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ORIGINAL ARTICLE

Application of fuzzy – Neuro to model weather parameter variability impacts on electrical load based on long-term forecasting

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KEYWORDS

Electrical load;
Load forecasting;
Fuzzy logic;
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Weather parameter

Abstract Long-term load forecasting provides vital information about future load and it helps the power industries to make decision regarding electrical energy generation and delivery. In this work, fuzzy – neuro model is developed to forecast a year ahead load in relation to weather parameter (temperature and humidity) in Mubi, Adamawa State. It is observed that: electrical load increased with increase in temperature and relative humidity does not show notable effect on electrical load. The accuracy of the prediction is obtained at 98.78% with the corresponding mean absolute percentage error (MAPE) of 1.22%. This confirms that fuzzy – neuro is a good tool for load forecasting.

1. Introduction

The power industries that are saddled with the responsibility of providing power services, sometimes cannot meet up with the demand of their customers [1,2]. This may be a result of insufficient power generated, transmitted and distributed or lack of proper forecasting. Other factors that may contribute to the insufficiency of power supply include variation in weather parameters, limited capacity, lack of proper maintenance, and increase in the number of customers. In most developing countries such as Nigeria, the problem of inadequate power supply has great impact on the livelihood of the population and their economy. To address any of these problems, it is necessary to predict the amount of power needed for future use through load forecasting. In this regards, load forecasting becomes an indispensible tool for power industries, since it provides the industries with information that helps in reliable generation, transmission and distribution of power effectively to their customers, it also avails the industries with an opportunity to plan their system operation, control, maintenance and expansion of power facility with no or less consequence on their customers [3,4]. Thus, accurate load forecasting leads to substantial reduction in cost of operation and maintenance on the part of power providers and increases the reliability of power supply to their customers [5–8]. Types of load forecasting are classified into four categories [1,9].

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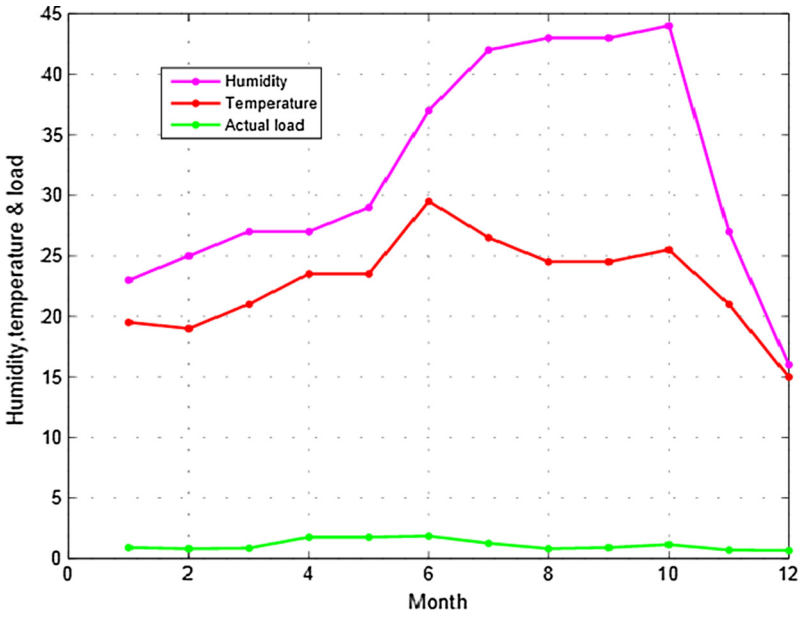

Figure 1 Load, temperature and humidity vs. month for 2013. *Source:* MCADSU and YEDC.

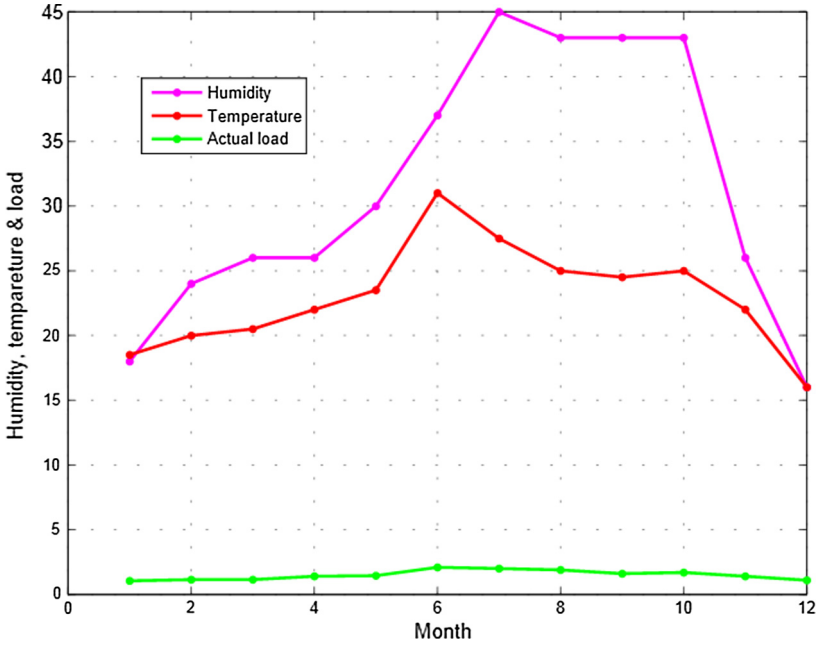

Figure 2 Load, temperature and humidity vs. MONTH for 2014. *Source:* MCADSU and YEDC.

- Very short-term load forecasting: forecasting for few minutes to a few hours.
- Short-term load forecasting: forecasting within a time period of few hours to few days.
- Mid-term load forecasting: forecasting for few weeks to a few months.
- Long-term load forecasting: forecasting within the period of one year to more than one year.

Several methods of load forecasting have been proposed in literatures such as regression, time series, exponential smoothing, ARMA model, Data mining, fuzzy logic and artificial neural network (ANN) [8,10–15]. These methods are classified as conventional and Artificial Intelligent (AI). ANN and fuzzy logic methods are usually referred to as AI techniques because of their abilities in emulating human way of computation. In this work, fuzzy- neuro will be employed to forecast an electrical load in terms of weather parameters (Temperature and Relative humidity) based on long-term forecasting and the following objectives will be realized: to use fuzzy logic technique to fuzzify the input data to give a predicted load, to use ANN to correct the fuzzy logic prediction error, to use the

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