The data science Master degree

Data & Knowledge Engineering (MDKE)

Myra Spiliopoulou (Studies Coordinator)
Chair Business Informatics II, Head of Knowledge Management & Discovery Lab

**Methods:** Machine learning algorithms for high-dimensional dynamic data

**Ongoing Projects:**

- 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
Data science and MDKE

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
What do you need to do Data Science?

1. Data

- a social network
- a medical record
- a patient
- a disease
- a bicycle
- a pizza
What do you need to do Data Science?

1. Data
   - a social network
   - a medical record
   - a patient
   - a disease
   - a bicycle
   - a pizza

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
Structure of the MDKE

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
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:
  one Scientific Teamproject and the Master thesis
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:
  one Scientific Teamproject and the Master thesis

HOW TO CHOOSE MODULES:
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
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:
  one Scientific Teamproject and the Master thesis

HOW TO CHOOSE MODULES:

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
2. Consult the Module catalogue to find what we offer in winter & summer
3. Consult the LSF to find what is offered in this term
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:
  one Scientific Teamproject and the Master thesis

HOW TO CHOOSE MODULES:
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 Individual project, intended for one student only
2. Consult the Module catalogue to find what we offer in winter & summer
3. Consult the LSF to find what is offered in this term
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!
DOs and DONT’s when you choose modules

▶ DO NOT choose courses that are not in the Module Hand Book, even if they show up in LSF
DOs and DON'T’s when you choose modules

▶ DO NOT choose courses that are not in the Module Hand Book, even if they show up in LSF
▶ DO NOT choose seminars before attending PPSW, unless you have had a scientific seminar in your previous studies
DOs and DONT’s when you choose modules

▶ DO NOT choose courses that are not in the Module Hand Book, even if they show up in LSF
▶ DO NOT choose seminars before attending PPSW, unless you have had a scientific seminar in your previous studies
▶ DO NOT choose courses that expect background you do not have
DOs and DONT’s when you choose modules

- DO NOT choose courses that are not in the Module Hand Book, even if they show up in LSF
- DO NOT choose seminars before attending PPSW, unless you have had a scientific seminar in your previous studies
- DO NOT choose courses that expect background you do not have
- DO NOT assume that you can acquire background knowledge you do not have in parallel to a course that requires this background knowledge
DOs and DONT’s when you choose modules

- DO NOT choose courses that are not in the Module Hand Book, even if they show up in LSF
- DO NOT choose seminars before attending PPSW, unless you have had a scientific seminar in your previous studies
- DO NOT choose courses that expect background you do not have
- DO NOT assume that you can acquire background knowledge you do not have in parallel to a course that requires this background knowledge
- DO NOT use LSF to map courses to areas; use exclusively the Module Hand Book
DOs and DONT’s when you choose modules

▶ DO NOT choose courses that are not in the Module Hand Book, even if they show up in LSF
▶ DO NOT choose seminars before attending PPSW, unless you have had a scientific seminar in your previous studies
▶ DO NOT choose courses that expect background you do not have
▶ DO NOT assume that you can acquire background knowledge you do not have in parallel to a course that requires this background knowledge
▶ DO NOT use LSF to map courses to areas; use exclusively the Module Hand Book
▶ 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

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.

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.

Myra Spiliopoulou (Studies Coordinator) www.kmd.ovgu.de
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

Interviews with teachers on their courses under
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

Myra Spiliopoulou (Studies Coordinator) www.kmd.ovgu.de
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

Interviews with teachers on their courses under
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.

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.

Myra Spiliopoulou (Studies Coordinator) www.kmd.ovgu.de
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
<table>
<thead>
<tr>
<th>Module</th>
<th>Size</th>
<th>Prerequisite type</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Visualization</td>
<td>ca. 120</td>
<td>should have</td>
<td>Programming skills</td>
</tr>
<tr>
<td>2 Visual Analytics</td>
<td>ca. 120</td>
<td>better have</td>
<td>Visualization</td>
</tr>
<tr>
<td>3 Visual Analytics in Healthcare</td>
<td>ca. 25</td>
<td>must have</td>
<td>Visual Analytics</td>
</tr>
</tbody>
</table>
More example pathways
## Pathway through Scientific Computing

**Module** | **Prerequisites (must have)**
--- | ---
1. *Wissenschaftliches Rechnen I (WR1)* | Introduction to linear Algebra
2. *Wissenschaftliches Rechnen II (WR2)* | **WR1**
3. *Wissenschaftliches Rechnen III (WR2)* | **WR1, WR2**
4. *Geometric Formulations of Inviscid Fluids and their Discretizations* | **WR2, WR3**

1. WR1: Introduction to scientific computing
2. WR2: Dynamic systems and partial differential equations
3. WR3: Tensor analysis, vector calculus and applications
<table>
<thead>
<tr>
<th>Module</th>
<th>Prereq type</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evolutionary Multi-Objective Optimization (EMO)</td>
<td>prereq for examination</td>
<td>midterm exam</td>
</tr>
<tr>
<td>Swarm Intelligence (SI)</td>
<td>prereq for examination</td>
<td>midterm exam</td>
</tr>
<tr>
<td>Computational Intelligence in Games (CIG)</td>
<td>must have</td>
<td>programming skills</td>
</tr>
<tr>
<td>Module</td>
<td>Prereq type</td>
<td>Prereqs</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>---------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>ST  ST  Datenbanken Implementierungstechniken (DB2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WT  WT  Transaction Processing (TP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WT  WT  Distributed Data Management (DDM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST  ST  Advanced Topics in Databases (ATDB)</td>
<td>better have</td>
<td>DB2</td>
</tr>
<tr>
<td></td>
<td>(1st)</td>
<td></td>
</tr>
<tr>
<td>WT  WT  Advanced Database Models (ADBM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WT  WT  Data Warehouse Technologies (DWT)</td>
<td>better have</td>
<td>DB2</td>
</tr>
<tr>
<td>both</td>
<td>should have</td>
<td>DB2 or ATDB</td>
</tr>
<tr>
<td>(ScTP)</td>
<td>must have</td>
<td>programming test</td>
</tr>
<tr>
<td>both</td>
<td>must have</td>
<td>DB2 or ATDB or ScTP</td>
</tr>
</tbody>
</table>

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

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

- Admission procedure in place (application with CV, eventually interview)
- Further prerequisites apply, depending on the topic of seminar / teamproject
<table>
<thead>
<tr>
<th>Module</th>
<th>Size</th>
<th>Prereq type</th>
<th>Prerequisites</th>
</tr>
</thead>
</table>
| WT                  | 60   | must have one of | · Grade 2.3 or better in *Neuronale Netze*  
|                     |      |             | · Grade 1.7 or better in *Machine Learning*  
|                     |      |             | · ... or in *Adv Topics of Machine Learning*  
|                     |      |             | · Recommendation from a FIN-Professor                                             |
| ST                  | 30+  | must have  | *Introduction to Deep Learning*                                                 |
| both                | small| must have  | *Introduction to Deep Learning*                                                 |
|                     |      |             |                                                                               |
|                     |      |             |                                                                               |
### Delving into Computer Vision

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

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
First thing to do: Write down what advice you want.
Getting Advice

First thing to do: Write down what advice you want.

The first place to look for advice:

FAQs – to be reached from the landing page
First thing to do: Write down what advice you want.

The first place to look for advice:
FAQs – to be reached from the landing page

The persons to ask for advice:
▶ On how to plan your studies: Mentors
▶ General student issues: FARAFIN team

Myra Spiliopoulou (Studies Coordinator) www.kmd.ovgu.de
Getting Advice

First thing to do: Write down what advice you want.

The first place to look for advice:

FAQs – to be reached from the landing page

The persons to ask for advice:

▶ On how to plan your studies: Mentors
▶ General student issues: FARAFIN team
▶ On how to prepare for a specific course: Course teacher
▶ Exam issues: Examinations Office
Getting Advice

First thing to do: Write down what advice you want.

The first place to look for advice:

FAQs – to be reached from the landing page

The persons to ask for advice:

- On how to plan your studies: Mentors
- General student issues: FARAFIN team
- On how to prepare for a specific course: Course teacher
- Exam issues: Examinations Office
- 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!