Indirect inference for probabilistic wind power forecast models with Itô stochastic differential equations.

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Abstract:

The production of energy from renewable resources such as wind, solar, and biofuels, and its efficient storage has been the focus worldwide in the last decades due to limited reserves of fossil fuels. The inherent volatility of natural phenomena, e.g., the wind speed and direction, the cloud formation, makes it a challenge to forecast the power production from such resources and to integrate efficiently into the electricity grid.

The focus of the current work is to provide efficient probabilistic forecast models for the wind power production for short up to intermediate time horizons. We present a probabilistic forecast model represented by a parametrized Itô stochastic differential equation (SDE), aiming to quantify the uncertainty of a given forecast from numerical weather prediction (NWP). The model parameters are inferred using an indirect inference approach based on the available historical observations. Specifically, we use the maximum likelihood estimation of the two-moment approximation. Moreover, we study different parametric forms of the models to conclude on the most effective according to information criteria.

We apply the described approach to obtain reliable scenarios and confidence bands for forecasts of the aggregate wind power production in Uruguay.

Joint work with Raul Tempone and Soumaya Elkantassi, King Abdullah University of Science and Technology, KAUST.