Thesis (MSc / BSc)

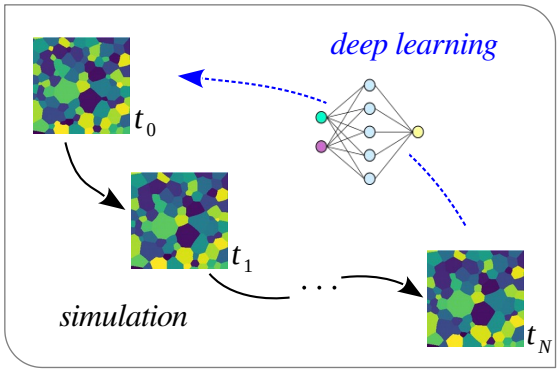
Karlsruher Institut für Technologie

IAM Institut für Angewandte Materialien

Microstructure backcasting via deep learning

Background:

High-performance materials, such as polycrystalline alloys and ceramics, rely on their microstructures and evolution under external loading to fulfill their functionality. Conventionally, microstructure evolution can be captured by simulation methods based on physical equations. However, since only the final microstructure is known for real data, reconstructing that desired microstructure by physical simulation follows an inefficient trial-and-error approach.



Your task:

Your task is to use deep learning to estimate past states from the final states of microstructures after evolution. To that end, you will generate data by multiphase-field simulation with a simulation platform, PACE3D, under a wide variety of simulation conditions. The generated data over multiple evolutions will then be used to train convolutional and recurrent neural networks to predict the past and, ultimately, the initial state the evolution started from.

Requirements:

Basic knowledge of materials science and physics is an advantage for this project. Knowledge of Python programming, an interest in numerical simulations, and a passion for new methods and topics are expected.

We offer:

- intensive support
- modern workstations and high-performance computers as a working environment
- productive and dynamic atmosphere in a team:
  - Cooperation with international research groups
  - Career prospects as a young scientist

Interest?

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