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Deep Learning for Renewable Power Forecasting: An Approach Using LSTM Neural Networks

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Abstract : Load forecasting has become crucial in recent years and become popular in forecasting area. Many different power forecasting models have been tried out for this purpose. Electricity load forecasting is necessary for energy policies, healthy and reliable grid systems. Effective power forecasting of renewable energy load leads the decision makers to minimize the costs of electric utilities and power plants. Forecasting tools are required that can be used to predict how much renewable energy can be utilized. The purpose of this study is to explore the effectiveness of LSTM-based neural networks for estimating renewable energy loads. In this study, we present models for predicting renewable energy loads based on deep neural networks, especially the Long Term Memory (LSTM) algorithms. Deep learning allows multiple layers of models to learn representation of data. LSTM algorithms are able to store information for long periods of time. Deep learning models have recently been used to forecast the renewable energy sources such as predicting wind and solar energy power. Historical load and weather information represent the most important variables for the inputs within the power forecasting models. The dataset contained power consumption measurements are gathered between January 2016 and December 2017 with one-hour resolution. Models use publicly available data from the Turkish Renewable Energy Resources Support Mechanism. Forecasting studies have been carried out with these data via deep neural networks approach including LSTM technique for Turkish electricity markets. 432 different models are created by changing layers cell count and dropout. The adaptive moment estimation (ADAM) algorithm is used for training as a gradient-based optimizer instead of SGD (stochastic gradient). ADAM performed better than SGD in terms of faster convergence and lower error rates. Models performance is compared according to MAE (Mean Absolute Error) and MSE (Mean Squared Error). Best five MAE results out of 432 tested models are 0.66, 0.74, 0.85 and 1.09. The forecasting performance of the proposed LSTM models gives successful results compared to literature searches.

Keywords : deep learning, long short term memory, energy, renewable energy load forecasting
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