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A Survey on Electricity Consumption Forecasting using Data Mining

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ABSTRACT: Today electricity is one of the basic need for living the life comfortably. Without electricity the industrial work, domestic work can get stopped. As electricity cannot be stored it need to be generated, we need to know the electricity demand. Data mining is one of the technique which is used for predicting the electricity demand. Some of the data mining techniques are predictive modeling, clustering, link analysis and deviation detection. The survey presents the recent study on predicting the electricity demand. It is possible to do the enhancement using machine learning approach.

KEYWORD: Predictive modeling, Data mining, Artificial Neural Network.

I.INTRODUCATION

Energy consumption is very rapid process in the world. As fossil fuels are consumed rapidly there is inadequacy to meet the energy demands. Electricity is the day-to-day need of the people. Electricity could not be invented as it is a natural phenomenon. It has great importance in our life as it illuminates houses, switch on the televisions, helps in cooking food, reduces work load with the help of many electric appliances. Electricity comes from photo voltaic energy, non renewable fuels, hydroelectric energy, nuclear energy, wind energy. Energy is the reliable source to supply electricity which is pollution free. For no pollution, we can simply go for NAP i.e., North American Power. It offers a gas which is called “cleangas”, that don’t cause pollution. They also provide a product called “greenelectric”. They also carry out the generation of uncontaminated energy from renewable sources.

In this survey the techniques of data mining are used to calculate the electricity demand. For this we need to know whats is data mining ?

A. *DATA MINING*

Basically data mining is also known as knowledge discovery. Data mining is extracting data from large databases and transform it into understandable structure for further use. Data mining is the analysis step of the “knowledge discovery in databases” process or KDD. The various data mining techniques are predictive modeling, link analysis, clustering, etc.

Many of the data mining techniques involve the use of Artificial Neural Networks. So let us see what is ANN?

B. *ARTIFICIAL NEURAL NETWORK*

An Artificial Neural Network is a group of interconnected nodes. It is similar to the network of neurons in the brain. In machine learning an ANN is a network inspired by biological neural networks.

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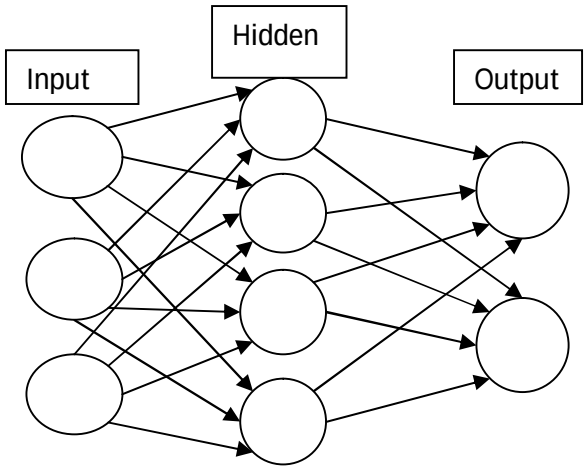

Figure I Artificial Neural Network

Here in figure 1, each circle indicates an artificial neuron and the arrow indicates the connection from the output of one neuron to the input of another neuron.

The survey aims at prediction of electricity demand. We cannot imagine our living without electricity because we are used to it and our work depends totally on electricity. For example, we can consider home appliances such as iron, washing machine, tube lights, fans, induction, etc. For all these things to work we require electricity. Therefore, we need to predict the electricity demand as it can only be generated. To maintain the work load we must know how much electricity is required. We need to calculate the electricity demand so that accordingly the electricity can be generated.

II. LITERATURE SURVEY

In this paper, the work done in the past years is presented. The various techniques which are used for forecasting electricity are put forth. The merits and demerits of the techniques are also explained.

Navjot Kaur and Amrit Kaur explores the predictive modeling technique for forecasting electricity. The value prediction method is implemented with artificial neural network. The meteorological factors such as temperature, humidity, rainfall, public holidays, etc are considered. The two methods for load forecasting are categorized as models and methods. Time series and regression analysis contribute as models and methods belong to computational and artificial intelligence. Regression based models are used because regression methods are easy to implement. Time series are the oldest methods used for load forecasting. To improve the load forecasting the approach can be explored to predict the agricultural electricity consumption.

Jian Deng has discussed electricity prediction using artificial neural network of China. The goal of his study is to provide accurate estimation model of electricity demand. The multilayer perceptron ANN model i.e., Artificial Neural Network with error back-propagation algorithm is used. This algorithm is used to estimate the electricity demand.

Harmanjot Singh Sandhu and Liping Fang has proposed a technique for calculating hourly electricity prices for wholesale electricity market in Ontario, Canada using feed forward neural network combined with data mining. For training the neural network 135 days are selelcted. The forecasting is done for nine days from different seasons. The similar prices days are used for each hour from a set of 90 days. The proposed method predicts the accurate electricity consumption from low to medium price.

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Weijie Mai and C. Y. Chung has put forth the idea of forecasting model on hourly basis for large commercial office buildings based on radial basis function neural network (RBFNN) which uses weather and historical load data. It is beneficial because it does not require any trial and error procedures. The data required consists only the weather and electric power consumption.

Hiroyuki Mori and Akira Awata has introduced a new method regression tree and Normalized Radial Basis Function Network i.e., NRBFN for electricity price forecasting. *If-then* rules are used to classify the input data. The combination of ANN and regression reduced the maximum errors for forecasting electricity prices.

Amit Jain has described the idea of short term load forecasting using SVM (Support Vector Machine) based on clustering. In this the available past data is clustered for forecasting the next day load. All the similar patterns of the day are considered for training the SVM. Also the threshold between the daily average loads of all the input training patterns and input testing patterns are used. The results of both with clustering and without clustering are put forth and form the different cluster patterns for different threshold values. This method avoids heavy computation.

Jongwoo Choi and Youn Kwae Jeong has proposed a method using clustering and silhouette algorithm for simple building electric power prediction model with local weather forecast information. A data mining technique called K-means clustering algorithm is selected. Cluster analysis and Correlation analysis are performed to find energy usage patterns. Cluster analysis silhouette index indicate that the season and the day type time parameters are important factors to classify the total electric power usage. Correlation analysis show the energy facility working patterns are strongly related to local weather conditions. The developed model can be used to replace a wattmeter to a computer application. The model can be also applied for optimal control problems in smart grid.

Noorollah Karimtabar and Sadegh Pasban has used data mining techniques to predict the electricity consumption in Iran- Mazandaran province. The regression model is used for the prediction. The prediction variables used are temperature, moisture and electricity consumption price. The research aimed at predicting recent years electricity consumption and prediction of future consumption.

Hoda K. Mohamed has presented an approach of data mining techniques for long term electricity forecasting in Egyptian Electrical Network. The knowledge discovery steps are implemented. Preprocessing is used to find the missing values, odd values, outliers and normalize data. Eleven different cases are tested with actual data collected from different sites. Comparison is done between these different cases.

Lei Wu proposed a hybrid model for day-ahead electricity price and load forecasting in smart grid. The proposed two stage integrated model of price and load was tested at the NYISO electricity market by considering several case studies. The framework improves the forecasts results by capturing the correlation of price and load in smart grid. The proposed model has an advantage in modeling non-linearity and non-stationary price or signal. The framework offers smaller forecast errors and error variances. Other factors such as weather conditions, transmission lines, power exchanges may help to improve the short-term forecasting when integrated in the AWNN model. However, these factor may cause over-fitting or fluctuate the accuracy of forecasting model. The future work include adopting feature selection techniques.

Ali Darudi has described a new technique of forecasting electricity price using a new data fusion algorithm. In this approach, several price forecasts obtained from independent forecast engines (ARIMA, ANN, ANFIS) are fused together to produce one unified forecast. To outperform the conventional fusion algorithm, modified OWA data fusion technique is used. It obtains the feedback from errors of the agents. This approach provides more accurate forecast results than the primary agents. This approach can yield even better results if the primary agent provide more accurate forecast results in the first place.

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Vincent Thouvenot has explained the automatic selection of explanatory variables in an additive model. We applied it to load forecasting in the short and middle term and consider two real data sets: EDF portfolio consumption (French data at a national level) and GEFCom2012 US data (local data on the distribution grid). In both approaches the automatical recovery of relevant feature which drive the electricity consumption process is shown. This approach combines nonlinear regression and variable selection procedure. This approach simplifies the analysis but breaks the longitudinal aspects of observed data.

III. CONCLUSION

The survey has been done of various techniques used in prediction of electricity consumption. The techniques have advantages as well as disadvantages. An alternative system or method can be designed which will overcome the limitations of existing system and provide accurate forecasting results.

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