Fault Detection of Three-Phase Induction Motor by using Deep Neural Network

Fourth European Conference of Prognostics and Health Management Society
3-6 July 2018, Utrecht, The Netherlands

Student Poster

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Research Objective

- Data-driven maintenance is an advanced methodology for monitoring the condition of machines to analyse and determine the best time for maintenance activities.
- 3-phase induction motor is widely used and plays a role in driving power for more than 50% of manufacturing.
- As faults rarely occur, data imbalance between normal and faulty conditions happens.
- We propose a **fault detection method** by using deep neural network for high accuracy and fast process.

Expected Contributions

- We can detect the fault with high accuracy and fast process by transforming the sensor data to image domain.
- [Synthetic fault data] The proposed method achieved **96.3%** fault detection accuracy and **95.0%** fault diagnosis accuracy, while it spends less than **10 seconds** to detect a fault.
- We are trying to compare the results between the real data and the synthetic fault data. The goal for accuracy is higher than 98.0%.
- It can be applied to the other motor types and other manufacturing machines.

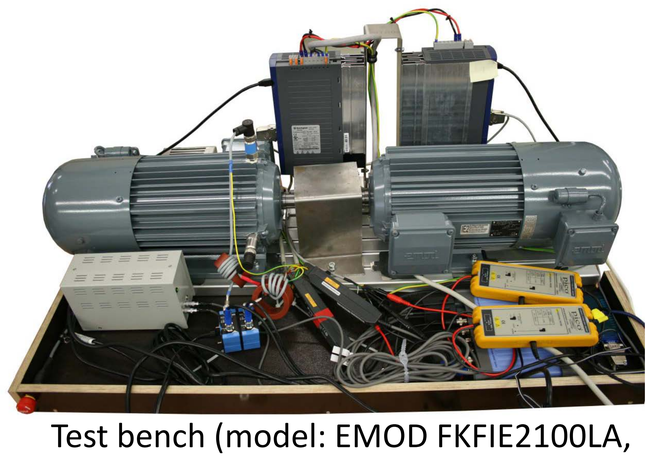
State of Research

- To overcome data imbalance problem, we proposed oversampling by generative adversarial network and synthesize the fault data using mathematical model.
- To solve the size of data, we developed a novel scalable data representation method with low complexity.
- We used normal condition data and synthetic fault data. But we collected the real fault data and try to classify the fault types.

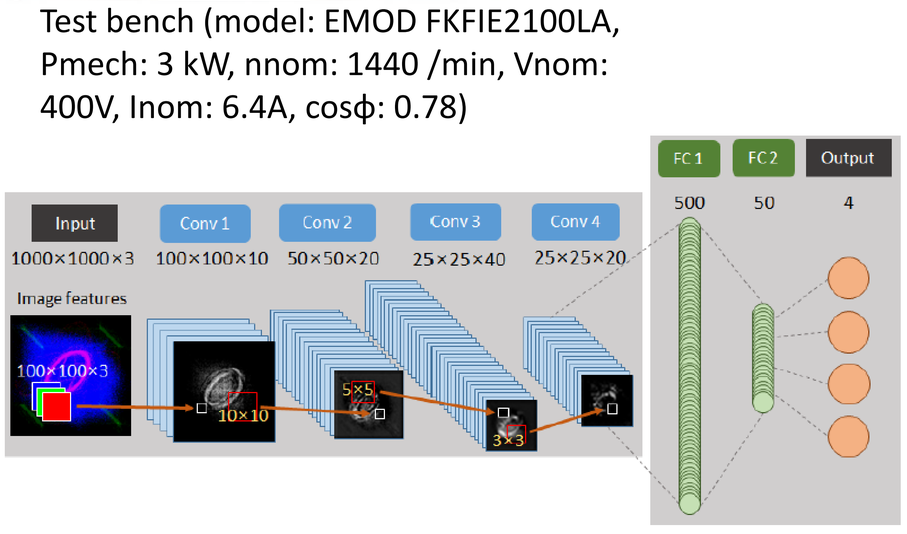
Next Steps

- Plan to classify the more detailed types of faults
- Need to extend the study of the performance evaluation to measured fault data and with various operating conditions on different types of induction motors.
- We will apply it to the actual practice with industrial partners.
- We will develop the predictive system, not only the detection system. We expect to reduce the cost and extend life span of machine by repairing components before actual breakdowns occur.
- We plan to research root cause analysis in manufacturing process.

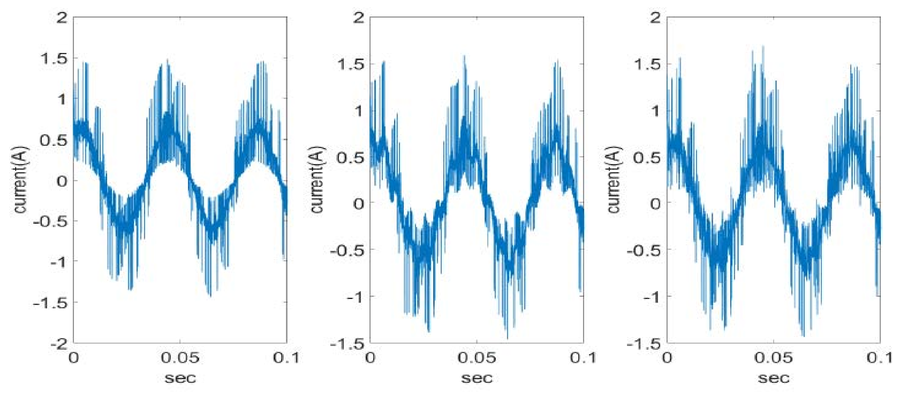
Research Details



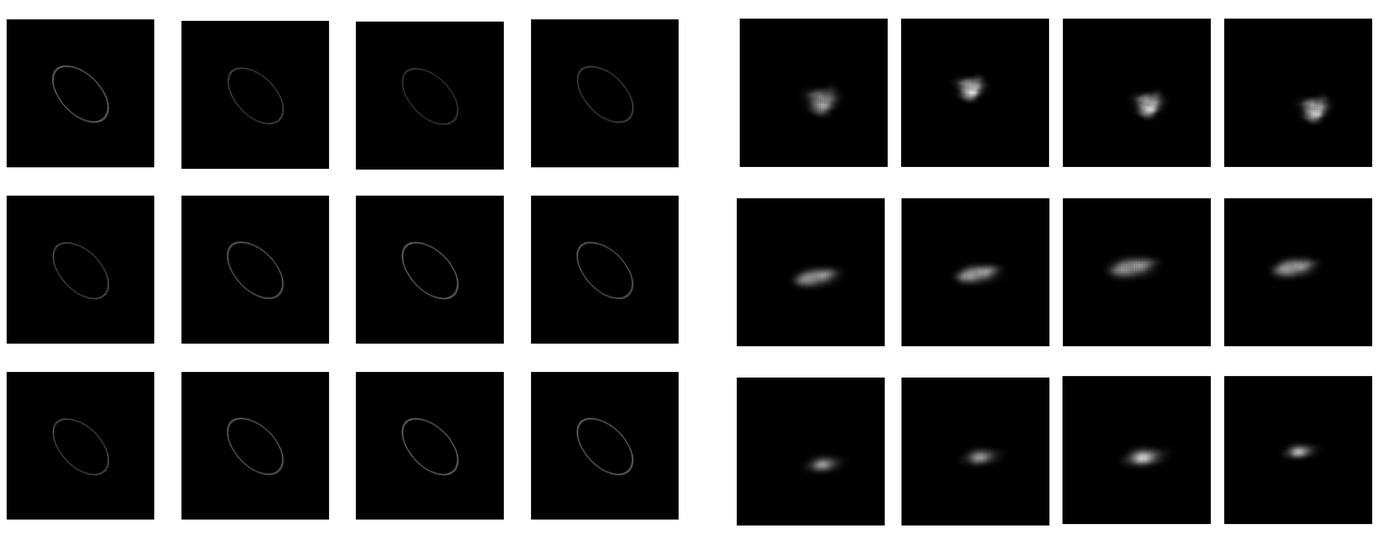
Test bench (model: EMOD FKFIE2100LA, Pmech: 3 kW, nnom: 1440 /min, Vnom: 400V, Inom: 6.4A, cosϕ: 0.78)



CNN Induction motor Fault Detector (CIFD)



Normal, rotor fault and bearing fault signals, respectively



Current values represented in Image (Normal, Inner and outer race damaged of Bearing)

Vibration values represented in Image (Normal, Inner and outer race damaged of Bearing)

Acknowledgments and References

- This work was supported by Korean Mistry of Trade, industry and Energy[ATC Program] and KIST Europe Institutional Program [Project No. 11806].
- Yong Oh Lee, Jun Jo, and Jongwoon Hwang. "Application of deep neural network and generative adversarial network to industrial maintenance: A case study of induction motor fault detection." Big Data (Big Data), 2017 IEEE International Conference on. IEEE, 2017.