TECHNISCHE HOCHSCHULE DEGGENDORF
Technologie Campus Hutthurm

Studien- bzw. Abschlussarbeit (m/w/d)

BA/ MA

KI in der FE-Simulation

DESCRIPTION

A group of researchers (consisting of Prof. Aung, Prof. Kölbl, Prof. Mayer, among others) at the THD is trying to find ways how to replace animal testing for tumor treatment tests by simulations and AI methods.

In a first step, it should be studied if summary results of finite element simulations can be reproduced by neural networks (NNs), given that the simulations have only few varying parameters. Therefore, data is created simulating a metal shield of fixed dimensions, but with holes of differing positions (see figure 1). A pulling force is applied to the metal shield in the simulation, and the results is, e.g., the location and magnitude of the deformations and stresses at all nodes in the shield (see figure 2).

The neural network will be trained with the results of a lot of simulations. Can we predict the outcomes of the computationally costly finite element simulation for unseen input configurations in real-time?

The thesis will be supervised by Prof. Mayer (AI) and Prof. Kölbl (Simulation)

RESEARCH QUESTIONS

- What data format is suitable as an input to the neural network? Can we use the mesh data directly, or do we have to render an intermediate representation (grid data) for the neural network?
- What is the smallest NN architecture that gives reasonable predictions given the current data?
- How do NN predictions compare to a traditional feature mining approach?
- Can summary statistics be precisely predicted? Possible future extension: Can we generate the full simulation result?

Possible goals for a bachelor or master thesis:

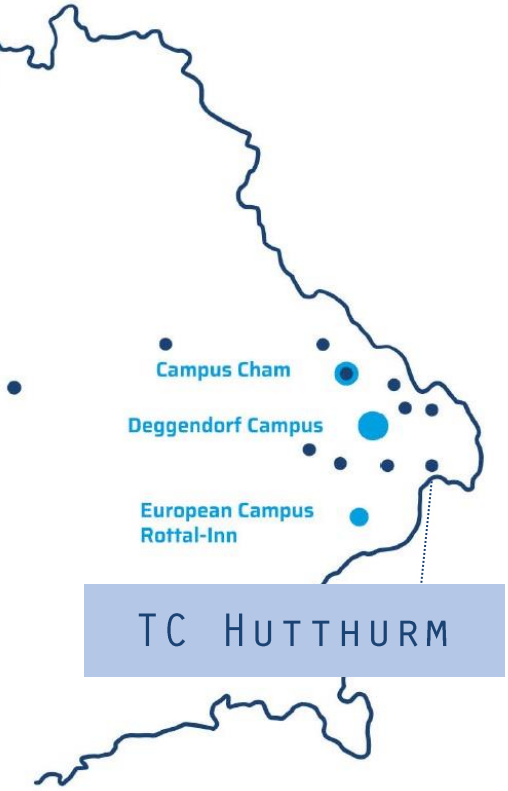
- Set up a Git environment with best practices for open-source development
- The code and repository is commented and written with best practices in terms of style (e.g. no further documentation is required for a new developer beside the code).
- Try to answer the beforementioned research questions.

ELIGIBILITY; FIELD AND PREREQUISITES

- Eligibility: Bachelor or Master thesis (KI-B, AIN-B, AID-M)
- Field: Artificial intelligence
- Prerequisites: Knowledge of Python and neural network training frameworks (Tensorflow or PyTorch). Knowledge of image processing methods. A general interest in research.

WORK ENVIRONMENT

Quality of education, future-oriented research, and personalized professional development. Our success is reflected in positive rankings and the high satisfaction of our students, graduates, professors, and staff. We are committed to offering attractive working conditions. Become part of an innovative and dynamic team and work where others go on vacation.



WHAT WE OFFER

- **Hands-on experience with exciting projects:** Become part of a dynamic team dedicated to developing innovative solutions every day.
- **A supportive and open work culture:** We prioritize a respectful and relaxed environment where you'll feel at home and be empowered to achieve your best.
- **State-of-the-art labs and cutting-edge facilities:** Work with the latest technology and access professional equipment to fully support your thesis work.
- **Flexibility for your work-life balance.**

CONTACT & APPLICATION

Supervision of the thesis by

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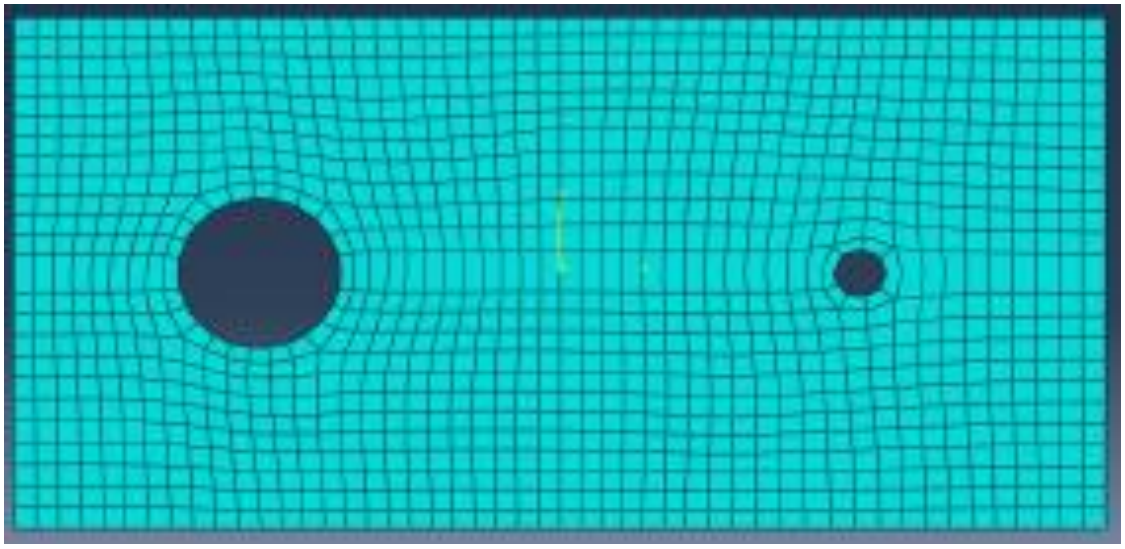

Figure 1: A visualisation of the mesh that is input to a finite element simulation

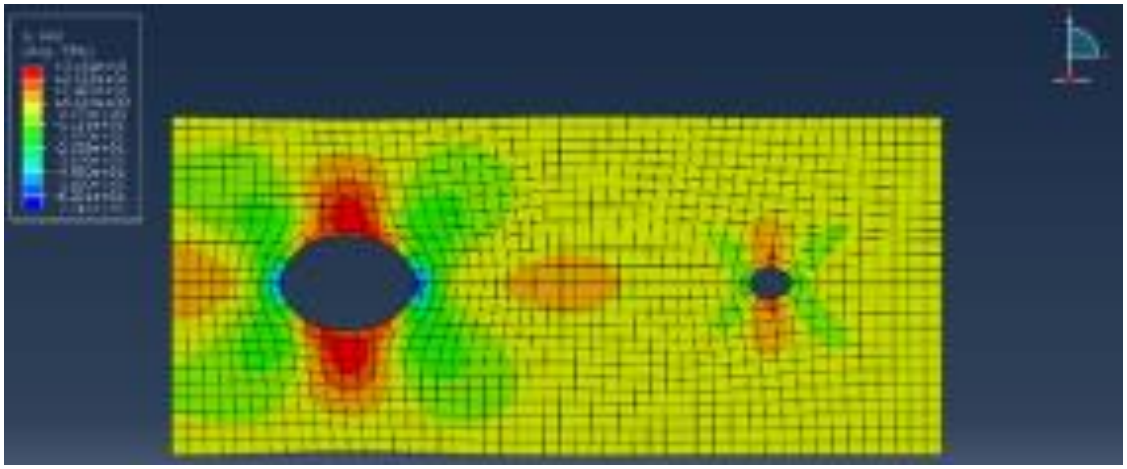

Figure 2: A visualisation of one of the simulation outcome parameters.