Metaheuristic approach for optimizing neural networks parameters in battery state of charge estimation

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ABSTRACT

To accurately estimate the battery state of charge (SOC), it is vital to improve the performance of a battery-powered system. This paper employs the recent proposed Evolutionary Mating Algorithm (EMA) for optimizing the weights and biases of Feed-Forward Neural Network (FNN) in estimating the state of charge (SOC) of Lithium-ion batteries. SOC estimation is the critical aspect in battery management system (BMS) to ensure the reliable operation of electric vehicles (EV) since there are no direct way to measure it. In addition, it is very nonlinear due to variation of charge/discharge currents and temperature. EMA is the recent evolutionary algorithm based on mating theory and environmental factor will be used in this paper to optimize the weights and biases of FNN on a common Li-ion battery, multiple data measurements, drive cycles and training repetitions. The performance of EMA will be compared with other algorithms to show the effectiveness of EMA in solving the SOC estimation problem. Findings of the study demonstrate the superiority of EMA in estimating the SOC of the batteries in terms of Root Mean Square Error (RMSE), mean Absolute Error (MAE) and Standard Deviation.

KEYWORDS

Batteries; Evolutionary mating algorithm; Feedforward neural network; Metaheuristic; State of charge estimator

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