Effect of Artificial Neural Network Approach in Load Forecasting Methods

L.R.Aravind Babu

Abstract: ***Artificial Neural Networks are the machine models impressed by the human brain and this intelligence technique that has found major applications in engineering and science. Several of the recent advancements are created within the field of computing, together with Voice Recognition, Image Recognition, and AI victimization Artificial Neural Networks. Artificial neural network (ANN) has been used for several years in sectors and disciplines like bioscience, defense business, robotics, natural philosophy, economy, forecasts, etc. These biological ways of computing are thought of to be consecutive major advancement within the Computing business. An outsized kind of mathematical ways are developed for load prediction. During this paper, I discuss and reviewed numerous approaches to load prediction victimization artificial neural network.***

Keywords: ***Neural Network, Load Forecasting, Back-Propagation, Regression technique, Symbolic logic***

I. INTRODUCTION

Accurate models for prediction of load are essential to the operation and coming up with of a utility company. Load forecasts are significant for energy suppliers, ISOs, monetary establishments, and different participants in electrical energy generation, transmission, distribution, and markets. Load forecasts are divided into three categories: short forecasts that are from one hour to minimum one week, medium forecasts from per week to a year, and long forecasts that are longer than a year. The forecasts for various time horizons are necessary for various operations among a utility company. The natures of those forecasts are totally different furthermore. Load prediction has continually been necessary for coming up with and operational call conducted by utility corporations. Short load forecasting will facilitate to estimate load flows and to create choices that may forestall overloading. Timely implementations of such choices cause the advance of network dependableness and to the reduced occurrences of apparatus failures and blackouts.

Most prediction ways use applied mathematics techniques or computing algorithms like regression, neural networks, symbolic logic, and knowledgeable systems. Two of the ways, supposed end-use and economics approach are loosely used for medium- and long prediction. The supposed similar day approach, numerous regression models, statistic, neural networks, applied mathematics learning algorithms, symbolic logic, and knowledgeable systems, are developed for short prediction.

As we see, an outsized kind of mathematical ways and ideas are used for load prediction. The event of acceptable mathematical tools can cause the event of a lot of correct load prediction techniques.

II. FACTORS FOR FORECASTS

For short load forecasting many factors ought to be thought of, like time factors, weather knowledge, and doable customers' categories. The medium- and long forecasts take under consideration the historical load and weather knowledge. The time factors embrace the time of the year, the day of the week, and also the hour of the day. There are necessary variations in load between weekdays and weekends. The load on totally different weekdays can also behave otherwise. As an example, Mondays and Fridays being adjacent to weekends, might have structurally totally different hundreds than Tuesday through weekday. Holidays are tougher to forecast than non-holidays owing to their relative infrequent incidence. Numerous weather variables and parameters can be thought of for load prediction. Temperature and wetness are the foremost unremarkably used load predictors. An electrical load prediction survey discussed [17]. Among them THI (temperature-humidity index) and WCI (wind chill index), are loosely utilized by utility corporations.

III. FORECASTING METHODS: A REVIEW

Two of the ways, supposed end-use and economics approach are loosely used for medium- and long prediction. A range of ways, that embrace the supposed similar day approach, numerous regression models, statistic, neural networks, knowledgeable systems, symbolic logic, and applied mathematics learning algorithms, are used for short prediction.

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Chen et al.,[4] takes the shape of predicting load because the perform of four components: L = Ln + atomic number 103 + Ls + Lr, wherever L is that the total load, Ln represents the "normal" a part of the load, Ls could be a special event element that make a considerable deviation from the same old load pattern, and Lr could be a fully random term, the noise. Chen et al. [4] conjointly recommended electricity rating as a further term that may be enclosed within the model.

An increasing model is also of the shape L = Ln · Fw · Fs · metal, wherever Ln is that the traditional (base) load and also the correction factors Fw, Fs, and metal are positive numbers that may increase or decrease the general load. Rahman [15] bestowed a rule primarily based forecast employing an increasing model. Weather variables and also the base load related to the weather measures were enclosed within the model.

Medium- and long load forecasting methods: The end-use modeling, economics modeling, and their combos are the foremost usually used ways for medium- and long load prediction. Long forecasts embrace the forecasts on the population changes, economic development, industrial construction, and technology development.

End-use models: These models are supported the principle that electricity demand comes from customer's demand for light-weight, cooling, heating, refrigeration, etc. therefore end-use models justify energy demand as a perform of the amount of appliances within the market [15].

Econometric models: The economics approach combines theory and applied mathematics techniques for prediction electricity demand.

Statistical model-based learning: In order to alter the medium-term forecasts, create them a lot of correct, and avoid the employment of the unprocurable data, Feinberg et al.,([11], [12]) developed an applied mathematics model that learns the load model parameters from the historical knowledge. I compared many load models and came to the conclusion that the subsequent increasing model is that the most correct L(t) = F(d(t), h(t)) · f(w(t)) + R(t),where L(t) is that the actual load at time t, d(t) is that the day of the week, h(t) is that the hour of the day, F(d, h) is that the daily and hourly element, w(t) is that the weather knowledge that embrace the temperature and wetness, f(w) is that the weather issue, and R(t) could be a random error. To estimate the weather issue f(w), I used the regression model f(w) = β0 + βjXj ,where Xj are instructive variables that are nonlinear functions of current and past weather parameters and β0, βj are the regression coefficients. The parameters of the model are calculated iteratively.

Short-term load prediction methods: Similar-day approach: This approach is predicated on looking out historical knowledge for days among one, two, or 3 years with similar characteristics to the forecast day. Similar characteristics embrace weather, day of the week, and also the date. The load of the same day is taken into account as a forecast. Rather than one similar day load, the forecast is a linear combination or regression procedure that may embrace many similar days. The trend coefficients are used for similar days within the previous years.

Regression methods: Regression is that the one in all most generally used applied mathematics techniques. For electrical load prediction regression ways are sometimes accustomed model the connection of load consumption and different factors like weather, day type, and client category.

Time series: Statistic is used for many years in such fields as economic science, digital signal process, furthermore as electrical load prediction. Especially, ARMA (autoregressive moving average), ARIMA (autoregressive integrated moving average), ARMAX (autoregressive moving average with exogenous variables), and ARIMAX (autoregressive integrated moving average with exogenous variables) are the foremost usually used classical statistic ways.

Neural networks: The employment of artificial neural networks has been a wide studied electrical load prediction technique since 1990. Neural networks are basically non-linear circuits that have the incontestable capability to try to non-linear curve fitting. The foremost common artificial neural specification for electrical load prognostication is back propagation. Back propagation neural networks use incessantly valued functions and supervised learning. Artificial neural networks with unsupervised learning don't need pre-operational coaching. Bakirtzis et al., [1] developed associate degree ANN primarily based short load prediction model for the energy center of the Greek Public Power Corporation. Conjointly Papalexopoulos et al., [14] developed and enforced a multi-layered feed forward ANN for short system load prediction. Within the model three forms of variables are used as inputs to the neural network: season connected inputs, weather connected inputs, and historical hundreds. Khotanzad et al., [9] delineate a load prediction system called ANNSTLF. ANNSTLF is predicated on multiple ANN ways that capture numerous trends within the knowledge. Within the development they used a multilayer perceptron trained with the error back propagation formula. Chen et al., [4] developed a three layer absolutely connected feed forward neural network and also the back propagation formula was used.

Expert systems: Knowledgeable systems work best once a personality's knowledgeable is obtainable to figure with code developers for a substantial quantity of your time in conveyance the knowledgeable data to the expert system code. Associate degree knowledgeable system might systemize up to a whole lot or thousands of production rules. Ho et al., [8] projected a knowledge-based knowledgeable system for the short term load prediction. The developed formula performed higher compared to the standard Box-Jenkins technique. Rahman and Hazim [15] developed a site-independent technique for short load prediction.

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Fuzzy logic: Symbolic logic could be a generalization of the same old mathematical logic used for digital circuit style. Associate degree input underneath mathematical logic takes on a truth worth of "0" or "1". Underneath symbolic logic associate degree input has related to it particular qualitative ranges. Once the logical process of fuzzy inputs, a "defuzzification" method is accustomed manufacture such precise outputs. References [13], [14], [18] describe applications of symbolic logic to electrical load prediction.

Support vector machines: Support Vector Machines (SVMs) are a newer powerful technique for finding classification and regression issues. This approach was originated from Vapnik's [7] applied mathematics learning theory. Mohandes [13] applied the tactic of support vector machines for short electrical load prognostication. The author compares its performance with the autoregressive technique. The results indicate that SVMs compare favorably against the autoregressive technique. Chen et al., [2] projected a SVM model to predict daily load demand of a month. Their program was the winning entry of the competition organized by the EU NITE network. Li and Fang [11] conjointly used a SVM model for short load prediction.

IV. FUTURE ANALYSIS DIRECTIONS

In this paper, I even have mentioned many applied mathematics and computing techniques that are developed for short- medium and long electrical load prediction. Many applied mathematics models and algorithms that are developed although are operational impromptu. The accuracy of the forecasts can be improved, if one would study these applied mathematics models and develop mathematical theory that explains the convergence of those algorithms. Researchers ought to conjointly investigate the boundaries of relevance of the developed models and algorithms. As so much as I grasp, nothing is thought on a priori conditions that would notice that prognostication technique is a lot of appropriate for a given load space. A crucial question is to analyze the sensitivity of the load prognostication algorithms and models to the amount of shoppers, characteristics of the realm, energy costs, and different factors. As mentioned on top of, weather is a crucial issue that influences the load. The same old approach to short load prognostication uses the forecasted weather state of affairs as associate degree input. However, one in all the foremost necessary recent developments in prediction is that the supposed ensemble approach that consists of computing multiple forecasts. Then likelihood weights are appointed to those ensembles. Rather than victimization the one weather outlook, weather ensemble predictions are used as multiple inputs for load forecasts. These inputs generate multiple load forecasts. I feel that the necessary analysis and development directions are: (i) combining weather and cargo prognostication and (ii) incorporating load prognostication into numerous call support systems.

V. CONCLUSION

Accurate load prediction is extremely necessary for electrical utilities in a very competitive atmosphere created by the electrical business liberation. During this paper I tend to review some applied mathematics and computing techniques that are used for electrical load prediction. I conjointly mentioned factors that have an effect on the accuracy of the forecasts like weather knowledge, time factors, and client categories, furthermore as economic and finish use factors. Load prediction ways use advanced mathematical modeling. Extra progress in load prediction and its use in industrial applications are achieved by providing short load forecasts within the style of likelihood distributions instead of the forecasted numbers; as an example the supposed ensemble approach is used. I think that the progress in load prediction is achieved in two directions: (i) basic analysis in statistics and computing and (ii) higher understanding of the load dynamics and its applied mathematics properties to implement acceptable models.

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