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A STUDY ON THE CLASSIFICATION AND MODEL OF ELECTRIC FORECASTING

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ABSTRACT

As energy is a key element in the country's future growth, a model system needs to be created in order to give energy demand projections in different sectors. Oversight of predictions has become a comprehensive element of corporate planning and decision-making in the last two decades. Forecasting is the prediction of the variable's future values on the basis of the same or other past values. In this study we have discussed about the electrical energy, electric forecasting, ideal electric forecasting model, parameters affecting the electrical forecasting, classification of electric forecasting and applications of artificial neural network.

Keywords: Electric, forecasting, energy, prediction

INTRODUCTION

The utilization of energy in a variety of ways in our contemporary world, such as mechanical, electrical, light, nuclear, thermal, etc. For residential and industrial uses, electricity is utilized in the form of electricity. It has now become a criterion that satisfies almost all kinds of consumers' needs. Electricity applications may be seen in every sector such as lighting, cooking, agriculture, transit, computers, air conditioners, coolers, fans, biomedicine, education, entertainment, etc. The electricity sector is thus one of the world's biggest industries. Our people are without electricity even after large

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power output. The planned power system is needed to meet this demand-to-production mismatch. Researchers appear to be striving continually to accomplish this objective for better alternatives while preserving dependability and electricity quality.

ELECTRICAL ENERGY

Among all energy, electricity is the most common type. Because of its benefits, it has impacted practically every human sector, such that, its vast distances are easier to transfer compared to other kinds of energy.

- It may be converted into any other energy type.
- It's extremely quick
- For later usage, it may be saved
- It contributes to worldwide communication.

The present situation has seen an unexpected rise in electricity consumption. Figure 1 indicates that nearly everywhere in the globe energy consumption is growing (1980-2016), which needs more power production.

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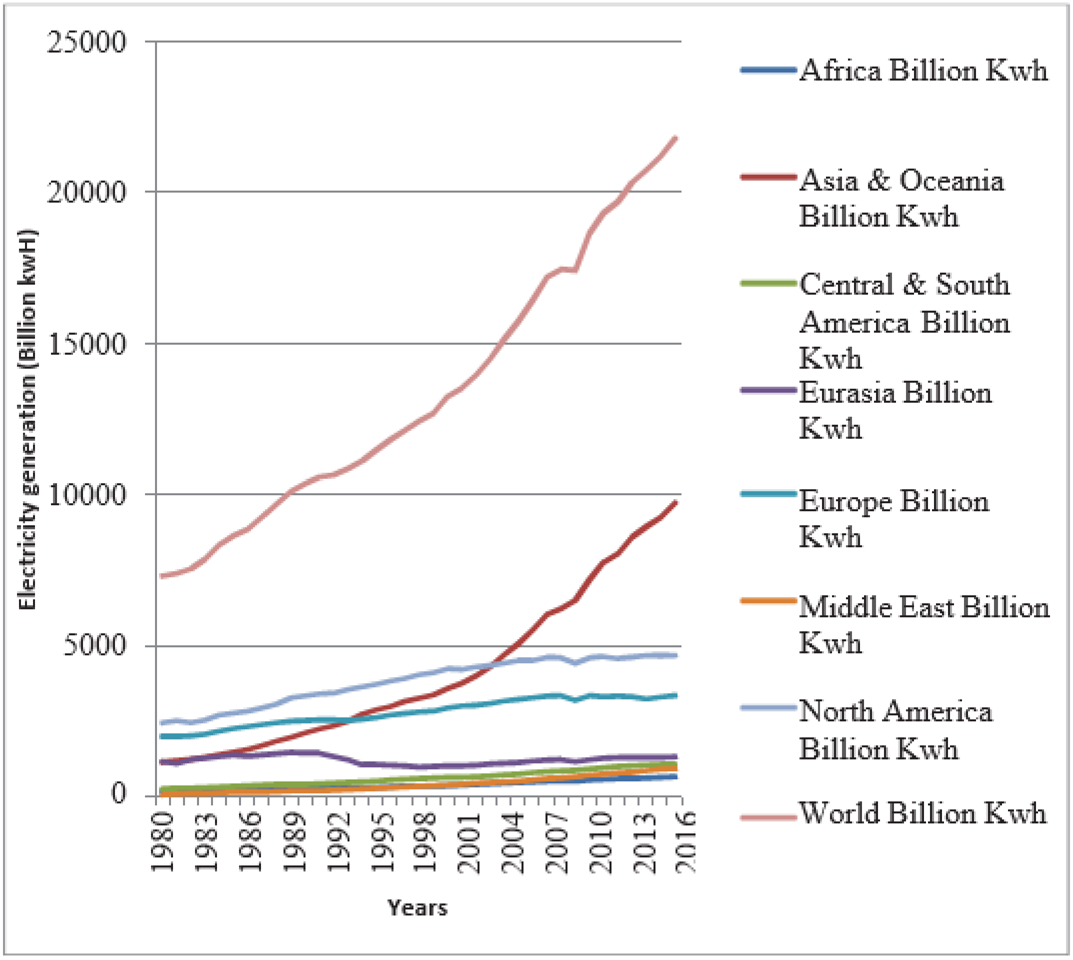

Figure 1: Worldwide electricity Consumption

This enormous demand for electricity is addressed through increased electricity production, which may be accomplished by setting up new power stations or expanding the capacity of existing power stations. More fuel, space, infrastructure, manpower, new and economical plants, renewables, improved and dependable management, greater electricity protection systems and so on are required. This requires a large amount of money, though. But these issues will only be dealt with to a certain degree via improved system design. The energy industries continue to strive to meet customer requirements and provide consumers with excellent power at the appropriate rates. There is no electrical power supply available in many locations. This is either because the power shortage or the needed region is far away. In other words, good power planning may allow for appropriate electrical arrangements.

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ELECTRIC FORECASTING

EF is the electricity prediction for the future. It is analyzed using historical data available. A foreteller forecasts the future load by his experience based on his intuition; however, the literature on this topic defines EF as,

- Prediction of electricity for the future.
- Prior estimation of electricity,
- It is the prediction of future data on the basis of historical data trend, and
- An attempt to determining the load in advance by performing scientific and engineering analysis.

This previous estimate helps the power system managers maintain the power balance between load and generation. This balance must be maintained both operationally and economically.

Importance Of Electric Forecasting

EF is a key component in designing the power system. An accurate EF not only helps the electricity engineers correctly operate a power system, but also offers the power supply firms economic advantages. The alternating current (AC) cannot be kept in bulk form and is not economical, thus, after production the produced AC must be fully used. Excess and the restricted amount of electrical power produced may lead to difficulties or crises on particular power systems. Where the expected electricity volume exceeds the actual energy consumption, issues may emerge following:

- The units of generating may have been needlessly engaged, which may result in greater fuel expenditures and increase the unit's maintenance expenses.
- In order to meet the expected extra demand, costly electricity, which was not at all needed, may be acquired. This surplus electricity is no way of selling it and receiving any revenues. It may thus be discarded or unused.
- An overestimation of demand clearly indicates that energy production units are

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used extensively. Therefore, they set higher prices. But, in fact, the demand for electricity is lower and the price must be lower. It therefore dissuades power sales from this specific supply sector.

- Unnecessary interruptions or load checks may be triggered in overly false prevision, upsetting consumers and reducing income.

IDEAL ELECTRIC FORECASTING MODEL

Good and better EF models must be created according to the goals of this chapter. To explain, a good predictive model should be known for several characteristics of a good predictive model. Several characteristics are as follows in relation to the exact EF model:

- **Adaptiveness -** The adaptivity of a model is the quality of a model, which even after a short time provides precise forecasts. An adaptive prediction model, in other words, maintains learning based on fresh data to provide genuinely anticipated values.

- **Recursiveness-** It relates to the model's capacity to replicate certain previous patterns in the predicted model. It needs to be able to adjust the forecast.

- **Computational economy-** With reduced time consumption, the prediction model must be computationally efficient. The model must be basic and non-complex.

- **Robustness-** Forecast models must be of quality, even with incorrect, poor and redundant data, to produce accurate forecasts. The measuring devices usually display measurement inaccuracies owing to age. The robustness of the forecasting model should be addressed.

- **Accuracy-** It is the main parameter in a successful predictive model. It must be the highest it can be. In order to evaluate the accuracy, the literature has several kinds of error measurements. A solid combination of the qualities mentioned along with their acceptable degree is required. These characteristics are always taken into account when creating a predictive model; otherwise, significant financial losses and other operational deficiencies are unavoidable.

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PARAMETERS AFFECTING THE ELECTRICAL FORECASTING

EF is directly or indirectly affected by several factors. Parameters that directly influence it are referred to as endogenous parameters and external parameters. These factors usually are divided into three categories: weather, demographic, and economic. The weather parameter falls in the group of endogenous variables, while the group of external variables is divided in two additional groups. In the majority of the studies, load parameters and temperature parameters are included for developing the EF model. Very few studies incorporated electrical characteristics together with many other data, including meteorological, economic, demographic, etc. Similarly, very seldom is the usage of electrical parameter. The following factors are categorically regarded the parameters affecting the electrical prediction together with the characteristics of the similitudes.

- **Similarity parameters:** Day of a week, an hour of a week, time of the day, season of the year, month of the year, holiday, special day, etc.
- **Meteorological parameters:** Temperature, humidity, atmospheric pressure, cloud cover, rainfall, etc.
- **Demographic parameters:** Type of locality, user density/ population, type of use, etc.
- **Econometric parameters:** Class of the user, the income of the user, lifestyle, place of use, type of appliances, etc.

CLASSIFICATION OF ELECTRIC FORECASTING

Different models may be categorized into different categories. Classified by the most frequent categories:

- type of model, and
- lead time of forecasting, along with the forecasting time span.

Lead time is the least time step that has to be predicted repeatedly over, for example, the STEF lead time is one hour. The entire time period, however, is the predicted

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duration for electricity. Below is the categorization based on classic models

1. Classification Based on Classical Models

For electrical forecasting, several classical/conventional models are created. During the 1970's, several of the following models made important contributions to the development of these models.

- **Additive forecasting model**

The real signal is split into many different components in the forecast model: trend, seasonality, regular variations, and noise. They are then combined to get a predicted additive model estimate.

- **Multiplicative forecasting model**

These models are comparable to the models of additives. The components are same, but the predicted results are multiplied. The output of these models is thus diverse.

- **End user model**

These models are based on the energy end-user information. This information includes characteristics such as appliances at the user's premises, user's application, user income, life, or user lifestyle, class, or user group, etc.

- **Econometric model**

The economic position of the user is the basis for such models. A high-revenue group mobile devices power not just for everyday usage but also for luxury reasons. The economic class of the consumer thus certainly impacts the electricity usage.

- **Time-series model**

The use of power depends on time. The use of power from midnight to morning is reduced, which is lower at midnight, then extremely high at night. This demand fluctuation is seen from season to season and sometimes. The electrical data series is termed electrical time series based on that. Based on the time series, a considerable number of models for the prediction purpose were built and evaluated by researchers.

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2. AI-based Electric Forecasting Models

Although the above-mentioned traditional models are simple, they are not more accurate in electrical prediction. AI-based models aim to create, simple and less voluminous EF models over a wider geographical region, which are adaptable, nonlinear and economical computationally. Several EF models based on AI may be seen in the past. The following is noticed about the forecast:

- EF is easy to achieve with any traditional prediction model under a 10% forecast error limit.
- Due to the extension and modernization of the power system structure, the demand for a very precise prediction model has raised.

Research into developing such models is thus still on and mathematical methods established lately have yet to be employed to create more precise and robust forecast models.

Based on its mathematical complexity, a predicting model may be considered simple or complicated in the computation of the predicted electricity. But the use of the AI method in developing the prediction model is necessary for the intended objectives. These methods are frequently employed in two different ways, i.e. a) to build the prediction model and b) to enhance the prediction model. It has been shown that the current mathematical tool, for example ANN, is complicated in comparison and relies on AI methods:

- Take a bit longer and provide better results than traditional approaches, since these technologies rely on social tendencies or intelligent systems.
- Adaptive in nature and able to more effectively explore the research area without trapping in local limits and delivering a tight range of global optimum output.
- are able to resolve certain difficult issues which cannot be identified by traditional methods or which are extremely complex.

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These AI-based methods represent a major advance in solving issues of this kind with minimal resources. The suggested prediction models in this thesis aim at reducing the complexity of such models, maintaining a greater degree of precision. In this sequence, the future load is predicted by using just the load data together with the day type parameter. In the literature, methods for developing prediction models are available based on AI.

APPLICATIONS OF ARTIFICIAL NEURAL NETWORK

An NN has many characteristics, i.e., enormous parallelism, distributed depiction and computing, capacity to learn, generalizations, adaptability, intrinsic contextual processing of information, tolerance to failure and low energy usage. Because of these characteristics, an ANN may address many nonlinear and difficult real-world situations. An ANN is inspired by the BNN and is being used by many scientists in several disciplines in order to solve diverse issue areas, such as pattern classification, clustering or categorization, prediction or forecasting, optimization, content management, etc. Because ANN is inspired by BNN, ANN's applications resemble BNN. Below is a short overview of some of the uses in connection.

1. Pattern classification of various data distributions

The NN characterizes a pattern in the pattern categorization. These patterns have to do with specific characteristics such as linguistic character, a voice signal, EEG waveform, categorization of blood cells or any other issue of pattern classification. There is a particular design for each kind of signal or collection of samples. The NN is introduced to these patterns during training. NN can distinguish the pattern based on the quality of the training.

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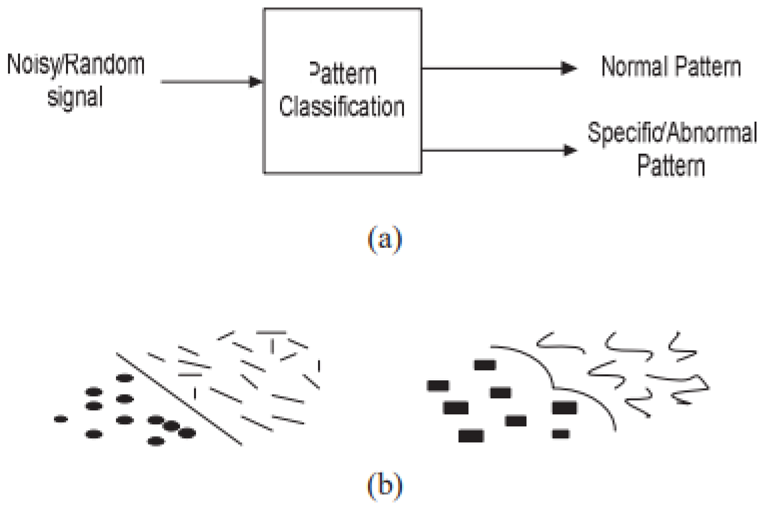

Figure 2: Pattern Classification: block diagram; various data distributions

2. Clustering/ categorization

This application is almost like the categorization. Several samples exhibit commonalities in one group as shown in Figure 3. The ANN identifies these commonalities on the basis of unmonitored learning. Data mining, data compression and other deep data analysis are popular clustering applications.

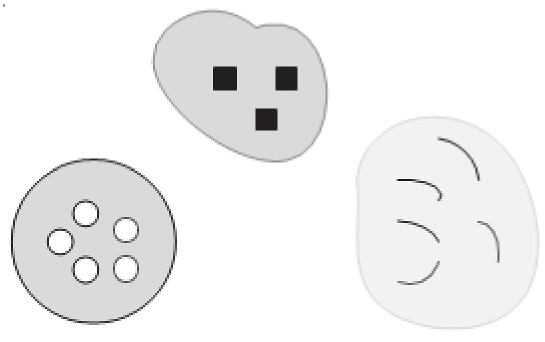

Figure 3: Clustering or categorization of the information/ data points

3. System identification

Identification of the system is an essential element of the black box system

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investigation. In this actual world, many of the genuine system cannot be readily identified. Some mathematical model cannot easily describe these models. ANN is utilized for the establishment of a black box system. Under such circumstances These models are built on the observations, by training a NN. These models simply support and support the behavior of the system rather than the underlying model.

4. Noise reduction

When two items compare and match, they cause some noise if they are not the same. If this noise falls under specified tolerance limits, an item is deemed to be identified as fully. NN detects input patterns and generates noiseless outputs.

CONCLUSION

In this article we had done our study on electric forecasting while taking all these factors in mind, the Artificial Neural Network (ANN) model attempted to predict energy consumption for 2020. In the context of the allocation to Indian power production of different energy resources, an optimum electricity allocation (OEAM) model was also developed for the year 2020. The present research and assessment provide essential statistical conclusions.

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