

Electricity Price Estimation Using Advanced Deep Learning Model

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Abstract: Estimation of power price furnish is an emerging trend and analysis model of consumption. To handle those problems one of a kind deep learning strategies are used for load and fee prediction. For the estimation of power price it is mainly support for customer and distributor. On this paper, deep learning getting to know methods are used for estimation price for power energy. Regularized regression, Random Forest (RF), Linear Discriminant Analysis (LDA) are used for feature selection and extraction. Enhanced Convolutional Neural Network (ECNN) classifier method used for prediction. The proposed model well performed in different criterion.

Index Terms: Power price prediction, Deep Learning, ECNN

1 INTRODUCTION

In these times current is a powerful factor in public and commercial environment. The entire world is based on power. In the absence of power life has an tragedy for smart world. Power Utilization consist of many classification. It is mainly classified as business and home. Power generation practically half or more rate devours by home use. Comparing to tradition grid, the smart grid is an effective for managing power utilization, production and division. Specifically, while comparison with other commodities, power exchange consist of different features. Time factors, Business markets, due to these characteristics dynamic change of current rate. Power utilization may different for some circumstance such as function, holidays, weather, working days, electric device and number of users. Data Analytics (DA) is an emerging field for prediction analysis. DA is making the decision from the large amount of real time data sets. Data analyst predict the power price using statistical methods to get an meaningful information.

1.1 DEEP LEARNING(DL)

Deep learning is familiar as innovation field of neural network. Even as this achievement of dl models initiated in laptop technological know-how applications, like Photo recognition, speech reputation, or system translation, the advantages of dl have additionally unfold inside the remaining years to several strength-associated programs. Deep feature selection algorithm and frame model improve the estimation of current air rate. Similarly, DL give the best an different field of power energy price and load estimation. DL consist of innovative approaches like Deep Auto encoders, Deep stacking network. Deep restricted Boltzmann Machine (DBM) is consist of many layers, which contain hidden layer to connect the different layers of input and output units. The DL important methods for forecasting the large amount of variety data. Multilayer Perceptron (MLP):MLP is an supervised fully connected layers.

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Each node is connected with every other nodes. Convolutional Neural Network (CNN): It is an massive popular in DL.CNN not fully connected and multilayer output. Long short term memory network(LSTM): The main purpose of LSTM is sequence prediction problem.

2 RELATED WORKS

It is classified into two categories power load forecasting and energy cost forecasting.

2.1 ELECTRICITY LOAD ESTIMATION

Multilayer Neural Network model mainly focus on power estimation, but this model consist of time factors dependency and loss rate of nodes are high. LSTM to make the decision by splitting it into trained and sample data. While using the feature selection and extraction techniques give the accuracy for the different benchmarks schemas. Computing the data give an effective result of predictions. The primary data is not estimate the power plant precise. The author describe the method for utilization model of electricity. They observe the model it varies from residential and business era.

2.2 ELECTRICITY PRICE ESTIMATION

The authors view point of predict price, novelty model using the DL approaches like ECNN,LSTM and Deep Neural Network(DNN). This technique will consider the 25 above benchmarks. It will bring the improvement in accuracy and computation time. The result look forwards to all benchmarks with a trained data. This is not appropriate for real time applications. The DL methods DNN and support vector machine not assure the electricity price forecasting. While power load balancing to avoid the excess availability of power and insufficiency. Forecasting also give the meaningful information for business statistics.

2.3 PERFORMANCE METRICS

To evaluate the forecasting performance using Symmetric mean absolute percentage error(SMAPE),Mean Absolute Scaled Error (MASE).SMAPE is used for calculate the error percentage in large amount of data. It criticize the below and above boundary in symmetric range.

$$sMAPE = \frac{2}{k} \sum_{t=1}^k \frac{|Y_t - \hat{Y}_t|}{|Y_t| + |\hat{Y}_t|} * 100\%$$

where k is no of points, Y_t are the test data and \hat{Y}_t the predict data. It has give the error percentage between 0-100.

$$MASE = \frac{1}{k} \frac{\sum_{t=1}^k |Y_t - \hat{Y}_t|}{\frac{1}{n-m} \sum_{t=m+1}^n |Y_t - Y_{t-m}|}$$

Calculate the absolute error in each sample, it will not give an infinity value. It is unsafe for outliers. Y_t is an original data, \hat{Y}_t forecast error data, T time series.

3 PROPOSED WORK

The proposed model to expect the electricity rate. The following steps to require the predict charge

- Feature Selection
- Feature Extraction
- Parameter tuning
- Forecasting Engine
- Performance Analysis

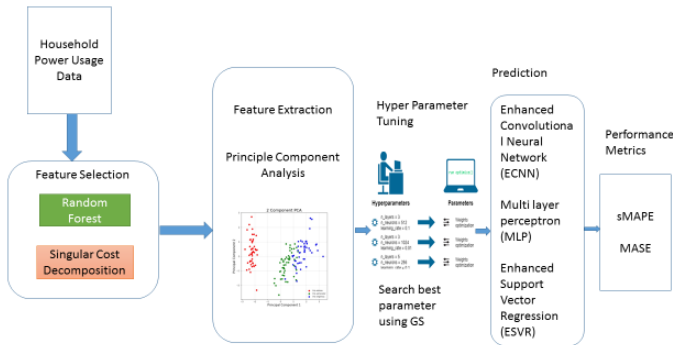


Fig. 1. Electricity charge prediction model

3.1 DATA ENGINE

The household electricity power consumption has include the date ,time, voltage and some business information holds. Every other choose hourly consuming electricity facts. Those sources is useful to predict the price of the power.

3.2 FEATURE SELECTION

Random Forest method to address the relevant features from the processing data. This has to reduce time and improve accurate results. It has make decision through the tree structure based and produce good reliability.

3.3 FEATURE EXTRACTION

Principal Component Analysis (PCA)works as a dimensionality discount technique for classification problems. The goal of acquiring independent components to reduce the attribute selection of function area. To benefit the summarize information using dividing each function by way of its widespread deviation. It gets rid of the weakest function repeated until the it reaches the limit.

3.4 PARAMETER TUNING

The hyper parameter tuning select the optimize parameter that is control learning model. It has reduce the predefine loss function on given unconstrained data. Grid search trains the dataset for optimizing parameter function.

3.5 FORECAST ENGINE

Hourly price facts are used to educate the classifier and predicts the charge of future. Enhanced Support Vector Regression (ESVR) is then educated the use of training facts to get prediction results. Simulation consequences display that ESVR outperformed in our situation. ECNN is to train the model with using of label data. It produce a multiple layer that consist of input, hidden and output layer. The input layer consist of n x k neutrons matrix. This input passes through the hidden layer and number of neutrons. The bias weight and previous layer output calculation of matrix is an output. This process continue to output layer and that is produce probability score of each function. It is fully connected layer. The stopping function based on the loss rate value of function during connected layers.

3.5 ATTAINMENT ANALYSIS

The novelty model is evaluated through the performance evaluators like SMAPE and MASE.

TABLE I
PERFORMANCE EVALUATOR

DataSet	Technique	sMAPE	MASE
HEPC	ESVR	37.78	2.23
HEPC	ECNN	6.3	2.03

4. RESULTS AND DISCUSSION

The following figure shows that prediction strategies applied in training dataset.

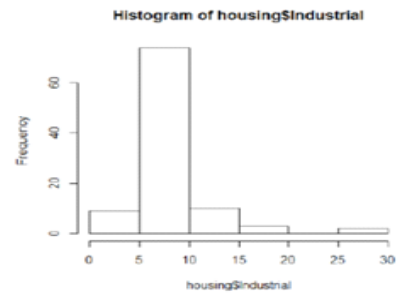


Fig. 2. Feature Importance of Industrial

DL performs in a massive volume of data for train samples. The efficiency and accuracy has consist of various kind of dataset. The data samples taken from three different categories.

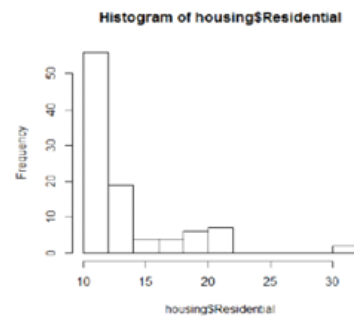


Fig. 3. Feature Importance of Residential

The price forecasting for the upcoming month and load estimation also analyzed. RF and LDA for selecting and extracting the features of processing data. The dataset consist of 0.8 training data and 0.2 sample test data.

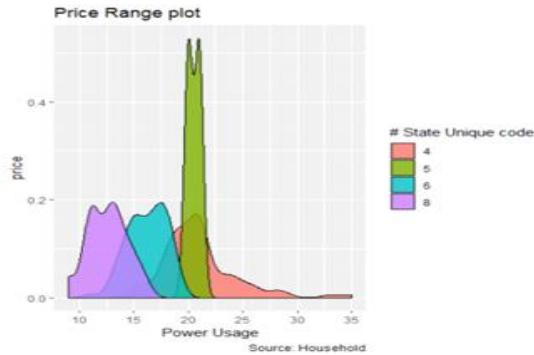


Fig. 4. Price prediction against power usage

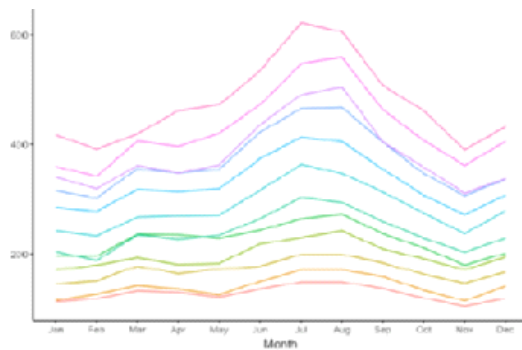


Fig. 5. Every month Price prediction

5. CONCLUSION

The number one intention is to boom the accuracy of forecasting the usage of those models. The result has analysis large amount of data in real time dataset This novelty method shows the improvement in RF, LDA relevant attribute selection and ECNN for accurate prediction in power energy price. These techniques remove the repeated data and missing values gives a effect in prediction for deep learning model. The reduction of attributes provide the decrease cost and time factor also improve.

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