

## Neural-network based defect detection for industrial visual inspection of an additive manufacturing process

Industrial vision systems are often used for process monitoring and control. Manually designing and engineering the involved pattern recognition can be cumbersome and expensive, particularly for complex tasks. Thus, there is an increasing trend to deploy neural networks that learn the task based on training examples. Gathering the required ground truth labels with accurate bounding boxes remains tedious work, often strongly limiting the number of labeled examples available for training. The objective of research topics like data augmentation, transfer learning, and few-shot learning is to achieve a good model accuracy even with a limited amount of training data.

The specific application to be considered in the thesis is the detection of scratch defects in images of an additive manufacturing (3D print) process. Scratches appear as dark vertical lines as shown in the figure below. Their characteristics (e.g., width, length, density, darkness) varies and must not be confused with similar but normal structures resulting from the geometry of the parts.

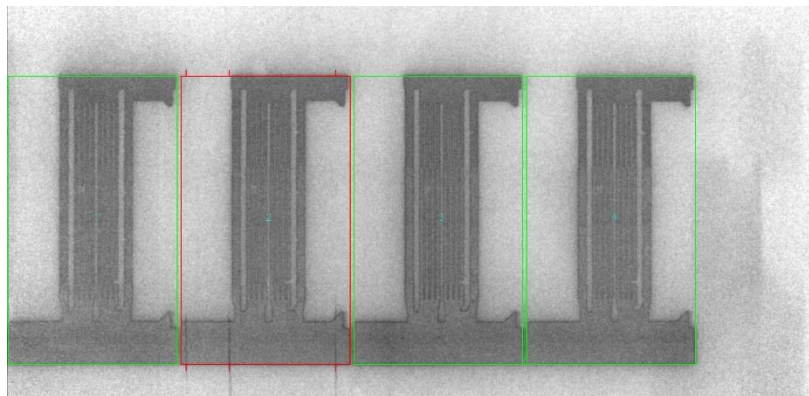


Fig. 1. Example of a powder bed image in an industrial additive manufacturing process. The part inside the red box has three scratches visible as dark vertical lines at the bottom.

### Tasks

- Evaluation of state-of-the-art object detectors (e.g., based on YOLO) to detect the scratches, e.g.,
  - How does the performance vary w.r.t. the number of labeled training examples?
  - How does the model generalize across different products (part geometries)?
- Consideration of suitable data augmentation and transfer learning methods (optionally: few shot learning)

The scope of the work can be scaled depending on the type of thesis (Master/Bachelor).

Good skills in Python and Keras/Tensorflow are necessary.

### Contact

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