

Bachelorthesis/ Masterthesis

The Thesis

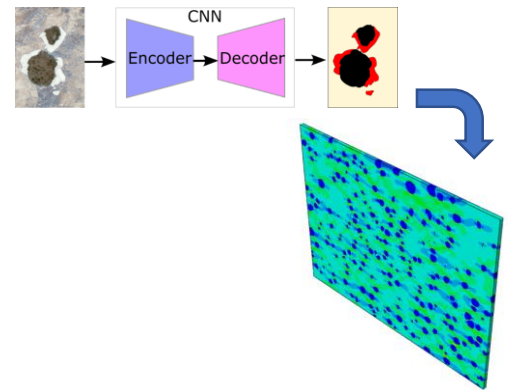
Title AI-based segmentation of real microstructural images of ferritic-pearlitic nodular cast irons

Introduction The mechanical properties of ferritic-pearlitic cast irons can be adjusted over a wide range by selective adjustment of their microstructure. However, the predominantly empirical studies have so far not led to a sustainable understanding between microstructure and effective mechanical properties. FE models based on real microstructural images can close this gap, but their construction requires a reproducible and robust segmentation of the microstructural images. An approach based on artificial intelligence shall be used for automatic image segmentation instead of conventional methods.

Objective In this thesis a Convolutional Neuronal Network (CNN) shall be implemented for the segmentation of real microstructural images. This is to be trained efficiently by means of transfer learning on the basis of suitable data sets in order to subsequently build reproducible micromechanical FE models based on the results of the CNN.

Zeitplan

- 20 % Literature search
- 20 % Generation of data sets for training the CNN
- 20 % Implementation and training of the CNN
- 20 % Evaluation and analysis of the results
- 20 % Documentation



The Institute

The IWM investigates application-relevant issues in materials engineering of metallic and ceramic materials and their composites.

In the **Group of Micromechanics**, the focus is on the experimental investigation of damage mechanisms of structural materials and the development of integrative, multi-scale simulation models with the aim of property prediction, especially for fatigue loading, taking into account local mechanical material properties in the design of components.

What we expect

- Interest in materials
- Experience with Python (ideally)
- Interest in machine learning and neural networks
- High motivation

What to expect

- Comprehensive onboarding
- Close supervision and regular status meetings
- Good working atmosphere
- Opportunity to participate in the integration of advanced modeling methods