

The data science Master degree

Data & Knowledge Engineering (MDKE)



INF

FACULTY OF
COMPUTER SCIENCE

Myra Spiliopoulou (Studies Coordinator)



Knowledge
Management &
Discovery Lab



Chair Business Informatics II, Head of Knowledge Management & Discovery Lab

Methods: Machine learning algorithms for high-dimensional dynamic data

Ongoing Projects:

- ★ ImmunLearning (2019 - 2022): EFRE project on a diagnostic test for immunocompetence for elderly people (with U Med OVGU)
- ★ CHRODIS+ (2017-2020) EU Joint Action on “Implementing good practices for chronic diseases”
- ★ UNITI (2020-2022) EU Project on “Unification of treatments and Interventions for Tinnitus patients”

Further cooperations in medical research:

- Learning on longitudinal epidemiological data (U Med Greifswald)
- Intelligent wearables for patients with diabetic foot (U Med Magdeburg)
- Phenotyping, patient evolution - clinic & m/eHealth (U Med Regensburg)
- Phenotyping and patient response to treatment (CHARITE)

1. MDKE for data science
2. Planing your MDKE studies
3. Example Pathways
4. Getting Advice

1. MDKE for data science

What do you need to do Data Science?

1. Data
2. Methods
 - to process data – efficiently
 - to learn from data
 - to describe complex objects
 - to present complex objects and what we know on them
3. Business understanding
4. Understand how to match Data with Methods

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- ▶ a social network
- ▶ a medical record
- ▶ a patient
- ▶ a disease
- ▶ a bicycle
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Thematic areas:

Starting: Fundamentals of Data Science [12-18 ECTS]

1. Learning Methods and Models of Data Science [18-36 ECTS]

2. Data Processing for Data Science [18-30 ECTS]

3. Applied Data Science [18-24 ECTS]

and finally: the Master thesis [30 ECTS]

Where to find more information?

Module catalogue of the degree, also known as “Module Hand Book” (MHB)

- ▶ This is a large PDF document:
 - ★ It contains the description of each module we offer in the FIN.
 - ★ It contains one section per thematic area of the degree, with all the modules that fit to this area.
 - ★ In it, you may find a module more than once! Some modules fit to more than one thematic area.
- ▶ You find it under <http://www.inf.ovgu.de/ordnungenma.html>
Entry ‘Data & Knowledge Engineering’ (in the middle of the page)
- ▶ It is updated once per semester ⇒ Choose the most recent one.

and in the LSF

2. Planing your MDKE studies

IMPORTANT:

- ▶ The data science Master DKE has no compulsory modules.
- ▶ It is up to you to choose the modules in each thematic area.
- ▶ The only obligatory modules are:
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1. Make yourself familiar with the types of modules we offer
 - 1.1 Lecture (called "Vorlesung") with Exercises (called "Übung")
 - 1.2 Seminar
 - 1.3 Scientific Teamproject or Teamproject for short, intended for teams
 - 1.4 Individualproject, intended for one student only

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4. Consult your mind and your heart: write down what you are interested in, listen to your curiosity, go with your strengths
5. Plan for three semesters, but be ready to re-plan later!

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- ▶ DO consult the interview video with the teacher, before enrolling to the course

Where to find more information?

URLs:

Landing page: `www.inf-international.ovgu.de`

and from there you follow the links to:

- ▶ Entry point for new students
- ▶ FAQs for new students
- ▶ Support for international students

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Interviews with teachers on their courses under

www.inf.ovgu.de/inf/en/Study/Being+a+student/Incoming/Courses+Introduction-p-5078.html

From that page you reach interview videos, in which teachers elaborate on their courses: what the course is about, what expectations they have from the students, what can the students do after completing the course successfully

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Mentors!

There is an international team of mentors to help you in the start of your studies. Infos on how to reach them from the URLs above.

3. Example Pathways

Why pathways?

- ▶ Each course requires some background knowledge.
- ▶ Some courses build upon others.
- ▶ The MDKE does not consist only of courses: the last semester is for the Master thesis.

In the three semesters preceding it, you must acquire all the knowledge you need to master it.

An example of a simple pathway

	Module	Size	Prerequisite type	Prerequisites
1	<i>Visualization</i>	ca. 120	should have	Programming skills
2	<i>Visual Analytics</i>	ca. 120	better have	<i>Visualization</i>
3	<i>Visual Analytics in Healthcare</i>	ca. 25	must have	<i>Visual Analytics</i>

More example pathways

	Module	Prerequisites (must have)
1	<i>Wissenschaftliches Rechnen I (WR1)</i>	Introduction to linear Algebra
2	<i>Wissenschaftliches Rechnen II (WR2)</i>	<i>WR1</i>
3	<i>Wissenschaftliches Rechnen III (WR2)</i>	<i>WR1, WR2</i>
4	<i>Geometric Formulations of Inviscid Fluids and their Discretizations</i>	<i>WR2, WR3</i>

1. WR1: Introduction to scientific computing
2. WR2: Dynamic systems and partial differential equations
3. WR3: Tensor analysis, vector calculus and applications

	Module	Prereq type	Prerequisites
ST	<i>Evolutionary Multi-Objective Optimization (EMO)</i>	prereq for examination	midterm exam
WT	<i>Swarm Intelligence (SI)</i>	prereq for examination	midterm exam
ST	<i>Computational Intelligence in Games (CIG)</i>	must have	programming skills

	Module	Prereq type	Prereqs	A	B
ST	<i>Datenbanken Implementierungstechniken (DB2)</i>			1st	2nd
WT	<i>Transaction Processing (TP)</i>			2nd	1st
WT	<i>Distributed Data Management (DDM)</i>			2nd	1st
ST	<i>Advanced Topics in Databases (ATDB)</i>	better have	<i>DB2</i>	3rd (1st)	2nd
WT	<i>Advanced Database Models (ADBM)</i>			2nd	1st
WT	<i>Data Warehouse Technologies (DWT)</i>	better have	<i>DB2</i>	2nd	3rd
both	<i>Scientific Team Project (ScTP)</i>	should have must pass	<i>DB2</i> or <i>ATDB</i> programming test	3rd –	3rd –
both	<i>Student Conference (StudConf)</i>	must have	<i>DB2</i> or <i>ATDB</i> or <i>ScTP</i>	3rd	3rd

Note: a well-founded database course is prerequisite for all modules; this you have from your bachelor degree (MDKE prerequisite).

	Module	Size	Prereq type	Prerequisites
ST	<i>Data Mining I</i>		prereq for examination	three within-term tests
ST	<i>Data Mining II</i>		should have	background in DM/ML
WT	<i>Recommenders</i>		should have	background in DM/ML
WT	<i>Data Science with R</i> [teacher: Uli Niemann]	30+	must have [*]	background in DM/ML programming skills
both	<i>Advanced Topics of KMD</i> (6 ECTS seminar)		must have [*, ⊙]	background in DM/ML programming skills
both	Teamproject	$n \times 3$	must have [*, ⊙]	background in DM/ML programming skills

- * Admission procedure in place (application with CV, eventually interview)
- ⊙ Further prerequisites apply, depending on the topic of seminar / teamproject

	Module	Size	Prereq type	Prerequisites
WT	<i>Introduction to Deep Learning</i>	60	must have one of	<ul style="list-style-type: none"> · Grade 2.3 or better in <i>Neuronale Netze</i> · Grade 1.7 or better in <i>Machine Learning</i> · ... or in <i>Adv Topics of Machine Learning</i> · Recommendation from a FIN-Professor
ST	<i>Deep Learning II: Learning Generative Models</i>	30+	must have	<i>Introduction to Deep Learning</i>
both	Teamprojects, Advanced seminars on Deep Learning	small	must have	<i>Introduction to Deep Learning</i>

	Module	Size	Prereq type	Prerequisites
ST	<i>Introduction to Computer Vision</i> ¹	25	must have	Programming skills, basic knowledge in image or signal processing, basic knowledge in geometry, analysis and linear algebra
WT	<i>Computer Vision and Deep Learning</i> ²	25	must have	Programming skills, basic knowledge in computer vision, optimization techniques, and in linear algebra

1. Topics of the course *Introduction to Computer Vision*:

- ▶ Early Vision Techniques: Feature extraction and artefact suppression in images, multiple view geometry for stereo vision and structure from motion.
- ▶ Introduction to High Level Computer Vision: Model-driven object detection, Object tracking, Introduction to image classification

2. Topics of the course *Computer Vision and Deep Learning*:

- ▶ Predefined and trained feature detection and reduction in images
- ▶ Discriminative and generative models for image classification
- ▶ Multilayer perceptrons and convolutional neural networks for image analysis
- ▶ Application of (deep) neural networks for/in image classification, object detection, semantic image segmentation, stereo vision, object tracking

4. Getting Advice

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- ▶ Complex plans of studies, general troubleshooting: Studies coordinator (me)
myra@iti.cs.uni-magdeburg.de
- ▶ General issues on international studies: Coordinator of International Studies

Thank you for your attention!

Much success with your studies with us!