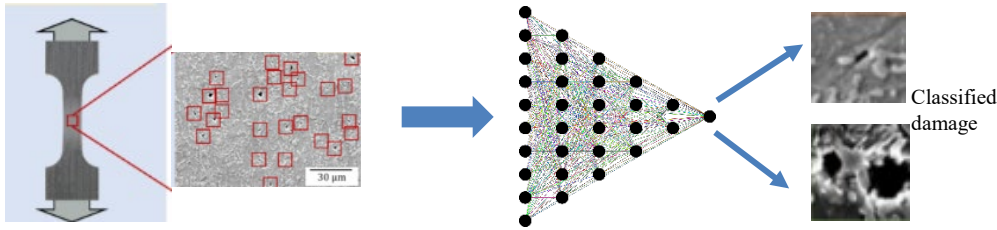


# Mini/Bachelor/Master Thesis

## What does Deep Learning Learn?



Institut für  
Metallkunde und  
Materialphysik

### Motivation:

Machine learning, in particular deep learning, is becoming increasingly important in the field of materials science. For example, in the classification of damage sites in different materials, a performance similar to that of human experts have been achieved.

However, deep neural networks are essentially "black box" processes that do not directly allow us to understand how the classification was "made" by the network. On the other hand, explainable predictions are vital not only to gain trust into the machine learning application but also to further our own understanding of materials science. For example, even though the performance of the algorithm is comparable to what humans can achieve, it is not clear whether human experts and machine learning models would regard the same image feature as important when arriving at their conclusions.

In your research project (bachelor or master thesis), you focus on understanding how the machine learning algorithms arrive at their results and aim to make the models more transparent and explainable. Further, you will engage with human experts and evaluate how humans and machine learning approach the same task and compare the respective approaches in reasoning.

### Tasks:

- Building on existing machine learning approaches, use tools such as LIME and others to gain a deeper understanding of how the machine learning algorithms arrive at their conclusions and make them more explainable.

### What we offer:

- Experience in state-of-the-art machine learning approaches.
- Shaping the field of materialsAI at the intersection of machine learning and materials science.
- Possibility to publish the results in high-ranking conferences or journals.

### The ideal candidate will:

- be interested or have experience in modern machine learning frameworks (TensorFlow and/or PyTorch)
- be interested or have experience in machine learning and software development in Python
- have a background in engineering, physics or mathematics with corresponding interests and skills

### Earliest projected starting date:

October 2022

### Contact:

Dr. Ulrich Kerzel  
Ulrich.Kerzel@rwth-aachen.de

Institut für Metallkunde  
und Materialphysik

Direktorin:  
Prof. Dr. Sandra Korte-Kerzel

Postanschrift/Mail:  
RWTH Aachen  
52056 Aachen  
Germany

Gebäude/Deliveries:  
Kopernikusstraße 14  
52074 Aachen

Tel.: +49 (0)241 80-26855  
Fax: +49 (0)241 80-22301

imm@imm.rwth-aachen.de  
www.imm.rwth-aachen.de