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International
Journal
Of Modern Engineering Research (IJMER)

Short Term Load Forecasting Using Multi Layer Perceptron

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Abstract: *Load forecasting is the method for prediction of Electrical load. Short term load forecasting is one of the important concerns of power system and accurate load forecasting is essential for managing supply and demand of electricity. The basic objective of STLF is to predict the near future load for example next hour load prediction or next day load prediction etc….There are various factors which influence the behaviour of the consumer load. The factors that we consider in this paper are Load,Temperature, humidity, time. The ANN is used to learn the relationship among past, current and future parameters like load, temp. In this paper we are using Multi parameter regression and comparing the results with the Artificial Neural network output. Finally, outcomes of the approaches are evaluated and compared by means of the Mean absolute Percentage error (MAPE).ANN outcomes are more fairly*
accurate to the actual loads than those of conventional methods. So it can be considered as the suitable tool to deal with STLF problems.
Keyword: *Multi parameter regression, ANN, load, temperature, humidity, MLP.Short term load forecasting using Multi layer perceptron Network*

I. Introduction

Load forecasting can be defined as the technique to estimate of how much electricity will be needed in the future.Load forecasting has always been important for planning and operational decisions conducted by utility companies. Electricity load forecasting is an important task for supply and demand management of electricity Imprecise load forecasting will raise the operating cost of the utility company. Especially under a market environment, accuracy means money. It is estimated that a raise of 1% in prediction error caused an increase of a million pounds in operation costs per year for an electricity utility. Forecasting the load is a difficult task as the load series is complex and exhibits several levels of seasonality. The load at the present hour is dependent on load at the previous hour, load at the same hour on previous day and on the load at the same hour on the day with the similar denomination in the before week.

There are mainly five types of load

1. Domestic
2. Commercial
3. Industrial
4. Agricultural
5. Other loads like street lights, bulk supplies etc.

Commercial and agricultural loads are characterized by seasonal variations. Industrial loads are base loads and are weather dependent.

II. Load Forecasting Types

There are three types of load forecasting

1. Short term load forecasting :one hour to one week
2. Medium term load forecasting: one week to one year
3. Long term load forecasting: longer than a year

In this paper the type of load forecasting we used is short term load forecasting (STLF). Short term load forecasting is used for day to day function and scheduling of the power system. Long term load forecasting is mainly used for system planning. It typically covers a period of 10 to 20 years. Medium term load forecasting is mainly used for the scheduling of fuel supplies and maintenance, which usually covers a few weeks. STLF is used to reduce the operating cost, electric supplier will use forecasted load to control the quantity of running generator units. It is important to supplier because they can use the forecasted load to control the number of generators in operation. STLF is very important for electricity trading. Hence, there is need to establish high accuracy models for STLF, which has many difficulties. The first reason is because the load series is complex and exhibits several levels of seasonality. Secondly, the load at a given hour is dependent not only on the load at the previous hour but also on many other factors.

III. Factors Effecting Self

It is important to consider several factors for short term load forecasting such as time factors, weather data, and possible customer classes. The most important factor in STLF is time as its impact on consumer load is highest. The time factor includes the time of the day, the day of the week, the hour of the day. The load is also influenced by Weather conditions, which is the most important variable for load forecasting. Temperature and humidity are the most frequently used load predictors. Temperature is the measure of degree of hotness or coldness of a body. Temperature is directly proportional to load during summer season and inversely proportional during winter season. Humidity is a word used for the amount of water vapours in air. The assortment of water vapours and humidity was defined as absolute humidity. It is expressed in terms of percentage. There are also factors like wind speed, precipitation, cloud cover etc…In this paper the factors that we consider are Time, load, Temperature and humidity.

IV. Conventional Methods

Many forecasting techniques have been applied to Short term load forecasting to improve accuracy and efficiency. They can be classified as either traditional methods or modern methods. The techniques that come under traditional method are

1. Similar day look up approach
2. Regression based approach
3. Time series analysis
4. Support vector machines

The modern load forecasting methods are

1. Artificial neural networks
2. Fuzzy logic
3. Expert system

In this paper we have taken one traditional method and one modern method to compare the results. The conventional method used here is Regression. The term "regression" was used in the nineteenth century to describe a natural phenomenon, namely that the progeny of exceptional individuals tend on average to be less exceptional than their parents and more like their more distant ancestors. Linear regression is one of the most widely used statistical techniques. By using this statistical relationship can be calculated between total load and weather conditions.

The objective in regression analysis is to identify a function that describes, as closely as possible, the relationship between these variables so that the value of the dependent variables can be predicted using a range of independent variables values. In the multiple linear regression method, the load is found in Short term load forecasting using Multi layer perceptron Network terms of explanatory (independent) variable such as weather and other variables which influence the electrical load.

V. Ann Approach for Load Forecasting

ANN is usually formed from many hundreds or thousands of simple processing units, connected in parallel. Artificial neural networks are developed since 1980 and extensively applied. ANN is the most efficient method for load forecasting because of many reasons like it is able to approximate numerically any continuous function to a desired accuracy. ANN is capable of mapping an automatic relation between input and output parameters. They learn the relationship and store this learning into their parameters. Multi layered perceptron is the most widely used ANN model.

It consists of one input Layer, one or more hidden layers and one output layer. Each layer employs several neurons and each neuron in a layer is connected to the neurons in the adjacent layer with different weights. Signals flow into the input layer, pass through the hidden layers, and arrive at the output layer. We used a fully connected feed forward type neural network consisting of one hidden layer. Back propagation algorithm was utilized for training. The optimal number of hidden neurons was obtained experimentally by changing the network design and running the training process several times until a good performance was obtained.

IV. Figures and Tables

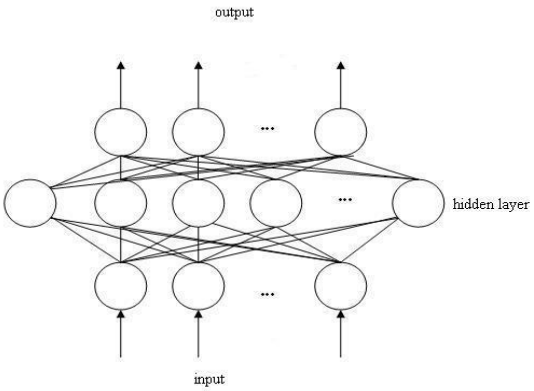
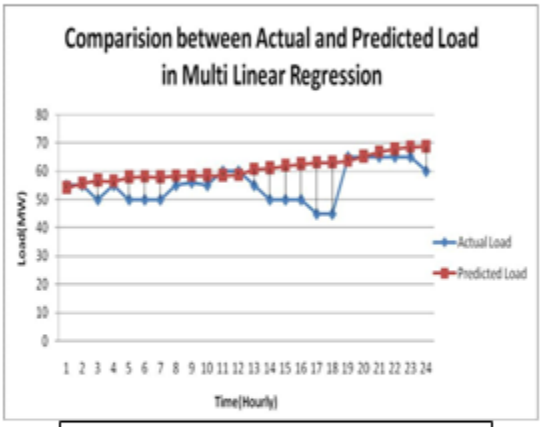


Fig. 1 Multi Layered Perceptron

Graph1: Multi linear regression

TIME	Actual Load	Predicted Load	MAPE
1	55	54.03545	0.073072259
2	55	55.7359	0.05575013
3	50	56.75779	0.563149263
4	55	56.47803	0.111971927
5	50	57.8264	0.65219994
6	50	57.97981	0.664984129
7	50	57.83448	0.652873327
8	55	58.36772	0.25513003
9	56	58.27573	0.16932534
10	55	58.42701	0.259621791
11	60	58.41611	0.109992353
12	60	58.62287	0.095634293
13	55	60.72875	0.433996456
14	50	61.06994	0.922495115
15	50	61.98087	0.998405737
16	50	62.51197	1.042664176
17	45	63.04307	1.670654757
18	45	63.11112	1.676956014
19	65	63.61662	0.088678147
20	65	65.20825	0.013349337
21	65	66.85322	0.118796422
22	65	67.90072	0.185943522
23	65	68.56839	0.228742788
24	60	68.77514	0.60938497

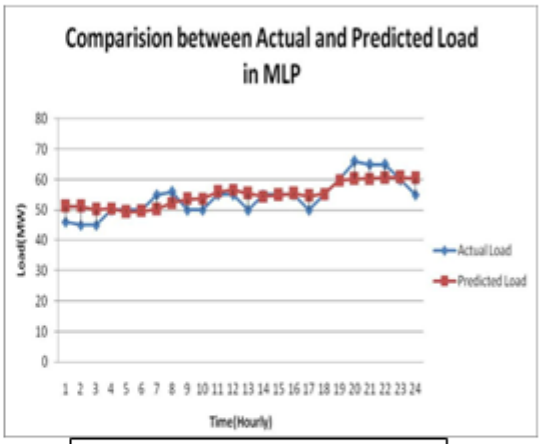
Table1: Multi Linear Regression Comparison table



Graph1: Multi linear regression

Graph 2: Multi layer perceptron

Time	Actual	Predicted	Mape
1	46	51.21164	0.472068
2	45	51.21462	0.575428
3	45	50.16063	0.477836
4	50	50.50773	0.042311
5	50	49.3891	0.050908
6	50	49.65262	0.028948
7	55	50.20518	0.363244
8	56	52.3951	0.268221
9	50	53.51667	0.293056
10	50	53.72032	0.310026
11	55	55.89173	0.067555
12	55	56.62574	0.123162
13	50	55.46758	0.455632
14	55	54.49764	0.038058
15	55	54.90636	0.007094
16	55	55.42111	0.031903
17	50	54.62491	0.385409
18	55	55.31143	0.023593
19	60	59.76695	0.016184
20	66	60.13748	0.370108
21	65	60.33373	0.29912
22	65	60.52262	0.287011
23	60	60.75657	0.05254
24	55	60.50058	0.41671

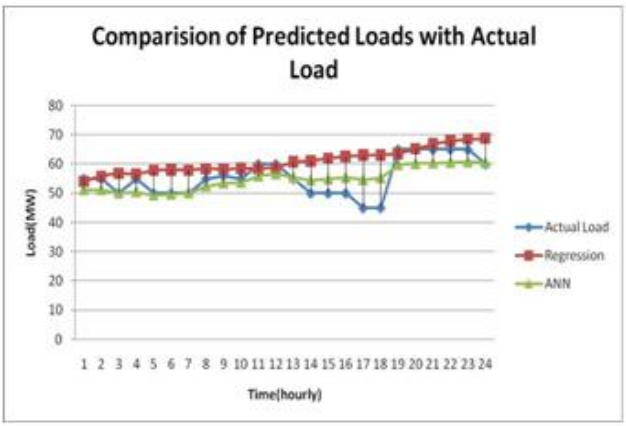


Graph 2: Multi layer perceptron

Table2: Multi layer Perceptron Comparison Table

METHOD	MAPE
MULTI LAYER PERCEPTRON NETWORK	0.227
MULTI LINEAR REGRESSION	0.4855

Table3: comparision of Map



Graph 3: Comparison table

VI. Conclusion

In this paper we have presented an electric load forecasting using two methods .The first method is the conventional method called multi linear regression and second method is the Artificial neural network. The result of MLP network model used for one day ahead STLF shows that the network has a good performance and reasonable prediction compared to conventional method. Mean absolute percentage error is calculated between actual and predicted loads for both the methods. The results suggest that ANN model with MLP structure can perform good prediction with least error and finally this neural network could be an important for short term load forecasting.

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