Deep Learning Based Fault Diagnosis of Bearing in Mechanical Systems with Nested Scatter Plot using Stator Current Signals

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Abstract

Mechanical rotary systems are widely employed in industrial application process and power plant. The malfunction of components in the systems is attributed to the faults and leads high maintenance costs and safety concerns [1]. To minimize the undesired faults, fault detection and diagnosis (FDD)has been a research frontier in the academia and industry for the past decade. Here, FDD on bearing faults is studied, because bearing faults are the most common fault type [2].

In this study, the improved fault diagnosis method for bearings in the load part of the rotating system using stator current is proposed. Among the variety of available signals, stator current signals are chosen because they are affected by the abnormal behavior of air gap induced from bearing defects [3]. The challenge is that the extraction of fault-related features is hard in the stator current signal because the noise can be severely induced by the inverter while controlling motors. These adversities bring a negative impact on the performance of existing fault diagnosis methods based on domain knowledge or machine learning.

By using nested scattered plot (NSP) [4], stator current signals are converted to the images containing a large amount of information. The transformed NSP images of stator current signal can contribute to the efficient fault-related feature extraction of the CNN model because convolution neural networks (CNNs) have shown outstanding performance in image recognition and classification [5]. As a result of our experimental evaluation using KAT bearing fault dataset [6] shows of superior FDD accuracy to the other machine learning based FDD.

Keywords: *Fault detection and diagnosis (FDD), nested scattered plot (NSP), convolution neural networks (CNN), stator current*

References

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Biography

Chan Hee Park is a Ph. D candidate at Department of Mechanical Engineering in Seoul National University, South Korea. Her research topic is prognostics and health management (PHM) for electric motors.

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