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Adaptive neuro-fuzzy approach for solar radiation prediction in Nigeria

Lanre Olatomiwa [a,c], Saad Mekhilef [a,*], Shahaboddin Shamshirband [b,**], Dalibor Petković [d]

[a] Power Electronics and Renewable Energy Research Laboratory (PEARL), Department of Electrical Engineering, Faculty of Engineering, University of Malaya, 50603 Kuala Lumpur, Malaysia
[b] Department of Computer System and Technology, Faculty of Computer Science and Information Technology, University of Malaya, 50603 Kuala Lumpur, Malaysia
[c] Department of Electrical & Electronic Engineering, Federal University of Technology, PMB 65, Minna, Nigeria
[d] University of Niš, Faculty of Mechanical Engineering, Department for Mechatronics and Control, Aleksandra Medvedeva 14, 18000 Niš, Serbia

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ABSTRACT

In this paper, the accuracy of a soft computing technique is investigated for predicting solar radiation based on a series of measured meteorological data: monthly mean minimum temperature and, maximum temperature, and sunshine duration obtained from a meteorological station located in Iseyin, Nigeria. The process was developed with an adaptive neuro-fuzzy inference system (ANFIS) to simulate solar radiation. The ANFIS network has three neurons in the input layer, and one neuron in the output layer. The inputs are monthly mean maximum temperature (T_{max}), monthly mean minimum temperature (T_{min}), and monthly mean sunshine duration ($\overline{n}$). The performance of the proposed system is obtained through the simulation results. The ANFIS results are compared with experimental results using root-mean-square error (RMSE) and coefficient of determination (R^2). The results signify an improvement in predictive accuracy and ANFIS capability to estimate solar radiation. The statistical characteristics of RMSE = 1.0854 and R^2 = 0.8544 were obtained in the training phase and RMSE = 1.7585 and R^2 = 0.6567 in the testing phase. As a result, the proposed model deemed an efficient techniques to predict global solar radiation for practical purposes.

Contents

1. Introduction

Many researchers worldwide have seen the utilization of vast and abundant solar energy resources on the earth's surface for electricity production as one of the way to meet the world

* Corresponding author.
** Corresponding author. Tel.: +60 146266763.
E-mail addresses: saad@um.edu.my (S. Mekhilef), shamshirband@um.edu.my (S. Shamshirband).

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