



Master Thesis

Theory and programming

Classification and Discrimination of Operating Conditions using Convolutional Neural Network (CNN)

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 wear and systems health.

The goal of this thesis is to implement, apply, and improve robust classification and discrimination approaches for the SHM field. The approaches are applied to distinguish different kinds of metalworking fluids by k-fold cross validation in combination with CNN, furthermore also to repeat existing good results on Case Western Reserve University (CWRU) bearing dataset as benchmark.

Meanwhile, lubricating properties of the Metalworking Fluid (MWF) strongly effect tool wear and workpiece quality. Therefore, 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 detailed goals of the thesis are as follows:

- Classify size and location of the bearing fault from CWRU dataset, repeat and improve results
- Definition of a new method for robust MWF classification
- Distinguish different types of MWF using existing AE data

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 to AE data to distinguish MWF
- 4) Apply CNN with suitably-defined filter to improve MWF classification
- 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

In case of perfect results the candidate will be invited as coauthor of an international publication.

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