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Forecasting Energy Consumption of a House using Radial Basis Function Network

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***Abstract*—** Electrical energy is used throughout the globe to power devices, appliances, and strategies of transportation used in everyday life. The uses of electricity are Residential uses, industrial uses, and Transportation. This paper targeted on Forecasting Energy Consumption of a House using historical information. The proposed work uses the Radial Basis Function (RBF) Network for forecasting the demand for energy consumption of a house using historical data. The result showed that the Radial Basis Function Network performs better than FeedForward BackPropagation Network (FFBPN), and Elman BackPropagation Network (EBPN) were compared with Mean Square Error (MSE) and accuracy values.

***Keywords*—**Radial Basis Function, Neural Network, FeedForward BackPropagation Network, Elman BackPropagation Network, RBF.

I. INTRODUCTION

Electricity is very important to live. Electricity is used largely in four main areas: business, public health, media, and transportation.

Artificial Neural Network(ANN) is a nonlinear statistical data modeling tool. In this paper, FeedForward BackPropagation Network, Elman BackPropagation Network, and Radial Basis Function are considered. FeedForward BackPropagation Network uses a Gradient-Descent technique with differentiable perform. Back Propagation Network technique error is propagated back to the hidden unit.

The Radial Basis function is an important tool in solving problems, involving time-series prediction and in pattern classification.

In this paper, Radial Basis Function Network used to forecasting energy consumption of a house using historical information. RBF Network compares with FeedForward BackPropagation and Elman BackPropagation Network, within the higher than 3 strategies Mean Square Error (MSE) and accuracy were computed.

Rest of the paper is organized as follows, Section I contains the introduction of Forecasting energy consumption and Radial Basis Function Network, Section II contain the related work of prediction and forecasting, Section III described problem formulation, Section IV the computational result, section V gives the conclusion.

II. RELATED WORK

There are various works exhausted the area of energy consumption prediction. Sukumar Mishra, Vivek Kumar Singh planned the systematic approach of monthly energy prediction exploitation Windowed Momentum algorithmic program in ANN [1]. Juan Vilar et al., procedures square measure associated with some day ahead pointwise forecast and want to 2 ways square measure a statistic autoregressive model, partial linear semi-parametric model [2].

Aowabin Rahman et al., a repeated neural network model to form medium-to-long term predictions of electricity consumption profiles in business and residential buildings at the one-hour resolution [3]. Jihui Yuan et al., ANN models are developed to predict the long run seasonal hourly electricity consumption for the 3 areas, considering the Feed-forward ANN trained with the Levenberg-Marquardt (LM) back-propagation algorithms [4].

Kunlong et al., to predict the annual household electricity consumption exploitation ensemble learning technique. The intense gradient boosting forest and feedforward deep networks square measure served as base models [5].

K. P. Amber et al., to match prediction capabilities of 5 completely different intelligent system techniques by prediction electricity consumption of associate administration building set in London, UK. These 5 techniques are; multiple correlations (MR), Genetic

Programming (GP), Artificial Neural Network (ANN), Deep Neural Network (DNN) and Support Vector Machine (SVM) [6]. Radisa et al., prediction of heating energy consumption of a university field, numerous artificial neural networks square measure won't to FeedForward BackPropagation Neural Network (FFBPNN), Radial Basis Function Network (RBFN) and Adaptational Neuro-Fuzzy interference system (ANFIS) [7].

L.G.B. Ruiz et al., Elman Neural Network for prediction such consumption and that we use a genetic algorithmic program to optimize the weight of the models [8].

M. Beccali et al., prediction model supported associate Elman artificial neural network (ANN) for the short-time prediction of the manage electricity consumption associated with a residential area [9].

O.L Usman, O.B Alaba a man-made Neural Network-based model, usually referred to as Radial Basis operate (RBF) network to time-series prediction of electricity consumption in Nigerian exploitation historical data [10].

Zuzana Majdisova et al., many RBF approximation ways square measure concisely introduced and a comparison of these is formed with regard to the steadiness and accuracy of computation [11]. Shiwei Yu et al., a hybrid Particle Swarm improvement and Genetic algorithmic program optimized Radial Basis operate (PSO–GA-RBF) neural network for prediction of annual electricity demand [12].

III. METHODOLOGY

The Radial basis function network is an artificial neural network. The Radial Basis function is an important tool in solving problems, including function approximation, time series prediction, and classification.

A Simple Algorithm for RBF Network

Step1: Read the data file Input K and
set of points $(x_1 \dots \dots x_n)$, the number of iterations I.

Step2: Place centroids $(c_1 \dots \dots c_k)$ at random locations,
set i=0.
/* Distance between instance x_i and cluster c_j*/

Step3: Find nearest centroid for same
Weights c_j, $\min_j D(x_i, c_j)$

Step4: Assign the point x_i to cluster c_j.

Step5: For cluster j= 1…..k;

Step6: Compute $c_j(b) = 1/n_j x_{i \to c_j} \sum x_i(b)$ for b=1…..d
and compute MSE.

Step7: Update all parameters j and k.

Step8: Repeat Step6 to compute new value for MSE.

Step9: If new MSE is smaller than the old MSE then
increase it else decrease it.

Step10: If i<I then goto Step7 else End

IV. RESULTS AND ANALYSIS

In this work, energy consumption forecasting of a house is done by FeedForward BackPropagation Network, Elman BackPropagation Network and Radial Basis Function Network. The historical dataset is used for the above three algorithms.

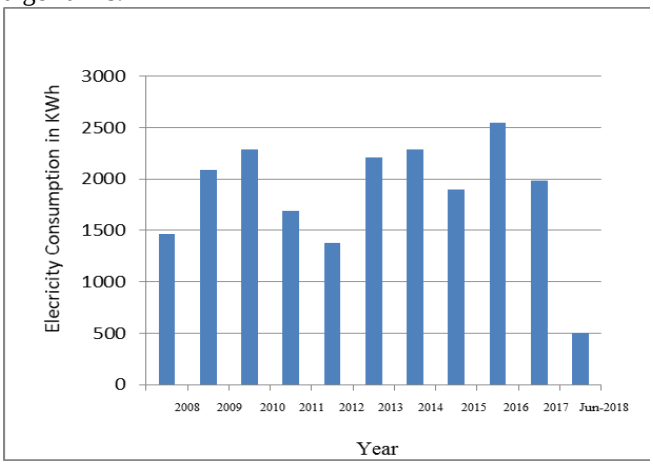

Figure1: Forecasting Energy Consumption in Single house

In Fig1, Describe the output of the actual data. Actual data which is collected from the Electricity Board in India, and data collected over the past 10 years. The Radial Basis Function Network used to produce the output.

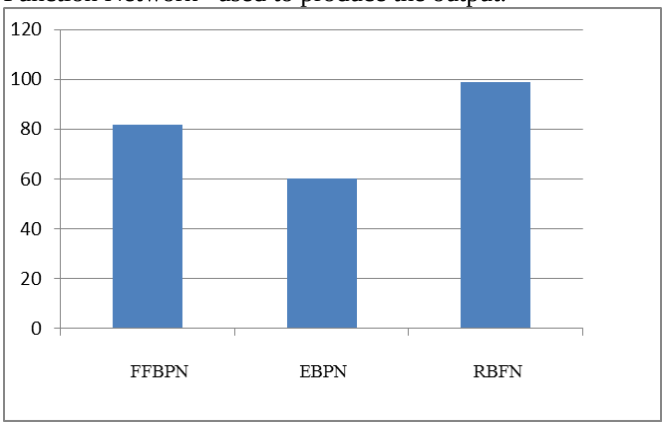

Figure2: Comparison of three Network with its accuracy.

In Fig2, gives the comparison of three network models, such as FeedForward BackPropagation Network, Elman BackPropagation Network and Radial Basis Function Network which clearly states that Radial Basis Function Network is to produce the best and efficient accuracy values other than the two network model.

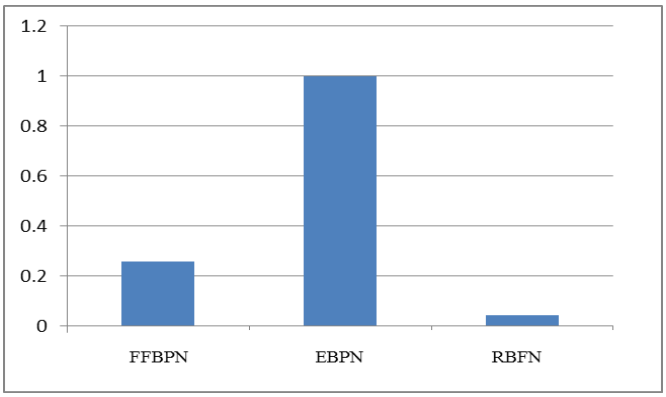

Figure3: Comparison of three Network with its Error

n Fig3, shows the comparison of three network models, such as FeedForward BacPropagation Network, Elman BackPropagation Network and Radial Basis Function Network which clearly states that Radial Basis Function Network is to produce lessor error other than the two network model.

V. CONCLUSION

In this paper, an attempt is made to forecasting energy consumption of a house with the dataset using different network models like FeedForward BackPropagation Network, Elman BackPropagation Network, and Radial Basis Function Network. The result obtained from the study showed that Radial Basis Function Network is capable of forecasting energy consumption with high-level precision than its above two network model, evident from the computed MSE values and accuracy.

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