World Academy of Science, Engineering and Technology
International Journal of Electrical and Computer Engineering
Vol:13, No:06, 2019

Remaining Useful Life Estimation of Bearings Based on Nonlinear Dimensional Reduction Combined with Timing Signals

Authors : Zhongmin Wang, Wudong Fan, Hengshan Zhang, Yimin Zhou

Abstract : In data-driven prognostic methods, the prediction accuracy of the estimation for remaining useful life of bearings mainly depends on the performance of health indicators, which are usually fused some statistical features extracted from vibrating signals. However, the existing health indicators have the following two drawbacks: (1) The differnet ranges of the statistical features have the different contributions to construct the health indicators, the expert knowledge is required to extract the features. (2) When convolutional neural networks are utilized to tackle time-frequency features of signals, the time-series of signals are not considered. To overcome these drawbacks, in this study, the method combining convolutional neural network with gated recurrent unit is proposed to extract the time-frequency image features. The extracted features are utilized to construct health indicator and predict remaining useful life of bearings. First, original signals are converted into time-frequency images by using continuous wavelet transform so as to form the original feature sets. Second, with convolutional and pooling layers of convolutional neural networks, the most sensitive features of time-frequency images are selected from the original feature sets. Finally, these selected features are fed into the gated recurrent unit to construct the health indicator. The results state that the proposed method shows the enhance performance than the related studies which have used the same bearing dataset provided by PRONOSTIA.

Keywords : continuous wavelet transform, convolution neural net-work, gated recurrent unit, health indicators, remaining useful life
Conference Title : ICEMI 2019 : International Conference on Electronic Measurement and Instruments
Conference Location : London, United Kingdom
Conference Dates : June 27-28, 2019