Curriculum
for the Continuing Education Programme
Data Science – From Mathematical Foundations to Applications
at the University of Innsbruck

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§ 1 Qualification profile

(1) Data scientists are data handling experts. They have high-level skills for solving complex data-related problems.

(2) Graduates

- have a thorough understanding of the mathematical foundations of Data Science,
- have an overview of state-of-the-art methods for supervised and unsupervised learning,
- are able to construct and analyse methods for handling a specific problem in Data Science,
- have in-depth knowledge of advanced methods and their applications for handling complex problems in Data Science in a particular field of application,
- can deal with real problems with partners from industry and business as well as the academic field,
- can perform data science tasks using appropriate software systems,
- can present results of a data science project to experts in the field as well as to end users in a clear way.

§ 2 Admission

(1) Precondition for being admitted to the continuing education programme is the completion of a pertinent Diploma, Bachelor's or Master's Programme at an approved educational institution home or abroad, whereby a Bachelor's programme must correspond to a minimum of 180 ECTS-Credits.

(2) A Diploma, Bachelor's or Master's programme in an engineering or natural sciences subject completed at the University of Innsbruck is in any case a pertinent study programme.

(3) Participants who have been admitted to the continuing education programme and who have paid their programme fee are admitted to the University of Innsbruck as non-degree students by the Rectorate.

§ 3 Language of instruction

The language of instruction of the continuing education course is English.

§ 4 Scope and duration

The continuing education programme covers 90 ECTS-Credits, 20 of which are credited to the Master's Thesis. One ECTS-Credit corresponds to a workload of 25 hours. The continuing education programme is a part-time programme over four semesters.

§ 5 Types of courses

Courses with continuous performance assessment:

1. **Lectures with practical elements** (VU) focus on the practical treatment of concrete scientific tasks that are discussed during the lecture parts of the course.
2. **Seminars** (SE) provide in-depth treatment of scientific topics through students' presentations and discussion thereof.
3. **Project studies** (PJ) promote scientific collaboration of two or more fields through the treatment of multidisciplinary topics and the use of various methods and techniques.

§ 6 Compulsory modules

The following compulsory modules covering 70 ECTS-Credits must be passed:

1.	Compulsory module: Foundations of Data Science	h	ECTS-Credits
a.	VU Mathematical Foundations and Outlook	5	12.5
b.	VU Software	2	5
c.	VU Reporting	1	2.5
d.	VU Data Management	1	2.5
	Total	9	22.5
	Learning Outcomes: Students acquire a profound understanding of learning environments for dealing with tasks in Data Science. They are able to apply mathematical concepts to develop and analyse basic methods in Data Science. Moreover, they have an overview of expansions to such methods as well as their applications. Students can perform basic data science tasks with a suitable software system such as R or Phyton, for example, import, clean / transform, visualise and model data using basic tools. They can communicate intermediate and final results of data science projects to both experts of the field as well as end users, for example in the form of a written report, a slide presentation, a web app or a dashboard. Students can merge and summarise different types of data (numerical, categorical, spatial and temporal) from different sources (single files, databases, web-based formats) to analyse them using methods of data science.		
	Prerequisites: none		

2.	Compulsory module: Methods of Data Science	h	ECTS-Credits
a.	VU Supervised Learning: Parametric and Semi-Parametric Modelling	3	7.5
b.	VU Unsupervised Learning	3	7.5
c.	VU Supervised Learning: Algorithmic Modelling	3	7.5
	Total	9	22.5
	Learning Outcomes: Students acquire in-depth knowledge of supervised learning through distributional regression, of unsupervised learning for multivariate data and supervised learning using algorithmic models. They are able to independently select and adjust a model of probability theory for a specific task, in particular to select suitable answer distribution, regressors and algorithms for parameter estimation. They are able to apply dimensional reduction techniques as well as scaling, clustering and association analysis. For a specific problem, they can independently select and adapt a predictive model, in particular they can implement flexible learning strategies using appropriate building blocks (base learners, kernels, rules, etc.) as well as hyper-parameter tuning.		
	Prerequisites: passed courses corresponding to at least 15 ECTS-Credits from compulsory module 1		

3.	**Compulsory module: Applications in Data Science**	h	ECTS-Credits
a.	**VU Advanced Methods and its Applications**	4	10
b.	**SE Current Topics in Data Science**	2	5
c.	**PJ Data Science in Practice**	4	10
	Total	**10**	**25**

Learning Outcomes:
Students acquire detailed knowledge of advanced methods and their applications for handling complex data science problems in particular fields of application. They are able to adapt and/or expand such methods to apply them in different situations. Students gain an in-depth understanding of selected state-of-the-art methods for dealing with advanced problems in data science. They can discuss current topics in data science with experts from the academic field as well as from industry and economy and summarise them in the form of a written report. They can deal with real problems in cooperation with partners from business as well as the academic field and communicate the results to experts and end users.

Prerequisites: positive evaluation of compulsory module 1 and passed courses corresponding to at least 15 ECTS-Credits from compulsory module 2

§ 7 Master's Thesis

(1) The Master's Thesis serves as proof of the ability to work on the chosen topic independently and according to the standards of scientific work with regards to content and methodology.

(2) The Master's Thesis corresponds to a workload of 20 ECTS-Credits.

(3) The topic for the Master's Thesis must be selected from one of the compulsory modules. Students are entitled to suggest the topic for their Master's Thesis themselves.

(4) Students have to announce their supervisor as well as the topic for the Master's Thesis to the Director of Studies in writing before they start working on it.

§ 8 Examination regulations

(1) Performance of modules is assessed by module examinations. Module examinations are to proof the knowledge and skills acquired in a module. Once all parts of a module examination are positively passed, the respective module is completed.

(2) Courses with continuous performance assessment are evaluated by regular written and/or oral contributions of the participants.

(3) The course lecturers have to inform the students in a suitable fashion on the targets, the contents and methods of their courses as well as of the contents, methods and evaluation criteria of the course examinations before the start of each semester.

§ 9 Academic degree

After positive evaluation of the all required examinations and the positive evaluation of the Master's Thesis, the graduates of the continuing education programme are awarded the academic degree "Master in Data Science" abbreviated "MDS".

§ 10 Coming into force

The curriculum comes into force one month after its announcement.

For the curriculum committee:
Dipl.-Ing. Tobias Hell, BSc PhD

For the senate:
Univ.-Prof. Dr. Ivo Hajnal