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Complete Ensemble Empirical Mode Decomposition with Adaptive Noise Temporal Convolutional Network for Remaining Useful Life Prediction of Lithium Ion Batteries

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Abstract : Uhumanned Underwater Vehicles generally operate in the deep sea, which has its own unique working conditions. Lithium-ion power batteries should have the necessary stability and endurance for use as an underwater vehicle's power source. Therefore, it is essential to accurately forecast how long lithium-ion batteries will last in order to maintain the system's reliability and safety. In order to model and forecast lithium battery Remaining Useful Life (RUL), this research suggests a model based on Complete Ensemble Empirical Mode Decomposition with Adaptive noise-Temporal Convolutional Net (CEEMDAN-TCN). In this study, two datasets, NASA and CALCE, which have a specific gap in capacity data fluctuation, are used to verify the model and examine the experimental results in order to demonstrate the generalizability of the concept. The experiments demonstrate the network structure's strong universality and ability to achieve good fitting outcomes on the test set for various battery dataset types. The evaluation metrics reveal that the CEEMDAN-TCN prediction performance of TCN is 25% to 35% better than that of a single neural network, proving that feature expansion and modal decomposition can both enhance the model's generalizability and be extremely useful in industrial settings.

Keywords : lithium-ion battery, remaining useful life, complete EEMD with adaptive noise, temporal convolutional net
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