

Deep Learning-Based Predictive Methods for Estimating Remaining Useful Life

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Abstract

Estimating the remaining useful life (RUL) is a crucial predictive activity in industrial applications. The literature indicates two research directions for RUL estimation: the first is to apply deep learning models, while the second involves similarity-based health state matching, which combines deep learning tools with a similarity measure based on the health indicator (HI) curve. This study proposes three methods to estimate RUL based on these two research notions. The first method adopts a Convolutional LSTM Network (ConvLSTM) model to estimate RUL. In contrast, the second method modifies the HI curve matching technique by introducing a CNN-based approach to construct the HI information and the cosine similarity method. Finally, the individual prediction results of these two methods are integrated to predict the RUL. The application results on the NASA C-MAPSS aircraft turbofan engine dataset show that the three proposed methods have better predictive performance regarding three evaluation metrics, ACC, SCORE, and RMSE, compared to the original literature method and that the ensemble of our methods produces the best average prediction performance. This is joint work with Yi-Zong Ji.