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Reservoir Computing-based Ensemble Photovoltaic Power Generation Forecasting

A Final Project Report by

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Abstract

PV power forecasting has been studied in several methods, Machine Learning(ML) has been popular in recent years. Studies have been reviewed that autoregressive moving average (ARMA), support vector machines(SVM) and artificial neural network (ANN) have been common in predicting data-driven time-series forecasting on renewable energy domain, 40% on solar predictions. These stand-alone models have been studied long enough that the limitations in each model have been studied in PV power generation to give an accurate prediction. Optimising using Recurrent Neural Network(RNN) with long short-Memory (LSTM) or RNN with the gated recurrent unit (GRU) was to overcome limitations in predicting with RNN. However, these methods lead to heavy computations and forecast gradients will disappear if input sequence length exceeds a certain limit. The focus of this study is to assess random-based learning in the RC in affecting uncertainty in PV power generation. In the recent decade as a viable alternative for training RNNs, reservoir computing was developed. However, these works do not access improvement on ESN when compared to uncertainty predictions in PV power generation. This research focuses on introducing a novel ensemble reservoir computing model using echo state networks. The proposed method uses the multivariate time series sequenced generated inputs to create the forecasting results by using AdaBoost ensemble model which is integrated with reservoir computing. The result of the initial implementation is that it has higher mean squared error values when predictions each iteration of the ensemble models. However, the proposed model has been evaluated using cross-validation for time series. With hyper-parameter tuning, the best results can be evaluated. The current model training took about ten minutes to train hence model training time needs to be observed and tuned. In the future, the proposed model is to be evaluated using benchmark models such as RNN, ANN and MLP models

Keywords: Reservoir Computing, Time series, Time series Predictions