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# Short frequency nowcasting of wind speed and gusts for wind turbines using Support Vector Machines

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Support vector machines (SVMs) are investigated for ultra-short frequency nowcasting 0–6 hours ahead) of wind speed and wind gusts. The predictions are provided using a ten-minute frequency. Therefore, the model has to be computationally fast, too. As only a few numerical weather prediction (NWP) models, the rapid update cycle models, are available within one hour computation for forecasts of the next few hours and only provide a hourly frequency different methodologies are needed.

Here, a support vector regression was used to provide point forecasts of wind speed and gusts for selected meteorological observation sites and wind turbines. A set of meteorological parameters was predefined. Based on this selection a radial basis function is used as kernel function and hyperparameters are optimized individually for each model via gridsearch. A step-wise feature selection algorithm is built to select the optimal feature combination for every site individually based on the training cross-validation score. The multi-step model is composed of one model for each of the 36 time steps (six hours in total). For comparison two statistic models are implemented: a persistence approach and a multiple linear regression model (MLR) with optimized feature selection.

The SVR model provide reasonable nowcasts for both gust and wind predictions. They outperform the other models in predicting patterns of wind gusts. For two selected episodes, one summer and one winter month this findings hold too. For summer the improvements in forecast skills are larger than for winter forecasts. As the optimisation of the SVR focused more on gusts the improvements for wind speed itself are not as large. Here, the simpler MLR outperforms the SVR at some sites. The MLR model takes a fraction of the training time and performs almost as good as SVR. For a time horizon of two hours, a statistical method like MLR could be a very good alternative to SVR. For longer time horizons the improvement of forecasts is greater and a SVR model usually performs better than MLR