Bachelor/Master thesis

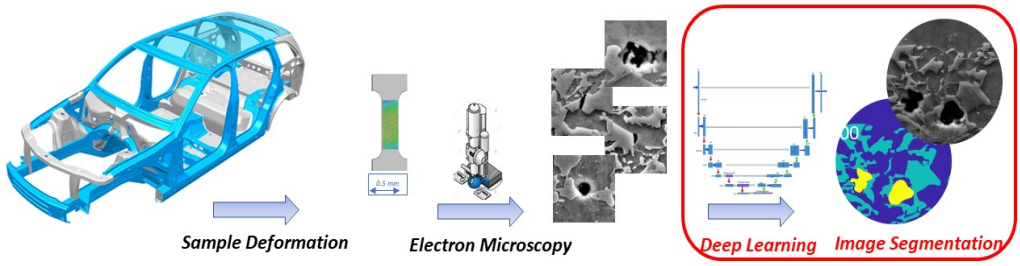
Improvement of microstructural image segmentation by deep learning

Institut für Metallkunde und Materialphysik

RWTH Aachen University

30. March 2021

Motivation:



New strategies in the field of characterization and design of light-weight and sustainable materials still lack more accurate information about the statistics of microstructural details, such as where damage originates at the microscale (see image above). For this, large amount of data need to be analyzed. Computer vision as a daily growing machine learning based pipeline provides a vast horizon of opportunities in this context of materials science.

To this end, some deep learning-based segmentation algorithms like U-net and GANs have been developed and implemented at IMM on high-resolution microstructural images acquired by scanning electron microscopy, out of which promising results have already been obtained. While existing semantic segmentation algorithms enable image analysis and quantification in our microstructural applications, they are highly dependent on dataset properties and network conditions.

The final aim of this project is therefore to improve the generalizability of existing segmentation methods' performance on microstructural images using the most updated methods like nnU-net, which is a self-configuring method, and/or dense U-net. Expanding the current capacities of this method for microstructural images would greatly assist our efforts to understand, predict and design for damage-tolerant materials and processing strategies in lightweight design, for example in car bodies.

Task:

- Improvement of the segmentation performance by application of the most recent deep learning-based segmentation algorithms on high resolution microstructural images from scanning electron microscopy.

What we offer:

- Experience in correlating machine learning and materials scientific applications.
- Work with a young enthusiastic team.

The ideal candidate will:

- Have a high motivation for developing and implementing machine learning - deep learning based algorithms on images.
- Have programing skills (Python), preferably familiar with Pytorch/Tensorflow.
- Have any engineering, physics, mathematics background with related interest and skills.

Contact:

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