Machine Learning Approach for Electrical Load Fore-Sadli_2019_J._Phys.__Conf._Ser._1361_012065

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Abstract. The management of power system in Lhokseumawe, Indonesia is complex task for transmission operator and is heavily reliant on knowledge of future energy demand. The available data allows for the maturation of the electricity market and encourages analysis of data to improve the generation, usage and management of electrical power. Our research specially will be based upon the Lhoksuemawe, Aceh data set which gives the total load on electric grid measured in intervals for past several years. In particular, our methods will use machine learning approaches by using support vector machine regression to forecast the average total load on Lhokseumawe, Aceh grid one day head of time. The results will be practically beneficial as utilities can use the predicted values to generate an adequate amount of energy to avoid grid outages and electrical losses as well as construct dynamic pricing schemes based upon future load.

1. Introduction

The management of power system in Lhoksuemawe, Aceh, Indonesia is a complex task for transmission operators and is heavily reliant on knowledge of future energy demand. A model that can accurately forecast load is essential in energy generation as the predicted load can determine which device should be operated in order to meet demand [1]. Failure to generate an adequate amount of energy can lead to grid failures and conversely, oversupply can lead to a waste of energy and resources. With the advent of decentralized electricity, it is essential to develop accurate pricing protocols based on current demand for which an understanding of future demand is critical. Traditionally methods from classical statistics and econometrics such as regression and auto-regressive moving average have been used to project future electricity demand, yet in this paper [2–7], we aim to use machine learning algorithms in an attempt to outperform these orthodox approaches.

Load forecasting is a critically important task for utility companies since it is crucial in determining the amount of electricity that the company should provide. In this case, we use SVM to forecast the average total load on Lhokseumawe, Aceh grid one day ahead of time.

2. Data and Method

2.1 Data

The electric data were employed from PLN, Lhoksuemawe, Indonesia. We use the electric capacity which recordings of PLN in Lhoksuemawe City for 2012-2014.

2.2Method

The machine learning based forecasting approach in this case will use support vector machine regression (SVR)[3]–[5]. The algorithm has science been modified for regression task and we can therefore apply it to the problem at hand. The SVR will solve the following optimization problem.

3. Result and Discussions

Based on the result we have strong evidence that machine learning based support vector machine regression algorithm has the ability to achieve high accuracy rates for the load forecasting problem, and consequently believe it would be rewarding to explore this area further.

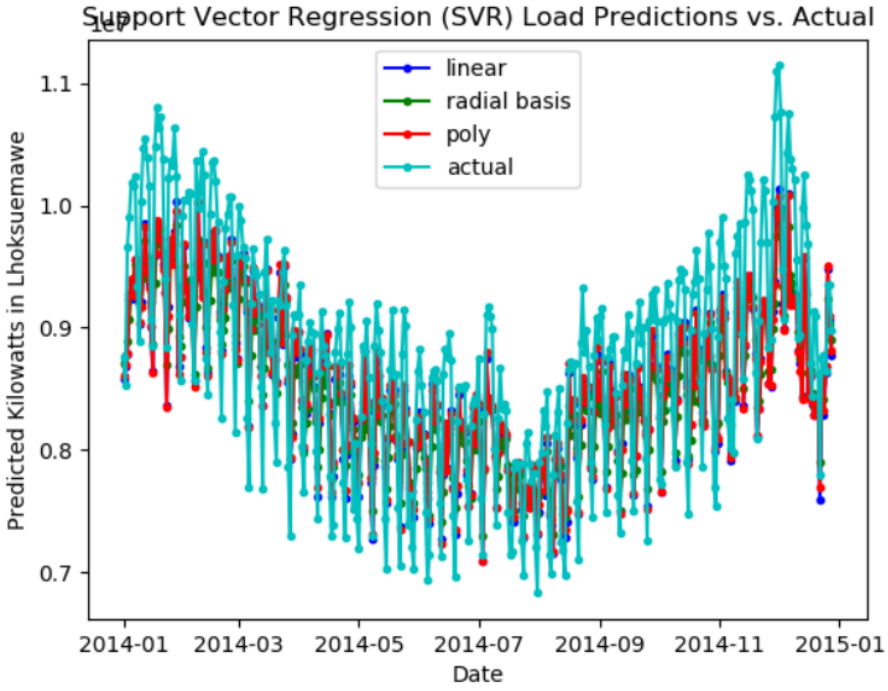

Figure 1. Support Vector Regression (SVR) Load Prediction vs Actual

However, the result in that aside of the processing steps, there is no information regarding the seasonality was used in the SVR [1] to achieve high accuracy rates on discriminative regression learning task when the dataset is not to large. The initial analysis showed that the load time series contained a significant seasonality component. This is suggestive that the seasonality information might not be necessary to

achieve high accuracy rates to forecast the average total load. Nevertheless, we found that the normalization and de-trending preprocessing step were crucial for machine learning methods to be successful, thus showing that in the Table 1. Table 1 show that the Root Mean Square Error based on kernel Linear, Radial and Poly. The ideas from time series analysis can be used in combination which machine learning to develop strong prediction models.

Table.1 Root Mean Square using kernel

No	Kernel	Root Mean Square Error
1	Linear	0.12265448101285267
2	Radial	0.13911655074507498
3	Poly	0.12299479706202326

4. Conclusions

Compare with the empirical result we have successfully demonstrated that machine learning techniques by SVR can result in accurate predictor for forecasting the average total load on the electric grid one day ahead of time in Lhokseumawe, Aceh, Indonesia. Regression, although it was integral to a to clustering based approach that also achieved fairly low error rates. We discovered that logarithmic and scaling and de-trending the load time series significantly increased the accuracy of the learning based model.

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