Short-Term Wind Speed Forecasting Using Reservoir Computing with Empirical Mode Decomposition

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ABSTRACT

Accurately predicting wind power generation is essential for the efficient management of renewable energy resources. This research focuses on short-term wind forecasting to address this challenge. In this research, we address the challenge of forecasting wind power generation by focusing on the prediction of wind conditions in the short-term. To achieve this, we employ an approach that combines empirical mode decomposition and reservoir computing (RC) models. The initial step involves decomposing the wind time series signal into subseries using empirical mode decomposition. This decomposition technique allows us to capture the underlying patterns and variations present in the wind data. Subsequently, we investigate the efficacy of RC models, including Echo State Networks (ESN) and Dynamics based Reservoir Computing, in predicting wind conditions. To assess the performance of the RC models, we compare them against popular recurrent neural network (RNN) models such as Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU). Through a comprehensive evaluation, we demonstrate that the dynamic RC model exhibits superior performance in forecasting wind conditions. This finding highlights the effectiveness of reservoir computing approaches for wind power prediction.