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Wind Power Forecasting Using Echo State Networks Optimized by Big Bang-Big Crunch Algorithm

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Abstract : In recent years, due to environmental issues traditional energy sources had been replaced by renewable ones. Wind energy as the fastest growing renewable energy shares a considerable percent of energy in power electricity markets. With this fast growth of wind energy worldwide, owners and operators of wind farms, transmission system operators, and energy traders need reliable and secure forecasts of wind energy production. In this paper, a new forecasting strategy is proposed for short-term wind power prediction based on Echo State Networks (ESN). The forecast engine utilizes state-of-the-art training process including dynamical reservoir with high capability to learn complex dynamics of wind power or wind vector signals. The study becomes more interesting by incorporating prediction of wind direction into forecast strategy. The Big Bang-Big Crunch (BB-BC) evolutionary optimization algorithm is adopted for adjusting free parameters of ESN-based forecaster. The proposed method is tested by real-world hourly data to show the efficiency of the forecasting engine for prediction of both wind vector and wind power output of aggregated wind power production.

Keywords : wind power forecasting, echo state network, big bang-big crunch, evolutionary optimization algorithm
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