Semi-supervised Learning for Predictive Welding Quality

Motivation

Automated welding is a main component of many production chains, e.g. in automotive body construction. At the same time, however, welded joints place high demands on quality inspection. Producing companies therefore have to invest a lot of time and effort in quality assurance and generate a lot of waste, especially through destructive testing. Artificial intelligence and machine learning promise data-based quality insights with significantly lower effort. In a preliminary study, process data from a robotic welding cell was recorded using several data sources and is now to be evaluated.

Task

The goal of this thesis is the development of concepts and implementations for semi-supervised Learning as combination of low amount of labeled data and a certain amount of unlabeled data for automated welding processes. Subtasks to be worked on could be:

- Research on and selection of appropriate state-of-the-art methods for semi-supervised learning like Generative Adversarial Networks or Variational Autoencoders
- Implementation of according ML pipeline modules like data preparation and feature extraction to use the semi-supervised approach
- Execution of tests on different data amounts to analyse the impact of the amount of data on the model performance
- If necessary, independent execution of data acquisition in robot cell

The focus of the work will be defined depending on the main points of interest. The programming language will be Python 3. As DL framework we use Tensorflow with Keras.

Prerequisites:

- High motivation and willingness to work
- Interest and ideally prior knowledge in data processing and machine learning
- Independent way of working

Our offer:

- Extensive support
- Delimited tasks, fast processing possible
- Familiarization with Machine Learning
- Expert insight into vehicle production
- If necessary, independent execution of data acquisition in robot cell