

Enhancing Temporal Extrapolation of Wind Speed Using a Hybrid Technique: A Case Study in West Coast of Denmark

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Abstract : The demand for renewable energy is significantly increasing, major investments are being supplied to the wind power generation industry as a leading source of clean energy. The wind energy sector is entirely dependable and driven by the prediction of wind speed, which by the nature of wind is very stochastic and widely random. This study employs deep multi-fidelity Gaussian process regression, used to predict wind speeds for medium term time horizons. Data of the RUNE experiment in the west coast of Denmark were provided by the Technical University of Denmark, which represent the wind speed across the study area from the period between December 2015 and March 2016. The study aims to investigate the effect of pre-processing the data by denoising the signal using empirical wavelet transform (EWT) and engaging the vector components of wind speed to increase the number of input data layers for data fusion using deep multi-fidelity Gaussian process regression (GPR). The outcomes were compared using root mean square error (RMSE) and the results demonstrated a significant increase in the accuracy of predictions which demonstrated that using vector components of the wind speed as additional predictors exhibits more accurate predictions than strategies that ignore them, reflecting the importance of the inclusion of all sub data and pre-processing signals for wind speed forecasting models.

Keywords : data fusion, Gaussian process regression, signal denoise, temporal extrapolation

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