics & Statistics for Data Science 1 /ILV / LV no.: THAL.1/Semester: 1 / ECTS: 3 – Final examination		

Module: THAL	Theory & Algorithmics (THAL)	18	ECTS
	Algorithmics & Statistics for Data Science 1 Lab /UE / LV no.: THAL.2/Semester: 1 / ECTS: 6		
	- Seminar papers - Final examination		
	Algorithmics & Statistics for Data Science 2 /ILV / LV no.: THAL.3/Semester: 2 / ECTS: 3		
	– Final examination		
	Algorithmics & Statistics for Data Science 2 Lab /UE / LV no.: THAL.4/Semester: 2 / ECTS: 6		
	- Seminar papers - Final examination		

2.3.8 Consolidation in DS application domain (VT)

| Module: VT	Consolidation	9	ECTS
Study program	University of applied sciences master degree program Data Science & Intelligent Analytics extra-occupational		
Position in curriculum	Semester 3		
Level	Semester 3: Master degree program		
Previous knowledge	Semester 3: No prerequisites		
Block course	No		
Group of participants	Bachelor graduates, beginning students		
Literature recommendations	Data Science for the Natural Sciences /ILV / LV no.: VT.1/Semester: 3 /ECTS:		
	- Cady, F. (2017) The Data Science Handbook. 2. Auflage, Wiley, Hoboken (ISBN: 978-1119092940). - Hütt, M.-T.; Dehnert, M. (2016) Methoden der Bioinformatik: Eine Einführung zur Anwendung in Biologie und Medizin. 2. Auflage, Springer Spektrum, Heidelberg (ISBN: 978-3662461495). - Selzer, P. M.; Marhöfer, R. J.; Koch, O. (2017) Angewandte Bioinformatik: Eine Einführung. 2. Auflage, Springer Spektrum, Heidelberg (ISBN: 978- 3662541340).		
	Data Science for Business & Commerce /ILV / LV no.: VT.2/Semester: 3		
	3		
	- Cady, F. (2017) The Data Science Handbook. 2. Auflage, Wiley, Hoboken (ISBN: 978-1119092940). - Meier, A.; Stormer, H. (2012) eBusiness & eCommerce: Management der digitalen Wertschöpfungskette. 3. Auflage, Springer, Berlin (ISBN: 978-3-642-29801-1). - Tamm, G. (2003) Konzepte in eCommerce Anwendungen. 1. Auflage, SPC TEIA Lehrbuch, Kelkheim (ISBN: 978-3935539661).		
	Data Science for Engineering /ILV / LV no.: VT.3/Semester: 3 /ECTS:		
	- Cady, F. (2017) The Data Science Handbook. 2. Auflage, Wiley, Hoboken (ISBN: 978-1119092940). - Heinrich, B.; Linke, P.; Glöckler, M. (2017) Grundlagen Automatisierung: Sensorik, Regelung, Steuerung. 2. Auflage, Springer Vieweg, Wiesbaden (ISBN: 978-3658175818).		

Module: VT	Consolidation	9	ECTS
	- Tränkler, H.-R.; Reindl, L. M. (2015) Sensortechnik: Handbuch für Praxis und Wissenschaft. 2. Auflage, Springer Vieweg, Wiesbaden (ISBN: 978- 3642299414). - Serpanos, D.; Wolf, M. (2017) Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies. 1. Auflage, Springer, Berlin (ISBN: 978-3319697147). - Kranz, M. (2016) Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry. 1. Auflage, Wiley, Chichester (ISBN: 978-1119285663).		
Skill acquisition	Data Science for the Natural Sciences /ILV / LV no.: VT.1/Semester: 3 /ECTS: 3 Students are familiar with fundamental usage areas of data acquisition, data storage, data analysis and data usage within the context of natural science applications. They understand the special challenges of this usage area and are familiar with established best practice methods. Furthermore, they are able to independently design and implement data-based applications in this area while taking domain-specific requirements into account. Data Science for Business & Commerce /ILV / LV no.: VT.2/Semester: 3 /ECTS: 3 Students are familiar with the usage areas of data acquisition, data storage, data analysis and data usage within the context of business-related and digital-commerce applications. They understand the special challenges of this usage area and are familiar with established best practice methods. Furthermore, they are able to independently design and implement data-based applications in this area while taking domain-specific requirements into account. Data Science for Engineering /ILV / LV no.: VT.3/Semester: 3 /ECTS: 3 Students are familiar with the usage areas of data acquisition, data storage, data analysis and data usage within the context of engineering-science and IoT applications. They understand the special challenges in this usage area and are familiar with established best practice methods. Furthermore, they are able to independently design and implement data-based applications in this area while taking domain-specific requirements into account.		
Course content	Data Science for the Natural Sciences /ILV / LV no.: VT.1/Semester: 3 / ECTS: 3 Students acquire fundamental knowledge of techniques and tools of data science in the area of natural sciences. They specifically learn about techniques and applications in the following areas: - Biology (e.g. genome research, medical diagnostic procedures, etc.) - Physics (e.g. object recognition by means of image data processing, etc.) - Chemistry (e.g. processing data-intensive experiments, etc.) The purpose of this course is to give students special insight into other areas of data processing and expand their problem-solving horizon. Data Science for Business & Commerce /ILV / LV no.: VT.2/Semester: 3 / ECTS: 3		

Module: VT	Consolidation	9	ECTS
	Students acquire detailed knowledge of the techniques and tools of data science in the area of business and commerce, specifically in: - Business intelligence and management information systems (e.g. dashboards) - Key figure systems and data structures - Forensic data analysis for fraud detection - Process mining for procedural optimization/illustration - Recommender systems (user/item/content-based collaborative filtering) - Customer profile analysis (e.g. lead scoring, customer lifetime value, etc.) The purpose of this course is to give students special insight into other areas of data processing and expand their problem-solving horizon.		
	Data Science for Engineering /ILV / LV no.: VT.3/Semester: 3 / ECTS: 3		
	Students acquire detailed knowledge of techniques and tools of data science in the area of engineering sciences and consolidate their knowledge with datasets from various engineering sciences (sensor technology, robotics, telemetry). The following topical fields are discussed in detail: - Data-driven maintenance (e.g. predictive maintenance, digital twin) - Data-optimized product design (e.g. design of product characteristics through 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 - Predictive data evaluation via neuronal networks		
Planned teaching and learning methods	Data Science for the Natural Sciences /ILV / LV no.: VT.1/Semester: 3 / ECTS: 3		
	– Lecture with discussion		
	Data Science for Business & Commerce /ILV / LV no.: VT.2/Semester: 3 / ECTS: 3		
	– Lecture with discussion		
	Data Science for Engineering /ILV / LV no.: VT.3/Semester: 3 / ECTS: 3		
	– Lecture with discussion		
Testing methods	Data Science for the Natural Sciences /ILV / LV no.: VT.1/Semester: 3 / ECTS: 3		
	– Seminar thesis		
	Data Science for Business & Commerce /ILV / LV no.: VT.2/Semester: 3 / ECTS: 3		
	– Seminar thesis		
	Data Science for Engineering /ILV / LV no.: VT.3/Semester: 3 / ECTS: 3		
	– Seminar thesis		

2.3.9 Graphic overview of modules throughout the study program

The following graphic depicts the individual modules throughout the entire study program and visualizes the structured character of individual topical fields. In the graphic, the number of ECTS credits of the respective module is used as the calculation basis for the size of individual modules.

Illustration 2: Module overview according to the study progression
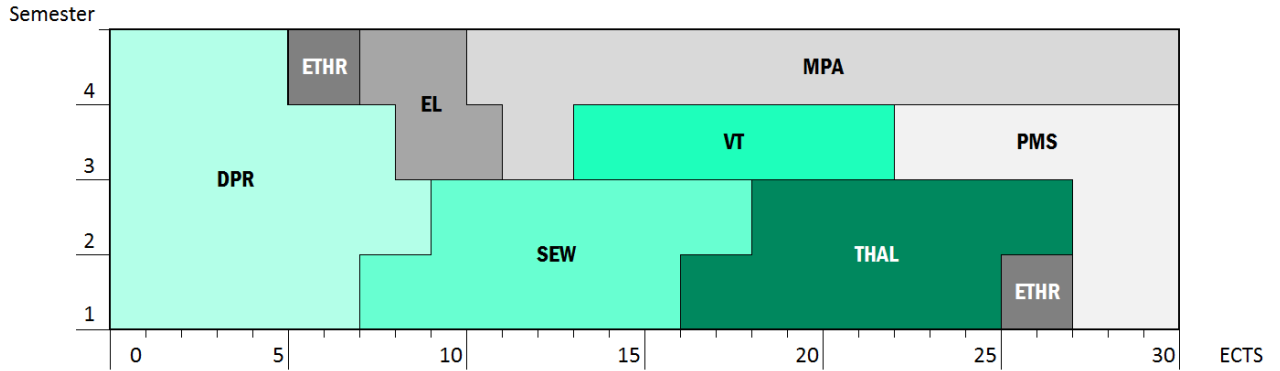
All modules are displayed below in table format with names and abbreviations in order to provide a better overview. The resulting table also includes a list of ECTS credits and weekly semester hours per module in order to ensure comprehensibility:

Table 9: Modules according to semesters

Line labels	ECTS abs.	SWS abs.
Semester 1	**30.0**	**17.5**
Software Development (SEW)	8.0	4.5
Practice, Management & Strategy (PMS)	3.0	2.0
Data Processing (DPR)	7.0	4.0
Business Ethics, Compliance & Law (ETHR)	3.0	2.0
Theory, Algorithmics & Statistics (THAL)	9.0	5.0
Semester 2	**30.0**	**17.0**
Software Development (SEW)	9.0	5.0
Practice, Management & Strategy (PMS)	3.0	2.0
Data Processing (DPR)	9.0	5.0
Theory, Algorithmics & Statistics (THAL)	9.0	5.0
Semester 3	**30.0**	**18.5**
Elective – Compulsory elective subject (ELE)	3.0	2.0
Practice, Management & Strategy (PMS)	7.0	3.5
Consolidation in DS application domains (VT)	9.0	6.0
Data Processing (DPR)	9.0	6.0
Master Thesis & Scientific Work (MPA)	2.0	1.0
Semester 4	**30.0**	**8.6**
Elective – Compulsory elective subject (ELE)	3.0	2.0
Data Processing (DPR)	5.0	3.0
Business Ethics, Compliance & Law (ETHR)	2.0	2.0
Master Thesis & Scientific Work (MPA)	20.0	1.6
Total result	**120.0**	**61.6**

3 ADMISSION CRITERIA

General admission criteria are regulated in Section 4 of the University of Applied Sciences Study Act (FHG) in the current version. Accordingly, the completed subject-specific university of applied sciences bachelor degree program or the completion of an equivalent study program at a recognized domestic or foreign post-secondary educational institute constitutes the subject-related admission criteria for a university of applied sciences master degree program.

The following content-related requirements are specifically required for the master degree program "Data Science & Intelligent Analytics":

1. Bachelor study programs or equivalent post-secondary educational qualifications from the subject area information technologies[3] that deal with the core subject areas of (a) computer usage, (b) database design and management as well as (c) software and application development[4] with a total scope of at least 20 ECTS are regarded as subject-specific for the present study program. Furthermore, topics from the field of natural sciences, mathematics and statistics[5], which encompass the core subject areas of (d) mathematics and (e) statistics[6] are to be addressed summarily with a total scope of at least 8 ECTS in these bachelor degree programs or equivalent post-secondary educational qualifications. Documented occupational qualifications can be taken into account in the assessment of subject-specific prior achievements in accordance with the extra-occupational mode of the present degree program.

2. FH Kufstein Tirol envisages a networking of bachelor and master degree programs in the architecture of the study program in accordance with the Bologna Process. After the successful completion of a bachelor degree program, graduates have multiple options at their disposal for pursuing a master degree program even outside of FH Kufstein Tirol. Graduates of the study program Web Business & Technology at FH Kufstein Tirol would in any case be admissible to the present master degree program due to the abovementioned subject-related prior education.

3. German and English are the teaching and examination languages at FH Kufstein Tirol for all degree programs. Thus, students from non-German-speaking foreign countries must provide respective documentation in the subject German.

4. The examination of the fulfillment of admission criteria is the responsibility of the Director of Studies of the master degree program "Data Science & Intelligent Analytics".

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[3] Based on ISCED 2013, Fields of Education and Training No. 061 (Information and Communication Technologies (ICTs))

[4] 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)

[5] Based on ISCED 2013, Fields of Education and Training No. 05 (Natural Sciences, Mathematics and Statistics)

[6] Based on ISCED 2013, Fields of Education and Training No. 0541 (Mathematics) and 0542 (Statistics)