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ICT FOR AUTOMATIC FORECASTING OF SHORT TERM ELECTRICAL POWER INTAKE: A CASE HAVE A LOOK AT IN CHENNAI, TAMIL NADU

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ABSTRACT :

Precise short term Electrical power forecasting is essential for efficient planning of electrical power systems operations. We represent a model for regular electricity forecasting of the short term (1day) electrical power utilization in Chennai, Tamil Nadu. The proposed model is created based on the analysis of historical reports of power utilization joint with information about the supplementary factors that influence the utilization of electrical power. The data is grouped into segments with the purpose of classifying similar utilization patterns. These utilization patterns are then correlated with weather forecasting conditions and used to create a computerized prediction model for electricity load forecasting. The computerized prediction model was developed in this project presents a faultless and reliable balance to manual prediction and is presently being evaluated for the chance of enhance the manual electricity forecasts with further information.

KEYWORD: ICT, Electrical forecasting, clustering, decision tree, regression, power utilization,

prediction, EDM, WEKA

INTRODUCTION:

In the communication development era ICT uses in the economic development of rural society in India. Political, Cultural, Socio-economic progress and decision selections at the moment rests on the power to access, gather, analyze and utilize records and facts. ICT is the medium that transmit particulars and facts to individual to extend their selections for Economic and social progress. In the recent day publics are carrying a hand-held pc connected to the internet to urge the data concerning the globe at their fingertips. Government of Asian country has associate valiant objective of remodeling the citizen-government interaction the least bit levels to by the online mode that is e-Governance. A triumphant ICT application in e-Governance giving a single step results for rural community is the important need now. ICT to improve the Electronic Governance in the course of wireless communication, because it is interlinked one.

Exact short term Electricity forecasting is essential for efficient operations planning of electrical power systems. Electricity Load forecasting can be classified into three types based on prediction period such as short term load forecasts period from one hour to one week, medium term load forecasts period from a week to a year, and long term load forecasts are stretch for more than one year. The different types of electricity load forecasts are related for various kinds of decisions in a power generation company. The long and medium term forecasts are used to verify the capacity of creation, conduction, allocation, annual maintenance, and future expansion plans, etc. Short-term forecasts are used for prosperity development and functions of electrical systems and present input data for electricity load flow and emergency scrutiny.

Data mining is used for a ramification of purposes in each the private and public sectors. The different algorithms and strategies like classification technique, Clustering technique, Regression model, artificial Intelligence and Neural Networks, association rules, decision tree, Genetic set of rules, Nearest Neighbor methods are used for find new facts discover from big databases. The discovery of electricity is the utmost attainment of human. Its use has made our lives so comfortable; today scientists in various countryside are trying greatest use of it for all purposes. Modern society today is enjoying all the facilities of communication are possible only through electricity. The main aim of Tamil Nadu Electricity Board (TNEB) is to carry out production, diffusion and circulation in an efficient manner and provide quality power to its end users. Availability of power is one among the largest inputs important for the sustained increase of any cost-effective system. This becomes even more crucial for a city like Chennai, which is one of the most industrialized and urbanized City in Tamil Nadu. In this cram give the awareness on the usage of various data mining techniques in power forecasting for Chennai, Tamil Nadu.

2. OBJECTIVE:

Electrical demand forecast is done using a wide variety of methods and techniques. Medium term electricity load and long term forecasting is usually prepared by using econometric and end-use based approaches while short term forecasting use different methods such as single day approach, regression model, expert systems, fuzzy logic, statistical learning algorithms in data mining. In recent years there has been a growing the use of Data Mining techniques, as part of attempts to enhance transparency and interpretability of the prediction models. This approach gives the opportunity of find out new patterns and hidden dynamics that describe the performance of the electrical load capacity related factors and based on that constructed models which are easily understand also add to an improve the awareness of the necessary factors that affect the power consumption.

The main aim of this research is to build up an computerized prediction representation that can be useful as an accurate and consistent complement to the daily manual (1day) forecast of electrical utilization that is presently complete by EDM.

In this work, we use data discovery investigation with detailed representation to make easy to understanding the patterns and the structure of the models. Investigation of historical records of electrical consumption in Chennai, Tamil Nadu indicates that the short term power consumption is characterized by three factors: First one is the type of day (workday, weekend or holiday), the second one is temperature, and third is season. The routine prediction model that we present in this paper takes input of these three reasons and generates as output a forecast of the utilization per hour for the day is a matter. In the experimental evaluation we use chronological data and thus the authentic temperature while the intended input for the ultimate model based on the forecasts of the temperature.

3. PROBLEM STATEMENT:

Here we intend to develop an ICT based Prediction model for forecasting the power utilization per day which shows a balanced correlation with manual prediction of power utilization. Tamil Nadu Electricity Board (TNEB) needs to forecast electrical load one day in advance in order to optimize energy production.

4. THE DATA MINING PROCESS METHODS

4.1. Clustering

Clustering examination is normally used in numerous packages including, pattern recognition, data evaluation, and photograph processing. Clustering also facilitates in classifying documents on the web for records discovery. In data mining, cluster examination affords a tool to attain near to the distribution of statistics and study the individuality of each cluster. Clustering can be labeled into the subsequent categories:

- Partitioning method
- Hierarchical method
- Density-primarily based technique
- Grid-based approach
- Model-primarily based technique
- Constraint-based technique

Clustering is an unproven gaining knowledge of method that separates a facts set into groups. if you want to cluster the burden forecasting dataset, first detached the long time motion prepare all statistics comparable. The long-term trend changed into eliminated via fitting the facts to a curve articulated with the aid of the quadratic polynomial equation.

$$p \;\; 12.45*10^{6} x^{2} \;\; 1.5*10^{3} x \;\; 115.6$$

For clustering we use the expectation Maximum set of rules entrenched in the system mastering workbench available on the WEKA. We adopt clustering with 0, 1, and 2 classes. Clustering with three training data set provide better effects. After clustering the electricity load forecasting dataset then we assemble a character version for every organization.

4.2 Decision Tree

A decision tree is a shape that includes a root node, branches, and leaf nodes. Every inner node denotes a test on an attribute, each department denotes the outcome of a take a look at, and each leaf node holds a class label. The topmost node in the tree is the basis node.

The blessings of having a choice tree are as follows:

- It does no longer require any domain understanding.
- It is simple to comprehend.
- The studying and type steps of a choice tree are simple and speedy.

We used the C4.5 choice tree algorithm, also from WEKA, to teach a classifier that assigns a brand new instance to one of the clusters. Figure 1 indicates the resulting classifier for three instructions: class0 corresponds to summer time workdays, class1 corresponds to wintry weather workdays, and class2 corresponds to weekends and vacations.

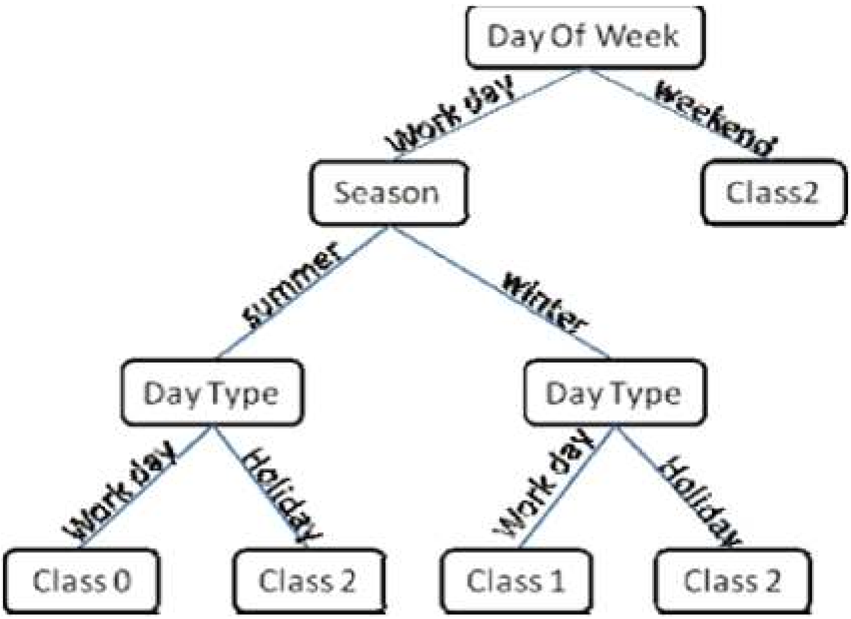

Figure 1: Decision Tree which describe the Relation among the Clusters and Time Factors disturbing the Electrical Demand

In this part we use the output of this level to construct three models one for each magnificence. Then those models will serve to forecast the electricity intake. Once our statistics are grouped in to classes representing seasons, workdays, weekends and holidays, we built fashions for every class the use of the multiple regression equation given beneath.

$$L_c^{d\ 1}\quad b1*L_C^{d}\quad b2*T^{d\quad 1}$$

Where L the electric load, d is the index of the day, c is the elegance of the day and T is the temperature. We are using most effective the temperature as the weather aspect, because during the exploratory data analysis we found that the humidity is much less correlated with the electricity consumption

The version became trained using the records from January 2008 to December 2012, and the records of year 2013 have been used as take a look at set. Some effects of the modeling are provided in figures 2, 3, 4, 5 and in the below table.

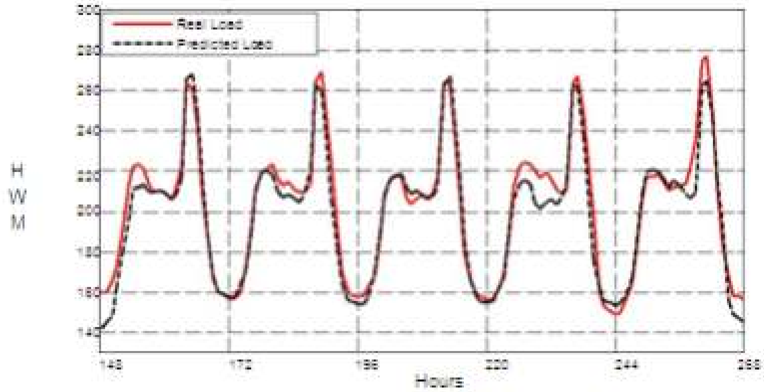

Figure 2: Sample of Comparison between the Predicted and Real Electricity Consumption for the Working Days of summer 2013.

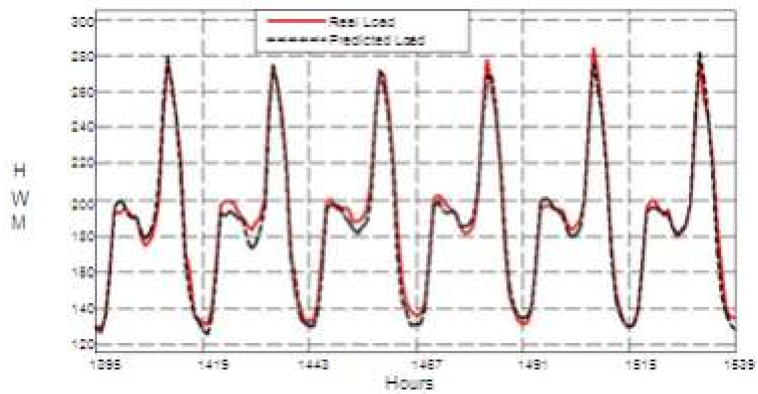

Figure 3: Sample of Comparison between the Predicted and Real Electricity Consumption for the Working Days of winter 2013.

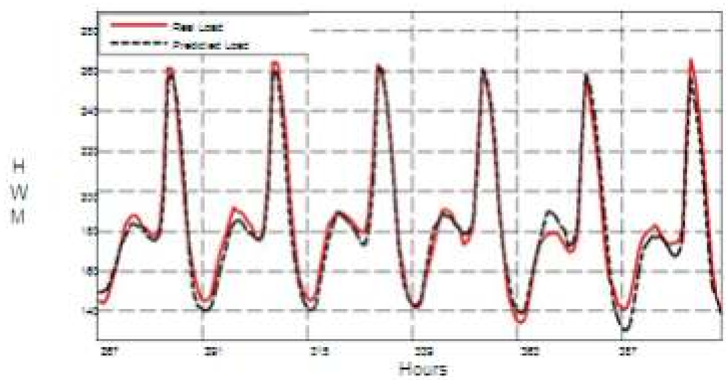

Figure 4: Sample of Comparison between the Predicted and Real Electricity Consumption for the Saturdays of 2013.

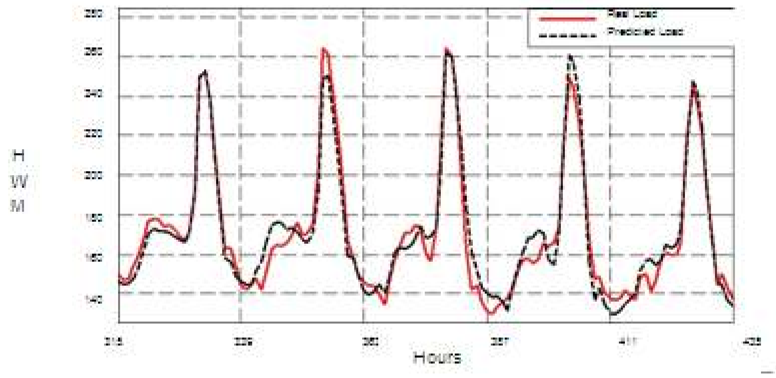

Figure 5: Sample of Comparison between the Predicted and Real Electricity utilization for Sundays of 2013.

4.3 MAPE (Mean Absolute Percent Error):

The beneath table affords the average of the Mean Absolute percent error (MAPE), acquired for every magnificence. For the weekends the biggest MAPE changed into acquired in Sundays and for workdays the largest MAPE turned into get at may be in summer season. The MAPE is calculated using equation.

$$MAPE \quad \frac{1}{N}\sum_{i}^{N}\left|\frac{Re\,a\,Load \;\; Forecasted\ Load}{Re\,a\,Load}\right|$$

Where N is the quantity of data point and i the index of the data point.

	Average MAPE	Maximo MAPE	Minimo MAPE	Standar Deviation
WorkDays (summer)	2.03	10.38	0.011	2.35
WorkDays (winter)	2.15	10.22	0.13	1.62
Saturdays	2.25	6.02	0.1	2.07
Sundays	4.35	12.07	.07	2.63
Average	2.3	12.07	0.015	2.5

The average of MAPE of the 326 days forecasted during the years 2013 is 2.3% which is a result. The prediction of the public holidays is not considered in this approach since each public holiday has its own individuality and can take place in different seasons.

3.2 Data Preparation:

In this report, training data phase consisted of cleaning the strengthening load statistics and the climate records. In power load records we determined several ordinary load curves which had been removed from our database, there were no lacking values inside the electric load records. The climate records had numerous lacking values, which were replaced with the aid of the final result of linear interruption among the precedent and the antecedent of every lacking records point. After the correction of the missing statistics we represent the electrical load in a matrix format with the time is related to days and the columns to hours.

3.3 Data exploration:

EDM has get entry to facts of power consumption in distinctive regions of which Chennai, Tamil Nadu location is one that one turned into decided on for the look at. The facts correspond to hourly measurements from January 2009 to December 2013. Due to the fact the weather information changed into not to be had consistent with hour from EDM for the corresponding period, we downloaded it from internet. Records exploratory analysis becomes completed to be able to advantage insight of the facts. We present below graph that explains the distinctive of the electricity load in Chennai, Tamil Nadu.

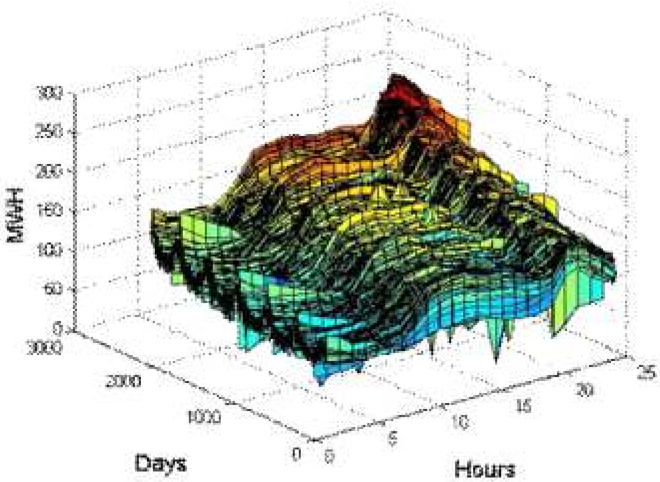

Figure 6: 3D design of Electrical utilization of Chennai Region from 2009 to 2013

Figure 6 is a three-dimensional design of electrical load; it shows the variant of the intake of electricity in keeping with hour over each day and for the duration of the five year length. Figure 7 is a two-dimensional design of the electrical load showing the seasonal and the long- time period trend. Figure 8, suggests the correlation among the long term electrical demand trend and the monetary development, expressed in GDP according to capita.

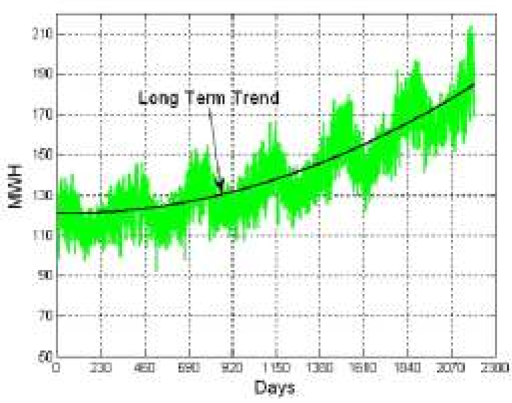

Figure 7: Electrical utilization of Chennai Region from 2009 to 2013 and the Long-Term Trend

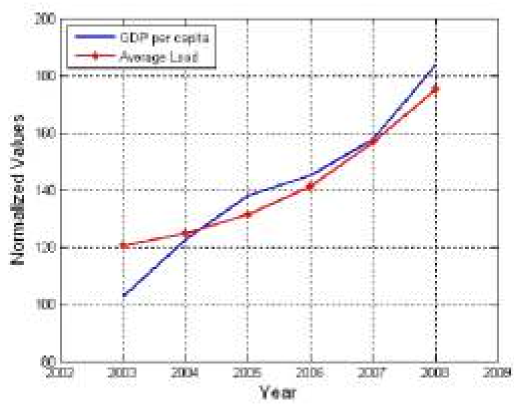

Figure 8: contrast of Electrical utilization Trend and the GDP Growth in the period 2009 -2013

The below figure 9 shows the regularize electrical load curvature after removing the long-term trend, it shows that the means is zero but with the seasonal variability remaining.

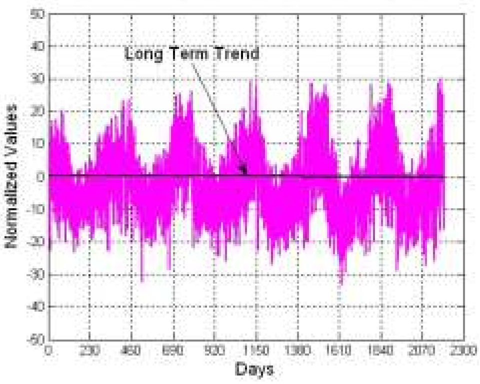

Figure 9: The Electrical utilization Data Without Trend

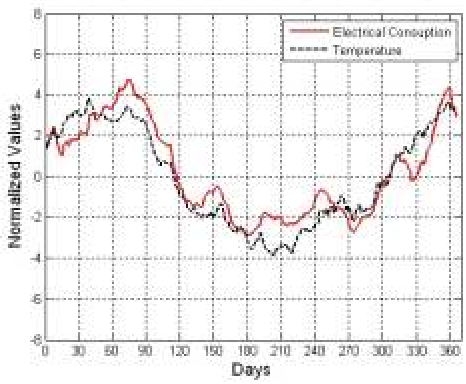

Figure10: Average Temperature and Average Utilization of the Years 2009 and 2013

The above figure 10 is an assessment between the electrical load and the temperature over the year. There's a strong correlation (Correlation Coefficient is 0.81) between the two variables. The high utilization and high temperature match up to the months of January, February, March, October, November, December (summer , warm and humid duration in Chennai, Tamil Nadu). The relaxation of length is considered the spring season (cooler and dry). A similar comparison become made among load and humidity, but it changed into discovered that the correlation is not robust (Correlation Coefficient is 0.25).

4. CONCLUSIONS

This paper exhibits work to represent model to forecast electrical utilization. Past data of electrical utilization is used with a set of approved models for forecasting electrical utilization. The rudimentary data exploration assist in better understanding of electrical consumption factors in Chennai, Tamil Nadu. The splitting of data into various categories of correlated days enhanced the implemented model's performance and efficiency. The process model offers a wide picture of power consumption behaviour which further gives a good market and risk analysis to forecast electricity consumption.

To build various forecasting techniques, we are in need of different data types, which was one of the problems faced during this research. The developed automated prediction models, will find its significant role in the process of load forecasting and these models will be subjected to further enhancement for the application at the EDM.

REFERENCES

1.V.K.Bhansali,"Energy conservation in India-Challenges abd achievements",IEEE,Industrial Automation and control,1995.
2.Nissanga Nishad Rasanajan,Nisal perera,"Energy Audit:A case study",IEEE, Industrial and Automation,1996.
3.Hari Seetha and R. Saravanan, "Short Term Electric Load Prediction Using Fuzzy BP".
4.Journal of Computing and Information Technology - CIT 15, 2007, vol 3, pp. 267–282

doi:10.2498/cit.1000987.
5.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, pp. 23±34.
6.Kavitha, M.Punithavalli, “Clustering Time Series Data Stream – A Literature Survey”.
7.(IJCSIS) International Journal of Computer Science and Information Security, Vol. 8, No. 1, April 2010.
8.Senthamarai, A.Krishnan and R. Hemalatha, “Performance Monitoring of Energy Flow I in the Power Transmission and Distribution System Using Grid Computing”. Journal of Computer Science 3 (5), pp. 323-328, 2007, ISSN 1549-3636.
9.Subbaraj and V.Rajasekaran, “Peak Load Forecasting Using Optimal Linear Combinations of Artificial Neural Networks”. International Journal of Electrical and Power Engineering 2 (I): pp. 50-54, 2008, ISSN: 1990-7958.
10.EDM, "Relatorio Anual de Estatistica," EDM2006.
11.M.L.G.a.U.o.Waikato.(2010,22ofNovember). http://www.cs.waikato.ac.nz/ml/weka/index.html.
12.Meetamehra.5ofoctober2010).DemandForecastingforElectricity:
http://www.regulationbodyofknowledge.org/documents/044.pdf.
13.Vera Figueiredo, Fátima Rodrigues, Zita Vale, “An Electric Energy Consumer Characterization Framework Based On Data Mining Techniques”. IEEE Transactions On Power Systems, Vol. 20, No. 2, May 2005.
14.H. Witten and E. Frank, Eds., Data Mining: Pratical Machine learning Tools and Techniques (Data management. San Francisco: Morgan Kaufmann, 2005, p.^pp. Pages.
15.J. Han and M. Kamber, Eds., Data Mining: Concept and Techniques (Data Management. San Francisco, 2006.
16.T. Hastie, et al., Eds., The Element of Statistical Learning: Data Mining, Inference and Prediction (Springer Serie in Statistics. Canada, 2001, p.^pp. Pages.
17.Y. Dodge, "Learning to Reason About Data," in The Concise Encyclopedia of Statistics, S. Science, Ed., ed, 2008.
18.NIST/SEMATECH. (22 November 2010). NIST/SEMATECH e-Handbook of Statistical Methods, http://www.itl.nist.gov/div898/handbook/.
19.P. C. (NCR), et al., "CRISP-DM 1.0: Step-by-step data mining guide," SPSS2000.
20.W. Underground. (2010, 20 September 2010). http://www.wunderground.com/.
21.X. Lua, et al., "Electricity market price spike forecast with data mining techniques," Elsevier, vol. 73 (2005), pp. 19-29, 2004.
22.J.-q. Li, et al., "The Application of Data Mining in Electric Short-term Load Forecasting," in Fifth International Conference on Fuzzy Systems and Knowledge Discovery, 2008, pp. 519-522.
23.E. Srinivas and A. Jain, "A Methodology for Short Term Load Forecasting Using Fuzzy Logic and Similarity," in The National Conference on Advances in Computational Intelligence Applications in Power, Control, Signal Processing and Telecommunications (NCACI-2009),, Hyderabad, India, 2009, pp. 1-7.
24.A.b.W.A. Razak, et al., "Short Load Forecasting Using Data Mining Technique," in 2nd IEEE Internacional Conference on Power and Energy (PECon 08), Maylasia, 2008, pp. 139-142.
25.H. Mori, et al., "Data Mining for Short-term load Forecasting," in Technical Meeting on Power Engineering, IEEE, Japan, 2002, pp. 623-624.
26.Moghram and S. Rahman, "Analysis and Evaluation of Five Short-Term Load Forecasting Techniques," in IEEE Transation on Power Systems, New York, 1989, pp. 1484-1491.

27.M. H. Y. Shahidehpour and Z. Li, "Short-Term Load Forecasting," in Market operation in Electric Power System: Forecasting, Scheduling, and Risk Management, I. John Wiley & Sons, Ed., ed, 2002.
28.E. A. Feinberg and D. Genethliou, "Load Forecasting," ed, pp. 269-285.
29.G.A. Adepoju, et al., "Application of Neural Network to Load Forecasting in Nigerian Electrical Power System," The Pacific Journal of Science and Technology, vol. 8, pp. 66-72, 2007.
30.H. K. Alfares and M. NAzeeruddin, "Electric load Forecasting: Literature Survey and Classification of Method," International Journal of System Science, vol. 33, pp. 23 - 34, 2002.

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