Power Systems Parameters Forecasting Using the Hilbert-Huang Transform and Machine Learning[1]

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A novel hybrid data-driven mathematical forecasting model is developed in order to increase the efficiency of short-term forecasting of non-stationary time-series. Suggested approach combines the effective tool of non-stationary time series analysis based the Hilbert-Huang integral transform (HHT) and machine learning methods. The original time series is decomposed by empirical modal functions that are then subject to the Hilbert transform in order to compute instantaneous amplitudes and frequencies at every time moment. Then the resulting modal functions and instantaneous amplitudes are used to automatically find optimal combinations of input variables for further application of machine learning models. Models that are examined include neural networks, support vector machines, the regression trees approach: random forest and boosting trees.

The random forests and gradient boosting trees learning techniques were examined. The decision tree techniques were used to rank the importance of variables employed in the forecasting models. The Mean Decrease Gini index is employed as an impurity function. The resulting hybrid forecasting models employ the radial basis function neural network and support vector regression.

Proposed strategy was tested on wind speed forecasting problem using real data acquired from the Atlantic offshore buoy data.

This is a joint work with Paul Leahy (Sustainable Energy Research Group, University College Cork, Cork, Ireland), Nikita Tomin, Victor Kurbatsky, Vadim Spiryaev (Dept. Electric Power Systems, Melentiev Energy Systems Institute, Irkutsk, Russia) and Denis Sidorov (Dept. Electric Power Systems, Melentiev Energy Systems Institute, Irkutsk State University Irkutsk, Russia)

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