

MADS-DL – Deep Learning

Organization

Prof. Dr. Stephan Doerfel



FACHHOCHSCHULE KIEL
University of Applied Sciences



Moodle (WiSe 24/25)

Agenda

Me

Values, Conduct, Help

Values

Getting Help

Code of Conduct

The Module MADS-DL

Outline

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Hi, there!

Prof. Dr. Stephan Doerfel

- ▶ Study of Mathematics (Diploma) at TU Dresden and TH Lund
- ▶ PhD in Knowledge Discovery, Focus on applicable knowledge for
 - ▶ recommender systems
 - ▶ conference guiding
 - ▶ impact evaluation
 - ▶ folksonomies
- ▶ Data Scientist & Software Engineer/Architect at Micromata
 - ▶ conception and implementation of Data Science projects
 - ▶ architecture, implementation and operations of large scale software projects
- ▶ Prof at FH Kiel :-)



Contact

Prof. Dr. Stephan Doerfel

- ▶ Always feel free to ask questions
 - regarding the current topics – during the sessions!
- ▶ after/between sessions
- ▶ during exercises
- ▶ email: stephan.doerfel@fh-kiel.de
- ▶ larger consultations
 - ▶ Office C.12 - 1.31 or Zoom
 - ▶ no regular office hours
 - ▶ preferably, drop a mail first, including topics of discussion



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Values

- ▶ Several social values are very important for us and taken very seriously by us
(us = me, the MADS program, and the FH Kiel).
- ▶ To illustrate that, the following are a couple of statements collected from
 - ▶ FH Kiel Guidelines,
 - ▶ a statement of our president (referring to an event in early 2024),
 - ▶ the doors of our buildings.

“For us, excellent teaching is
interdisciplinary,
application-oriented, based on
research and science, and
characterised by its
internationality and the
wide range of methods used.”

“Our University
thrives on diversity.

It creates educational processes
that are

gender-appropriate,
intercultural, and
non-discriminatory.”

Defending our Democracy Together!

- ▶ *"We condemn in the strongest possible terms the inhuman plans for deportations of individual groups in our society that have come to light and we oppose them resolutely!"* – Björn Christensen (president of FH Kiel) in his mail to colleagues and students, Jan. 24, 2024 (translated from German)
- ▶ In January, a rally was organized in Kiel and called for by various local organizations incl. democratic parties, unions, public service organizations, universities incl. FH Kiel, and many others



For Diversity



For Diversity - No space for discrimination!

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Getting Help

Here are helpful institutions for support with issues of almost any kind (finance, psyche, family, health, legal, discrimination, sexual harassment, ...):

- ▶ FH Kiel:  [Study Guidance](#)
- ▶ FH Kiel (Diversity Representative):  [Counseling](#)
- ▶ Studentenwerk SH:  [Student Advice Center](#)
- ▶ Allgemeiner Studierendenausschuss der FH Kiel: (ASTA):  [Beratung](#)
- ▶  [Beschwerdestelle der FH Kiel](#)



Feel free to talk to me, colleagues, and fellow students!

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Code of Conduct for our Sessions

- ▶ Be respectful and open-minded!
- ▶ Include everyone here.
- ▶ Ask your questions! Everybody has some!
- ▶ Share, Answer, Contribute actively!
- ▶ Collaborate!
- ▶ Try to find objective, factual, scientific arguments or hypotheses.
- ▶ Bring you personal perspective and experience into the discussion.
- ▶ Accept different opinions.

Addressing Each Other

Inclusive They: I (try to) use the inclusive pronouns they/their both in plural and singular.

- ▶ E.g. “Who would like to present their results?”

Meet on an equal footing:

- ▶ When speaking German, you can say Du to me.
- ▶ Let's agree on first name basis.

My FH Kiel, My MADS, My Harbor?

- ▶ Fix rooms – off campus
- ▶ Our university is growing in terms of students and programs – but not (fast enough) in terms of space and rooms.
- ▶ Long term perspective:
 - ▶ Job- and family-friendly, compact schedule
 - ▶ Both MADS cohorts closely together! Exchange, Network, Community!
- ▶ Work in progress – patience required!
- ▶ Mensa run: Let's find a compromise!



Let's discuss time: session start/end/break!

Students from other Study Programs

Welcome!

- ▶ Students from other programs are welcome to the lecture!
- ▶ Please register with me, via email.
- ▶ It is YOUR responsibility to organize all official aspects – proper registration, credits, compatibility with you program, . . .
- ▶ Check with the examination office, organizers of your program of studies

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This Course 1/2

Mode:

- ▶ officially: lecture + exercises (Lehrvortrag + Übung)
- ▶ no strict 90 + 90 separation
- ▶ material: script, Jupyter notebooks, YOUR OWN notes!

Lectures:

- ▶ “Seminaristischer Unterricht” – interaction, questions, answers are allowed and desired! Please share!

Exercises:

- ▶ You are active!
- ▶ paper-based + computer-based
- ▶ BYOD (Bring Your Own Device)
- ▶ no sample solutions!

“But one learns from books and
reels only that certain things
can be done.
Actual learning requires that
you do those things.”

Prince Farad'n Corrino (in Frank Herbert's "Children of Dune")

Active Participation



Active participation is the best way to prepare for becoming a data scientist in real life (and for the exam).

This Course 2/2

Everything else:

- ▶ register in Moodle course (password on whiteboard)
- ▶ preliminary course itinerary in Moodle
- ▶ handout pdf is presentation without animations
- ▶ eating and drinking (reasonably) allowed
- ▶ 15 min. break, roughly after 90 min. (remind me if I forget)
- ▶ use small breaks (whiteboard cleaning, ...) to talk to each other
- ▶ course evaluation (... midterm)
- ▶ mistakes in script or code? Let me know!



Download notebooks before the lecture starts.
Follow and comment them, while we discuss them.

Effort and Time

Workload	By completing a module you get awarded with ECTS-credit points. Every ECTS credit point stands for 30 hours of work load.	
	Credits ⓘ	5,0 Credits
	Contact hours ⓘ	48 Hours
	Self study ⓘ	102 Hours

Source: Module Database

Python



- ▶ We will use Python 3 for the practical parts of this course.
- ▶ Please make sure, your device is running python.
- ▶ Use a separate python environment for this lecture.
- ▶ Install latest packages, when needed.

Learning Goals of MADS-DL

- ▶ understand and apply the fundamental idea of how artificial neural networks are built, learned, and evaluated for classification and prediction
- ▶ apply PyTorch to create predictors and classifiers using neural networks
- ▶ understand and apply neural convolutional layers
- ▶ understand and apply selected advanced notions in deep learning

Attribution

Some parts of this lecture are based on scripts and notes of

Programmieren mit Neuronalen Netzen

Prof. Dr. Frank Puppe, Dr. Markus Krug, Amar Hekalo, M.Sc

Lecture at Würzburg University

Roadmap

1. **Introduction:** Motivation, Roots, Perceptron
2. **Basics:** Tensors, PyTorch
3. **Neural Nets in PyTorch:** Multilayer Architecture, Classification, Regression
4. **A Multilayer Network for Regression:** Mathematical model, activation functions, dummification
5. **Training:** Network modes, automatic differentiation, learning hyperparameters, optimization/validation
6. **Computer Vision:** CNNs, image classification, explanations
7. **Forecasting Sequential Data:** Sequential data, recurrent architectures, full proof of concept experiment
8. **Further Notions:** Depending on time: further neural network constructs.



We'll spend a lot of time on basics and training!
A deep understanding of the core elements is necessary
to understand training results and process.

DL in the Context my other Modules

- ▶ MMS contained basics for ML and DL and methods of unsupervised learning
- ▶ ML contained basics for the evaluation of supervised learning and methods for prediction and classification
- ▶ DL continues ML → more prediction, more classification
- ▶ DL complements (NOT replaces!) catalog of available methodology
- ▶ MMS, ML, and DL deal largely with tabular data
- ▶ We will also briefly consider time series data here
- ▶ optional EMDM
 - ▶ adds further depth to these topics
 - ▶ algorithms and optimization
 - ▶ new topic itemset mining
 - ▶ focus on graph data
 - ▶ broader discussion of time series

Examination

Portfolio Exam:


- ▶ Multipart portfolio
- ▶ conduct your own data science DL experiments
- ▶ choose a proper real-life dataset
- ▶ hand in code + results + text
- ▶ result: a Jupyter notebook describing and presenting a (small) data science project.
- ▶ train and optimize different DL architectures
- ▶ details on the individual steps of the portfolio follow
- ▶ portfolio tasks, important details, and rules follow!



Start looking for interesting datasets today!

Exam Registration and Submission

- ▶ Register with QIS!
- ▶ You may take part in the exam IF AND ONLY IF you are registered in QIS.
- ▶ Without QIS registration, your submissions must not be graded!
- ▶ There is a QIS registration period!
- ▶ Submission date in Moodle.
- ▶ Keep track of the deadlines of the other courses!

 Do the work over the course of the next 14 weeks.
Do NOT wait until the deadline!