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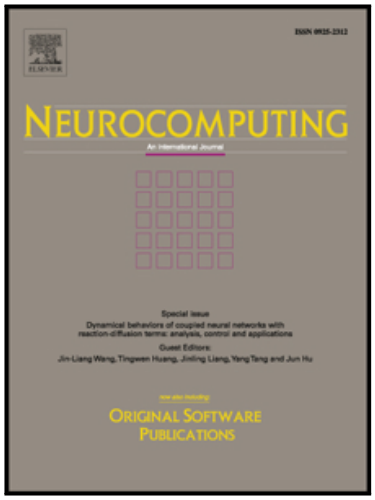

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A Switching Delayed PSO Optimized Extreme Learning Machine for Short-Term Load Forecasting

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Abstract

In this paper, a hybrid learning approach, which combines the extreme learning machine (ELM) with a new switching delayed PSO (SDPSO) algorithm, is proposed for the problem of the short-term load forecasting (STLF). In particular, the input weights and biases of ELM are optimized by a new developed SDPSO algorithm, where the delayed information of locally best particle and globally best particle are exploited to update the velocity of particle. By testing the proposed SDPSO-ELM in a comprehensive manner on a *tanh* function, this approach obtain better generalization performance and can also avoid adding unnecessary hidden nodes and overtraining problems. Moreover, it has shown outstanding performance than other state-of-the-art ELMs. Finally, the proposed SDPSO-ELM algorithm is successfully applied to the STLF of power system. Experiment results demonstrate that the proposed learning algorithm can get better forecasting results in comparison with the radial basis function neural network (RBFNN) algorithm.

Index Terms

Short-term load forecasting; extreme learning machine; switching delayed particle swarm optimization (SDPSO); neural network; time-delay.

I. Introduction

Load forecasting, which aims to predict the future load demand with satisfactory accuracy, plays an importance role in the generation scheduling, system reliability and power optimization and economical running of the smart grid. Based on the prediction time, load forecasting can be divided into three types, which are short-term, medium-term and long-term forecasting [27]. In this paper, we focus on the problem of the short-term load forecasting (STLF), which generally refers to the period of its prediction from one hour to one week.

In the past few years, many efforts have been made, and quite a considerable number of methods have been proposed for STLF. Especially, recent research has been going mainly toward two categories: one is the statistical methods, see, e.g., [1], [3], [21], and the other is artificial intelligence methods, see, e.g., [2], [9], [16], [17], [27]. Among various forecasting approaches, artificial neural networks (ANNs) have become the popular ones for the STLF due primarily to its attractive properties such as strong ability

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