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State of Health Estimation Based on GAN-LSTM-TL for Lithium-ion Batteries

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The state of health (SOH) is a critical parameter for characterizing the current state of a lithium-ion battery. In recent years, SOH estimation methods that employ machine learning and deep learning have invariably been the research hotspots for researchers in recent years. In the previous work paper, a battery SOH online estimation method based on GAN-LSTM algorithm was proposed to overcome the defects such as a large amount of computation and long-time consumption for prediction and to find a prediction method suitable for the time series data characteristics of lithium-ion batteries. Among the work, generative adversarial networks (GAN) are used to process the corresponding feature data and 30% of the dataset is selected to generate the dataset used for training. A long short-term memory (LSTM) network is used to learn the mapping relations between features and SOH. Transfer learning (TL) is utilized to enhance the adaptability of the LSTM network and achieve accurate SOH estimation by solving training and test problems between datasets of various lithium-ion batteries. The NASA battery sample dataset and the battery cycle aging test experimental dataset of the Advanced Life Cycle Engineering Center of the University of Maryland are used for experimental verification. The analysis of experimental results demonstrates that the model boasts pinpoint accuracy and incredible adaptability across multiple datasets.

Keywords: Lithium-ion battery, State-of-Health (SOH), Long short-term memory (LSTM), Generative adversarial networks (GAN), Transfer learning (TL).

FULL TEXT