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PII: S0263-2241(16)30064-1
DOI: http://dx.doi.org/10.1016/j.measurement.2016.04.007
Reference: MEASUR 3944

To appear in: *Measurement*

Received Date: 15 February 2016
Revised Date: 17 March 2016
Accepted Date: 5 April 2016

Please cite this article as: W. Sun, S. Shao, R. Zhao, R. Yan, X. Zhang, X. Chen, A Sparse Auto-encoder-Based Deep Neural Network Approach for Induction Motor Faults Classification, *Measurement* (2016), doi: http://dx.doi.org/10.1016/j.measurement.2016.04.007

A Sparse Auto-encoder-Based Deep Neural Network Approach for Induction Motor Faults Classification

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Abstract

This paper presents a deep neural network (DNN) approach for induction motor fault diagnosis. The approach utilizes sparse auto-encoder (SAE) to learn features, which belongs to unsupervised feature learning that only requires unlabeled measurement data. With the help of the denoising coding, partial corruption is added into the input of the SAE to improve robustness of feature representation. Features learned from the SAE are then used to train a neural network classifier for identifying induction motor faults. In addition, to prevent overfitting during the training process, a recently developed regularization method called "dropout" which has been proved to be very effective in neural network was employed. An experiment performed on a machine fault simulator indicates that compared with traditional neural network, the SAE-based DNN can achieve superior performance for feature learning and classification in the field of induction motor fault diagnosis.

Keywords: *Sparse auto-encoder; Deep neural network; Fault diagnosis; Denoising; Dropout*

1. INTRODUCTION

Induction motor as one of the industrial power driving sources, occupies an important position in national economy and has been widely applied to driving many kinds of machinery and industrial equipment, such as lifting hoist equipment, mining equipment, machine tools, etc. In order to guarantee normal operation of induction motors with timely maintenance, and avoid unnecessary loss, fault diagnosis on them is necessary [1, 2]. However, due to environmental interference and inherent motor structure complexity, effective fault diagnosis for induction motors is challenging. Up to date, various sensing techniques [3-5] have been employed to measure certain physical quantities, including current, vibration, radial and axial flux, rotor speed, etc., for the purpose of identifying induction motor faults. This is based on the fact that properties of the induction motor may change when there are some