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Electrical peak load forecasting using long short term memory and support vector machine

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Abstract. Electrical load forecasting is usually a univariate time series forecasting problem. In this case, we use the machine learning approach based on Long Short Term Memory and Support Vector Machine. Accurate the peak electric load forecasting. The time series or data set of the peak electric load recorded from the Substation system in Lhoksumewe, Indonesia. The main aim of this paper to predict and evaluate the performance of peak electric load at the substation for six months. The results obtained in the study, the LSTM and SVM are proving useful for peak electrical load forecasting. The resulting point both of machine learning technique based on LSTM and SVM are a possibility for analysis data for such purposes.

1. Introduction

Electricity load forecasting has always been an important issue not only in the power industry but also one of the factors to improve the economic efficiency of power enterprises. The core problem in many general time series forecasting models or methods can be applied for electric peak load forecasting. As we know the electric load is primarily a univariate time series [1], [2]. In this case, the dataset of temperature as types of climate information might not be useful in such mid-term peak load forecasting problem. This paper explores Long Short Term Memory (LSTM) and Support Vector Machine as the Machine learning techniques to generate and look for accuracy of the electric peak load at the substation in Lhokseumawe, Indonesia. Machine learning approaches are evidencing useful for electricity load forecasting. The physical of the load forecast in terms of the time period of the forecast is usually from one hour to one week (short-term forecast), the medium forecast is usually from a week to a year and long term forecast which are longer than a year [3], [4]. The goal of this paper to evaluate the performance of electric load based on the LSTM and SVM.

2. Data and Method

2.1 Data

The dataset used in this paper consists of a electrical peak load. Each set contains numerous time series with the peak load in substations. All datasets contain hourly measurement for six months, from January to June 2017. The raw data at this paper is the standard metadata exchange formats of txt. The average of the peak load shown in Table 1. In



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¹ this table, the total of an average of the peak load in substation from January to June in 2017 is 22.685 Mw.

Table 1. The Average of the Peak Load in Substations 2017

Month	Average
January	20.23548387
February	23.63571429
March	21.25483871
April	26.22666667
May	22.65483871
June	22.29666667
Grand Total	22.68508287

Figure 1 shows the electrical peak load profile at Substations in Lhosumawe, Indonesia. The load profile of the peak electricity load time series in data set a formonth average in MWh.

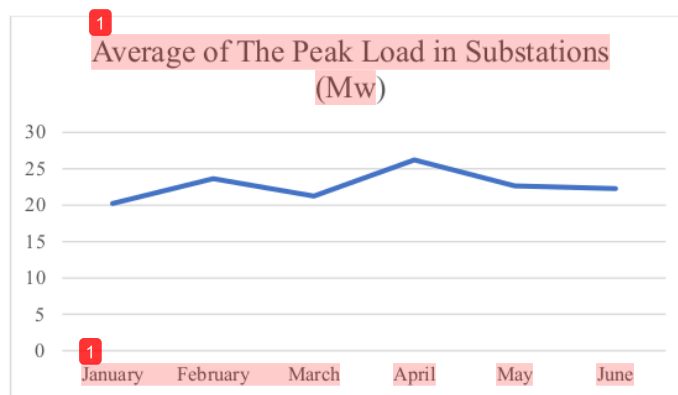


Figure 1. The load profile of month average of peak load in Substation 2017

2.2Method

This research area using the LSTM and SVM are included in the literature about load forecasting [1], [5]–[12]. The important element of load forecasting is finding the relationship between input variables and forecasting parameter. The LSTM is compared in univariate time series prediction for the day ahead load forecasting. The SVM is a new and promising technique for data classification[13] and regression in machine learning by used for time series prediction[3], [4], [12], [14], [15]. The LSTM are good in remembering information for long time and fortunately LSTM network a special form of RNN are capable in learning such scenarios.

3. Result and Discussions

From the result, an interesting observation can be made: model built without the temperature generally perform better than those built. The graph of many more sources from the substation system was visualized in Fig. 2 and Fig. 3. They all displayed similar behavior.

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Every substation system in Lhokseumae, Indonesia from the peak load profile follows a different curve, but they all display the following of all workdays follow a similar pattern, the seasonal plot shows good overlapping, small variations from week to week.

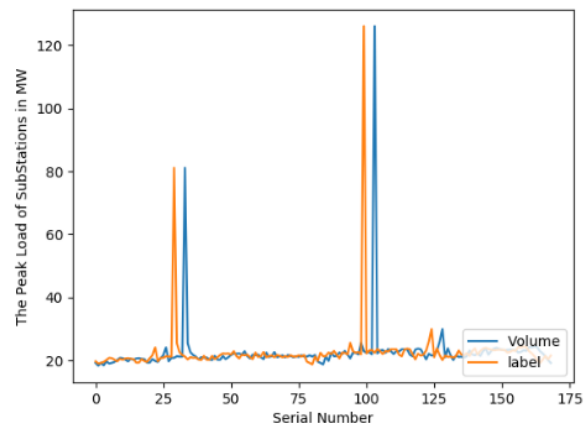


Figure 2. Electrical Peak Load Forecasting based on SVM

The peak load profiles in figure 2, seem less irregular, but the reliability of prediction will not improve considerably. The more erratic behavior related to loading consumption

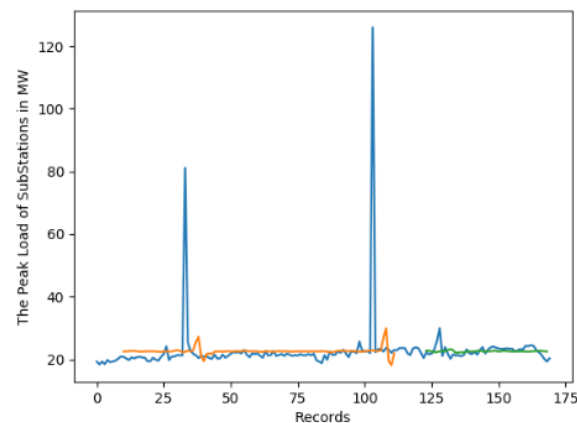


Figure 3. Electrical Peak Load Forecasting based on LSTM

Forecast accuracy can be resolute based on different accuracy or error measures that consider forecast errors over the entire forecast the peak load, summarized into a single value.

1**Table 2.** Accuracy model based on SVM and LSTM

Model	Accuracy (%)
SVM	4.289553602147689
LSTM	47.673406, Test Score: 11.91 RMSE, Test Score : 11.91 RMSE

The results of machine learning by SVM show the accuracy 4.289553602147689 % and by LSTM has accuracy 47.673406 %. As shown in Table 2. The results of both SVM and LSTM accuracy showing the lower accuracy measure, it's mean that better accuracy. When comparing forecast methods on the same dataset, different accuracy measure will, therefore, produce different performance rankings.

4. Conclusions

Based on the results obtained in the study, the LSTM and SVM are proving useful for peak electrical load forecasting. The resulting point both of machine learning technique based on LSTM and SVM are a possibility for analysis data for such purposes. The LSTM and SVM were compared using a large number of input variables while considering restriction that is imposed by limitation in the real world. Also, the research related to the classification of the customer's load profiles would enable the improvement of the accuracy of the load forecast.

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