Short-term Wind Power Forecasting with Support Vector Regression

CS 74/174 Machine Learning Project Proposal

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1 Problem

With the growing movement towards renewable energy sources, clean fuel sources such as wind power have increased market penetration. This increase in penetration gives rise to the need for power market operators to determine the size of operating reserves to balance power generation with load [1]. Our project will use a regression algorithm to provide a point prediction for power output from wind turbines up to 48 hours in advance.

2 Algorithm

We will use a Support Vector Regression algorithm as described in [2], [3] and §7.1.4 of [4]. We will incorporate data points of wind speed, wind direction, temperature, and humidity into our model. Instead of predicting wind power directly, we will predict wind speed first, then calculate expected power output based on data from typical wind turbines located near our wind data source.

3 Dataset

The dataset for wind measurements was graciously provided to us by Dr. Brian Hirth, research professor at Texas Tech University and the National Wind Institute [5]. The dataset contains measurements dating from 01/01/2002–present for three sites in the West Texas Mesonet. Each site recorded 5-minute averages of 3-second measurements of wind speed, wind direction, temperature, and dewpoint. The wind turbine power vs. wind data was downloaded from the National Renewable Energy Laboratory (NREL) Western Wind Resources Dataset [6]. This dataset contains wind speed and rated power output at 10-minute intervals for the years 2004–2006.

4 Milestone

By the milestone date, we plan to have the SVR algorithm coded and functioning on a small subset of the data. We will also have a simple cubic regression coded to predict wind power output based

on wind speed. We will tune the parameters and test the algorithm on more data before the final report.

References

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[3] Yao Zhang, Jianxue Wang, and Xifan Wang. Review on probabilistic forecasting of wind power generation. *Renewable and Sustainable Energy Reviews*, 32(0):255–270, 4 2014. doi: http://dx.doi.org/10.1016/j.rser.2014.01.033. URL `http://www.sciencedirect.com/science/article/pii/S1364032114000446`.

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[6] NREL: Western wind resources dataset. URL `http://wind.nrel.gov/Web_nrel/`.