Journal of IT in Asia, Vol. 6, 2016, 25 – 35

A Predictive Framework for Electricity Consumption

[1]Patrick Ozoh, [2]Shapiee Abd-Rahman and [3]Jane Labadin
[1]Department of Computer Science, Osun State University, Osogbo, Nigeria
[2,3]Department of Computational Science and Mathematics, Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
email: [1]pozoh2@gmail.com, [2]sar@unimas.my, [3]ljane@unimas.my

Abstract - *This study investigates the performance of regression model, Kalman filter adaptation algorithm and artificial neural network to assess their qualities for predictions. It develops predictive algorithms based on price, temperature and humidity as multiple variables affecting time-varying aspect of electricity consumption. In order to meet energy demand through the use of electricity as an energy source for daily activities in buildings such as air conditioning, lighting, computers and cooking stoves., adequate allocation of energy resources and planning should be done, including predicting for electricity consumption. The process involves collecting data from the power grid of Faculty of Computer Science and Information Technology building, Universiti Malaysia Sarawak. The forecasting techniques were tested on the data collected, and the dataset consists of electricity consumption readings, with electricity price, humidity and temperature included in the forecasting model. The performances of regression model, artificial neural network and Kalman algorithm were tested using statistical evaluation parameters, root mean squared error (RMSE) and mean absolute percentage error (MAPE); while the parameter, standard deviation, was used to check the validity of models. This study identified Kalman algorithm as the most effective method of predicting consumption data compared to regression model, and artificial neural network.*

Keywords: Kalman algorithm, regression model, ANN, predictions, price, temperature, humidity, statistical parameters.

1 Introduction

Electricity is a source of energy that cannot be dispensed with in daily life, especially in households. It enables the use of daily appliances (such as computers, medical devices, and telecommunication appliances) that increase people's quality of life. Most appliances used in daily life are powered by electricity and it is generally regarded to be almost impossible to live without them. As a result, electricity is seen as a necessity for social and economic welfare; it is essential to maintain economic activity in modern industrialized nations and social development. The issue of obtaining reliable forecasting methods for electricity consumption has been widely discussed by past research works. This is due to the increased demand for electricity and as a result, the development of efficient pricing models. Several techniques have been used in past research for predicting electricity consumption.

Since many countries require primary energy sources for sustainable development, world energy demand has increased tremendously (Taşpınar et al., 2013). International Energy Agency (2013) discussed total world consumption, taking into consideration different energy sources, which shows an increasing demand for electricity from 1971 to the present, as a result of economic, social and technological development. The paper proposed that proper planning is required for achieving proper energy management policy for decision makers, to minimize economic losses, by selecting appropriate forecasting models. Anon (2013) in its presentation identified selecting appropriate prediction models for planning and management in the energy market as a means of achieving efficient electricity consumption in electrical appliance use. The study indicated that introduction of new tools in analysing energy models would minimize economic losses, since forecasting has become a tool for optimizing energy resources. Also, accurately predicting electricity consumption will allow for an efficient allocation of resources in the energy grid, while improving efficiency in electric appliance use. The research concludes that more energy savings can be achieved if future electricity to be consumed by individual appliances is known.

Tripathi (2014) described artificial neural network technique as the most accurate and widely used method for electricity forecasting models. The analysis of a prediction model built on an artificial neural network based on learning, flexibility and real time response was illustrated by Yedra et al. (2014). Previous methods of using artificial neural network technique to forecast energy models were affected by approximations necessary for estimating data. Ozoh et al. (2014a) identified modified Newton's method as the most reliable technique for predicting electricity consumption. The Kalman filter adaptation algorithm is the same as modified recursive method as used in the research. Both are recursive techniques applied to electricity consumption predictions and both utilize the same algorithm. The Kalman filter adaptation algorithm was