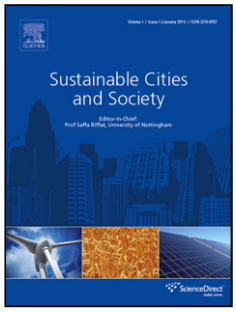

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Predicting Electricity Consumption in a Building Using an Optimized Back-propagation and Levenberg–Marquardt Back-propagation Neural Network: Case Study of a Shopping Mall in China

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Highlights

- Neural network algorithms can predict electricity consumptions in buildings.
- The proposed algorithms can be used effectively for energy consumption prediction.
- The LM-BP algorithm is more accurate and stable than the BP neural network.
- The neural network has a powerful learning function based on input parameters.

ABSTRACT

This study considered combinational control approaches for predicting electricity consumption in a building based on an optimized back-propagation (BP) neural network. Forecasting the electricity consumption of buildings is an important part of power management systems because it directly affects power dispatching and safe production. The BP neural network prediction method is used widely for this purpose because of its high plasticity and simple structure, but it has disadvantages such as slow convergence, fluctuations, and oscillation during training. We propose the use of the Levenberg–Marquardt back-propagation (LM-BP) neural network to enhance the accuracy of predictions by combining the gradient descent and Quasi-Newton method, thereby ensuring the fast convergence speed and maintaining better overall performance. Additionally, the network weights can be optimized by adaptive adjustment between the steepest gradient descent method and the Gauss–Newton method so the network can converge effectively. Hence, the accuracy and stability of the LM algorithm are improved, and a building electricity consumption prediction model can be established based on the improved BP neural network. Our results demonstrate that the forecasting model based on LM-BP neural network improves the accuracy and stability of predictions, and it is suitable for the short-term prediction of building electricity consumption.