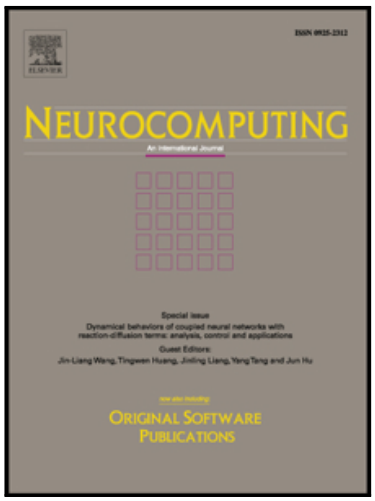


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# Verification and predicting temperature and humidity in a solar greenhouse based on convex bidirectional extreme learning machine algorithm☆

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**Abstract**

Predictions regarding the solar greenhouse temperature and humidity are important because they play a critical role in greenhouse cultivation. On account of this, it is important to set up a predictive model of temperature and humidity that would precisely predict the temperature and humidity, reducing potential financial losses. This paper presents a novel temperature and humidity prediction model based on convex bidirectional extreme learning machine (CB-ELM). Simulation results show that the convergence rate of the bidirectional extreme learning machine (B-ELM) can further be improved while retaining the same simplicity, by simply recalculating the output weights of the existing nodes based on a convex optimization method when a new hidden node is randomly added. The performance of the CB-ELM model is compared with other modeling approaches by applying it to predict solar greenhouse temperature and humidity. The experiment results show that the CB-ELM model predictions are more accurate than those of the B-ELM, Back Propagation Neural Network (BPNN), Support Vector Machine (SVM), and Radial Basis Function (RBF). Therefore, it can be considered as a suitable and effective method for predicting the solar greenhouse temperature and humidity.

*Keywords:* Solar greenhouse, support vector machine, radial basis Function, convex bidirectional extreme learning machine

## 1. Introduction

The solar greenhouse covered with plastic and a thermal blanket is a very complex dynamic system [1-3]. It extends the growing season in cold climatic conditions, producing greenhouse crops year round. As such, solar greenhouses

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