ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 4, April 2015

Evolutionary Load Forecasting using Artificial Neural Network

Syeda Samreen Saba[1], Nilajkar.R.M[2]

M.Tech (D.E), Dept. of ECE, GMIT, Davangere, India[1]

HOD, Dept. of ECE, GMIT, Davangere, India[2]

ABSTRACT*:* The anticipated effort targets to predict the load by utilizing Artificial Neural Networks (ANN). Short term load forecasting acts an important character for the economic, planning and reliable action of power systems. Consequently, numerous statistical techniques have been conventionally projected for these forecasting, but it have become tiring to build an exact functional model. This tiring task can be decreased by using ANN. ANN is a machine which is devised to model in fashion which the human brain does a particular task. The main intension of the anticipated effort is to build a NN model known as an Elman recurrent network on the flat form of MATLAB to simulate the load prediction. We also evaluate the results attained by weather and a non-weather sensitive model.

KEYWORDS*:*Elman recurrent network, Short term load forecasting (SLTF), weather sensitive and non-weather sensitive.

I. INTRODUCTION

Steep raise of power system networks and upturn in their complexity, different features are influential in electric power generation, demand or load management. Load forecasting in the precarious feature for profitable operation of power systems. Prediction of forthcoming loads is crucial for infrastructure development, network planning and soon. Load forecasting could be categorized in three classes, as short-term, medium term and long term load forecasting. Short term load covers hourly to weekly load, which are habitually essential for day to day economic operations.

II. RELATED WORK

Many aspects or parameters which can be endogenous or exogenous variables affects the short term load forecasting. The variables involves

The particular hour and its very previous hours are endogenous on the other side variable include the parameters like rainfall, temperature, humidity and wind speed. Other various factors also contribute to affect the SLTF. Which include Consumer type, Seasonal effects, Day of the week, Holidays and many more.

III. PROPOSED ALGORITHM

The Elman recurrent network is made use in this work. The arrangement of a recurrent neural network is similar to a humanoid brain network interconnection and working. The recurrent neural network structure presents loops and backward links in the network. Feedback networks are remarkably governing and we get highly elaborated. The behaviour of this class on networks is seen to be varying continuously till they attain an equilibrium state. This indicates the state of the network remains at the equilibrium until the input varies and a new equilibrium is to be found. Feedback architectures are also known to interactive or recurrent, even though the latter word is often used to represent feedback connections.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 4, April 2015

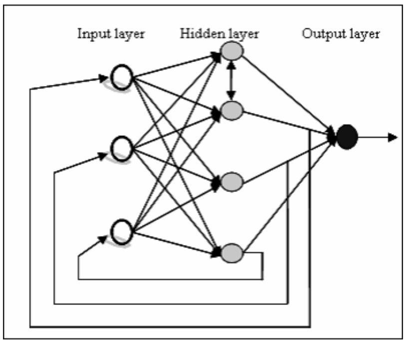


Fig 1, A typical topology of recurrent networks.

IV. DATA COLLECTION AND PRE PROCESSING

Data collection is a vital task of any kind of research study. Insufficient or inaccurate data can influence the results of a study and eventually lead to skewed results.In this, the actual load data was taken. Weather conditions impacts the load extremely. Thus the correlation between weather conditions and load consumption is overwhelmingly needed, specifically in locality where noteworthy weather condition changes are experienced.

A. *Data Storage*

Data storage can be carried out in different ways. The techniques utilized to implement storing data are external techniques like database management system (DBMS) or Microsoft excel and other conventional method. Data collected is stored in Microsoft Excel sheets in this work. These sheets are then imported into mat lab software by using the command as “xlsread”.

B.*Data Pre-processing*

The raw or pre-processed weather and load data is stored in the excel sheet. Nevertheless, this data is being normalized former to giving them to the network for training or prediction attempt. Data scaling is crucial due to the circumstance that neural networks are repeatedly vulnerable to raw data, it’s tremendously vital that data are scaled (classically values between -1 and 1,or 0 and 1,) to escape convergence problems.

C. *Data scaling*

The data scaling is made in order to advance interpretability of network model weights and uniform scaling matches originally the significance of variables. The equation shown below have undoubtedly been used and to normalize the load data and weather data.

$$Normalized\ value = \frac{\text{actual value}}{\text{maximum value}}$$

D. *Bad data detection and replacement*

Without the exception, few bad data were found in the overall load data. The bad data was replaced by taking average of previous hour and the very next hour load data.

E. *Alignment of the Input Vector (IV) of prediction models*

The two input vector composition are, one for non-weather sensitive model without any specification of the exogenous variables and the other for weather sensitive model involving the exogenous variables.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 4, April 2015

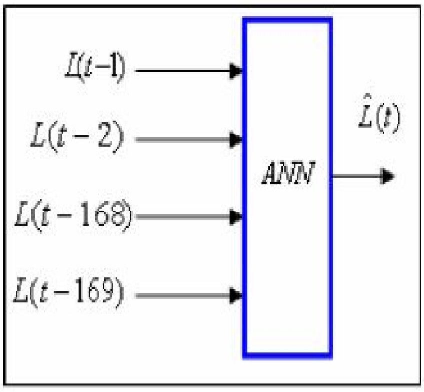


Fig 2 Alignment of the input vectors (non-weather sensitive) network model

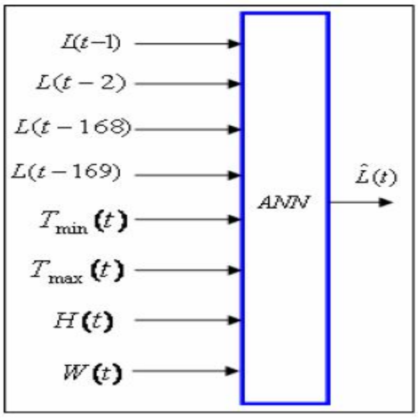


Fig 3. Alignment of the input vector (weather sensitive) network model

V. SIMULATION RESULTS

Differences between developed weather sensitive as well as non-weather sensitive models are evaluated. Along with it, the subsequent performance measure hired: mean percentage error *(MPE)* and mean square error *(MSE)* to estimate the performance of network models. The actual error in kWis also compared.

$$MSE = \frac{1}{N}\sum_{i=1}^{N}[(L_{actual}(n) - \hat{L}_{predicted}(n))]^2$$

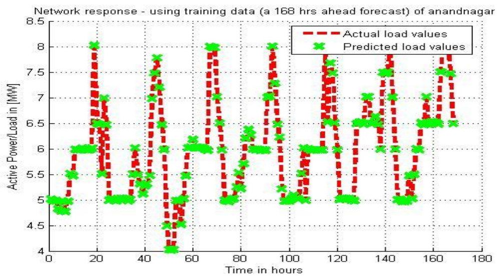
$$MPE = \sum_{i=1}^{N}[(L_{actual}(n) - \hat{L}_{predicted}(n))/L_{actual}(n)]/N$$

A. *Network architectural design for the ER model*

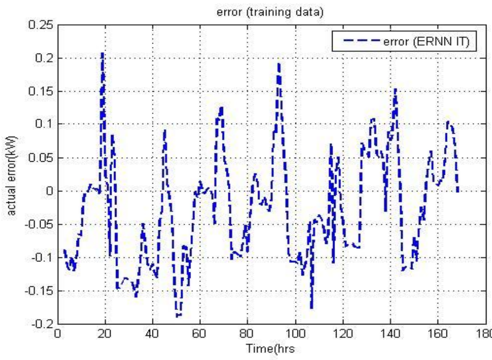
The network structure consists of 1 output neuron and 10 hidden layer neurons. A tan sigmoid transfer function is used for the activation for hidden layer and a pure linear transfer function is used in the output layer. Momentum factor and the learning rate both are kept constant although the training period at 0.35 and 0.75 respectively.

B. *Elman recurrent non weather sensitive model*

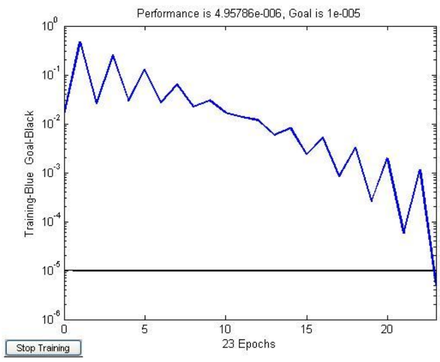
The weather data is not used in this model i.e. the weather data is omitted as it is non-weather sensitive model. The simulation results, corresponding error, and network performance for the non-weather model is shown below in Figure 2 (a), (b), and (c) respectively.



2(a) Simulated results



2 (b): The associated actual error (kW)



2(c) Training

C. *Elman recurrent weather sensitive model*

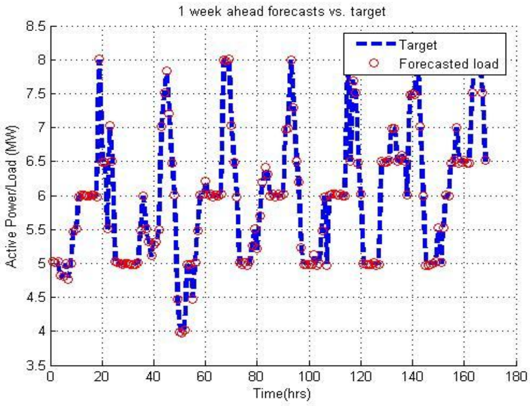
The weather variables that are used: humidity, minimum and maximum temperature, wind speed, and daily average wind. The acquired results and the actual error in kW, performance of this model is shown in Figure 3(a), (b) and (c) respectively. The Figure 3 (b) shows that weather sensitive forecasting network model operates somewhat better than the non-sensitive model.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

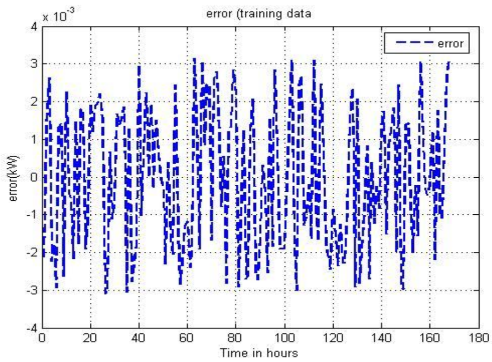
International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

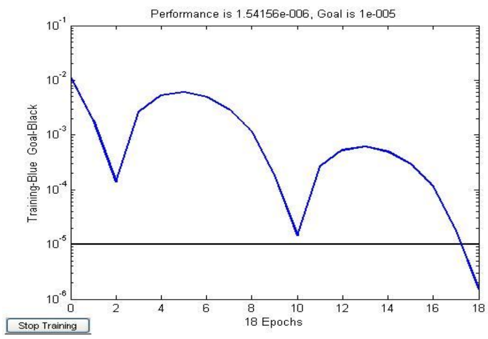
Vol. 3, Issue 4, April 2015



3(a) Simulated results



3 (b): The associated actual error (kW)



3(c) Training

V. CONCLUSION AND FUTURE WORK

The results expresses that the proposed algorithm performs better with the weather considered parameters. The proposed algorithm provides energy efficient path for data transmission and develops the entire network of entire network.When the performance of the proposed algorithm is reviewed between two modelsthe weather sensitive model and the non-weather sensitive model the performance of the weather used more epochs with the accurate results.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 4, April 2015

REFERENCES

1. Vinutha H D, K C Gouda and Chandan K N, "Electric load forecasting using a Neural Network Approach", International Journal of Computer Trends Technology (IJCTT), Vol. 11 No. 06 May 2014
2. Samsher Kadir Sheikh, M. G. Unde, "Short -term load forecasting using ann technique ", International Journal of Engineering Sciences & Emerging Technologies, Vol. 1, Issue 2, Feb 2012
3. Hesham K. Alfares and Mohammad Nazeeruddin, "Electric load forecasting: literature survey and classification of methods", International Journal of Systems Science, 2002, volume 33, number 1, pages 23-34
4. Text Book "Soft Computing techniques and its application" by Chaturvedi
5. http://www.mathworks.in/products/availability/index
6. http://en.wikipedia.org/wiki/Forecasting
7. http://www.researchgate.net/topic/backpropagation

BIOGRAPHY

1**. Syeda Samreen Saba**is a Research student in the Electronics and CommunicationDepartment, G.M Institute of Technology, Davengere, India. She is about to receive Master of Technology (M.Tech)degree with the specialization in Digital Electronics. Her research interests are Artificial Neural Networks (ANN), Load forecasting.

2.**Nilajkar. R.M** is an Assistant professor and Head of the department. He has received M.S with the specialization in Electronics and controls. He has the teaching experience of 25years. His research interests are Digital Electronics, control engineering and signals and systems.