Skysong Innovations

A unit of the Arizona State University Knowledge Enterprise

Induced Markov Chain for Wind Farm Generation Forecasting

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Inventor(s):

Vijay Vittal

Professor

School of Electrical, Computer and Energy Engineering

Junshan Zhang

Professor

School of Electrical, Computer and Energy Engineering

Tervor N. Werho

Post-Doctoral Scholar

School of Electrical, Computer and Energy Engineering

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Patents Pending

Contact

Shen Yan

Assistant Director of Intellectual Property, Physical Sciences

Skysong Innovations (formerly Arizona Technology Enterprises, LLC)

P: 480.884.1968

F: 480.884.1984

SHEN.YAN@SKYSONGINNOVATIONS.COM

TECHNOLOGYVENTURES@AZTE.COM

Background

Wind turbines are becoming an increasingly common source for energy, yet they can only generate output energy based on the current wind speed causing uncertainty during power system operation. To manage with this uncertainty wind power forecasts are used to predict energy output using statistical models and meteorological data. Statistical models are used to predict weather forecasts in the short-term (a few seconds to 6 hours), while medium and long term (24 hours to 6 months) forecasts use meteorological data. Statistical models are regarded as impractical requiring tuning from an expert for each wind farm, and there is still no guarantee it can be made to work efficiently. With the rise of renewable energy in the commercial and private sectors worldwide, wind power has seen a major growth and is in need of a more practical method to manage power uncertainty.

Invention Description

Researchers at Arizona State University have developed a model for wind turbine farms to efficiently predict and manage wind power uncertainty. This improved forecasting model uses the Induced Markov Chain, which uses prior power output data to predict uncertainty in power using test sets. These models have extremely low computational complexity and can produce a wide set of accurate forecasts in surpassing other current state-of-the-art forecasting algorithms. Furthermore, an Induced Markov Chain model is capable of generating high quality forecasts and can be uniquely tuned using a completely automatic procedure which does not require the attention of an expert. Additionally, the model can lead to reduced economic and environmental inefficiencies with adaptive prediction.

Potential Applications

- Wind Power Forecasting
- Replacement for Current Forecasting Algorithms
- Energy Market Predictions

Benefits and Advantages

- Powerful – This model can be applied to wind farms with drastically different behaviors and has shown up to 20% less mean square error
- Autonomous – High quality forecasts can be trained, generated, and tuned using a completely automatic procedure
- Preserving – Removing uncertainty can result in reduced burning of excess fossil fuels and greenhouse gases
- Extensive – Innovative model can be used to forecast wind power outputs between seconds to 6 hours ahead