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## Master Thesis

*Programming*

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### Classification and Discrimination of Metalworking Fluids based on Convolutional Neural Network

**Conditions:**

Duration:	6 Months
Requirements:	Strong ability in MATLAB programming Strong knowledge in Convolutional neural network Knowledge on Acoustic Emission signals
Language:	English
Target groups:	Master students

**Content:**

Besides conventional fault diagnosis methods, Acoustic emission (AE) is a promising technique for indirect assessment of tool wear in thread forming. Meanwhile, lubricating properties of the Metalworking Fluid (MWF) strongly effect tool wear and workpiece quality. So the AE signals from different MWF may be suitable to develop in-depth understanding of wear mechanism related to friction contact of tool flanks and workpiece. At present there are a few publications on MWF discrimination using Convolutional Neural Network (CNN), so it is novel to combine CNN with AE signal for distinguish different types of MWF.

The goal of this thesis is to find robust classification and discrimination approaches for distinguishing different kinds of metalworking fluid by k-fold cross validation CNN, which have been proven to get good results on Case Western Reserve University (CWRU) bearing dataset as benchmark. The detailed goals are as followings:

- Classify size and location of the bearing fault from CWRU dataset
- Distinguish different types of MWF
- Definition of a new method for robust MWF classification

The steps related to this work can be summarized as:

- 1) Apply CNN k-fold cross validation on CWRU bearing dataset as benchmark
- 2) Divide metalworking fluids dataset into different sub-dataset
- 3) Apply CNN and raw AE signals to distinguish MWF
- 4) Apply CNN with frequency-based filter data to distinguish MWF
- 5) Apply CNN k-fold cross validation on MWF
- 6) Compare the results of different methods and get conclusion
- 7) Complete and detailed documentation/presentation of the research results

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