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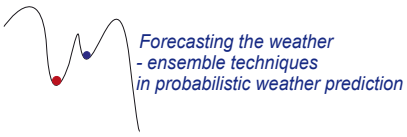

Probabilistic wind power forecasting using statistical meta-Gaussian models

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Probabilistic wind power forecasting is challenging in several aspects. One of them is the flexibility the forecast distribution should possess, such as skewness in both directions and the possibility of a positive probability mass at zero power production. In this work we propose a meta-Gaussian approach. The basic idea is to first transform all variables, not only the power production, to standard normal variables. Transformations are here estimated using local linear least squares modified to deal with mixed distributed variables. The second step is to assume that the transformed data are approximately multivariate Gaussian and estimate its parameters. It then follows that the conditional distribution of the transformed power production given the predictor variables also is Gaussian. Finally, a retransformation back to the original scale is applied to get the probabilistic forecast.

The methodology is demonstrated for short term forecasting up to 12 hours ahead using data for a Norwegian wind farm. Three different statistical models are tested based on (i) only the latest power measurement, (ii) only output/forecast from an atmospheric model and (iii) both the latest measurement and the atmospheric model forecast. Results show that in terms of the continuous ranked probability score the latest power measurement was more important than forecasts from the atmospheric model for forecasting up to approximately 3 hours ahead. The best forecasts for all lead times were not surprisingly obtained using both sources of predictive information.