Institute for Machine Tools and Industrial Management (*iwb*)
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Efficient Retraining of ML Models for Process Monitoring

Background

Machine-learning models support tool-condition and quality estimation in manufacturing processes. However, if the material, spindle, tool, or process parameters change, model performance can deteriorate. Since collecting and labeling large quantities of new data is time-consuming, efficient strategies for adapting models are needed.

Task

The work includes:

- Literature review of adaptive training, incremental learning, transfer learning, and retraining
- Definition of a possible validation strategy
- Comparison of training strategies, for example with new materials or a different spindle
- Analysis of model quality, training time, computational effort, and possible catastrophic forgetting

Goal

The goal of this work is to investigate how a model initially trained on a small dataset can be adapted to changing process conditions using as little new data and computational effort as possible. Potential applications include tool-wear monitoring and quality estimation in VAD.

Requirements

- Programming skills, ideally in Python and PyTorch
- Interest in machine learning and process monitoring
- Experience with time-series data is advantageous, but not required
- Initiative, a structured approach to work, reliability, and commitment

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