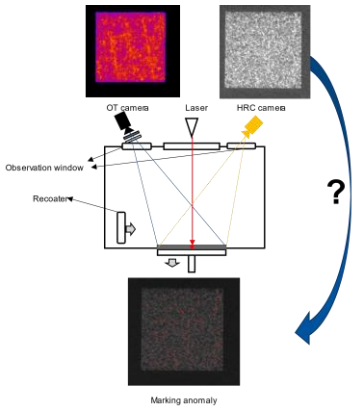
Unsupervised Deep Anomaly Detection for Laser Powder Bed Fusion

Research Question

Within the Cluster of Excellence „Internet of Production“, the IMA investigates together with the institute of digital additive production (DAP) of the RWTH Aachen University the interaction effects between process parameters and part quality for metallic 3D printing processes. However, due to the stochasticity of the printing process, part defects occur frequently. One possible solution to detect these process anomalies is by monitoring the printing process with different visual sensors like high-resolution cameras and optical tomography cameras. Because the process is highly stochastic, labeling the available data or detecting the anomaly behaviors during the process is afflicted with uncertainty. This leads to the question if unsupervised anomaly detection methods are applicable for the given use case. And if so, how well do they perform compared to other state-of-the-art approaches?



Source: DAP

Research Methodology

- Familiarization with the topics additive manufacturing with focus on Laser Powder Bed Fusion and Unsupervised Learning with focus on Anomaly Detection
- Reviewing suitable State of the Art anomaly detection methods
- Modifying and implementation of suitable methods for anomaly detection with regard to the given use case for Laser Powder Bed Fusion processes
- Evaluation and Discussion of the selected methods

Objectives and expected results

The scope of this thesis is to develop a new model for detecting anomalies in monitoring data for Laser Powder Bed Fusion processes. The developed model needs to be trained in an unsupervised way and compared to state of the art methods. Scope adjustments according to the type of thesis and research interests are possible.

Requirements and Work conditions

- Interest in working on interdisciplinary research topics and the willingness to learn new skills
- Programming experience in Python is advantageous but not necessary
- Experience or knowledge in 3D printing, additive manufacturing is advantageous but not necessary
- Monitoring data is available, but more data can be acquired if necessary
- Communication and written work needs to be in English

Contact

Hans Aoyang Zhou, M.Sc. | Tel.: +49-241 80-91144 | Email: hans.zhou@ima.rwth-aachen.de
Song Zhang, M.Sc. | Email: song.zhang@dap.rwth-aachen.de

Type of Thesis

Bachelor Thesis, Master Thesis

Degree Program: Mechanical Engineering, Computational Engineering, Industrial Engineering