An intelligent returned energy model of cell and grid using a gain sharing knowledge enhanced long short-term memory neural network

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Abstract

The reliable prediction of solar energy production and surplus is crucial for the stability of the electricity grid and effective energy distribution, particularly during peak consumption periods. Encouraging solar adoption by customers is also important despite fluctuations in solar energy generation. This paper addresses the need for an intelligent surplus solar energy prediction model, referred to as the Green Model, which aims to accurately predict surplus electrical energy that can be returned to the distribution grid. The Green Model utilizes a combination of a developed long short-term memory (LSTM) neural network and a novel optimization technique called deterministic selection network by gain sharing knowledge (DSN-GSK). The DSN-GSK optimizes the structure of LSTM by determining the optimal number of hidden layers, nodes in each layer, biases, weights, and activation functions based on the most important features that represent the relationship between generated solar energy and weather factors. The Green Model was evaluated and analysed, demonstrating high accuracy in the short-term prediction of surplus electrical energy with a minimal percentage of error. The model shows promising prospects for the development of returned electrical energy prediction. The main novelty of this paper lies in the development of the Green Model, which combines LSTM and DSN-GSK to enhance the accuracy of surplus solar energy prediction. The benefits of the Green Model include improved stability and efficiency of the electricity grid, effective utilization of renewable energy sources, and the reduction of negative environmental impacts. The contributions of this paper include advancing the field of intelligent energy prediction, optimizing the structure of LSTM, and providing valuable insights for the integration of renewable energy into the existing energy infrastructure.

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