Wind Speed Predictions

Carol Chiu

April 22, 2020

What is the Problem?

-The goal of this project is to accurately and efficiently forecast wind speeds occurring at a powerplant operation in Hawaii.

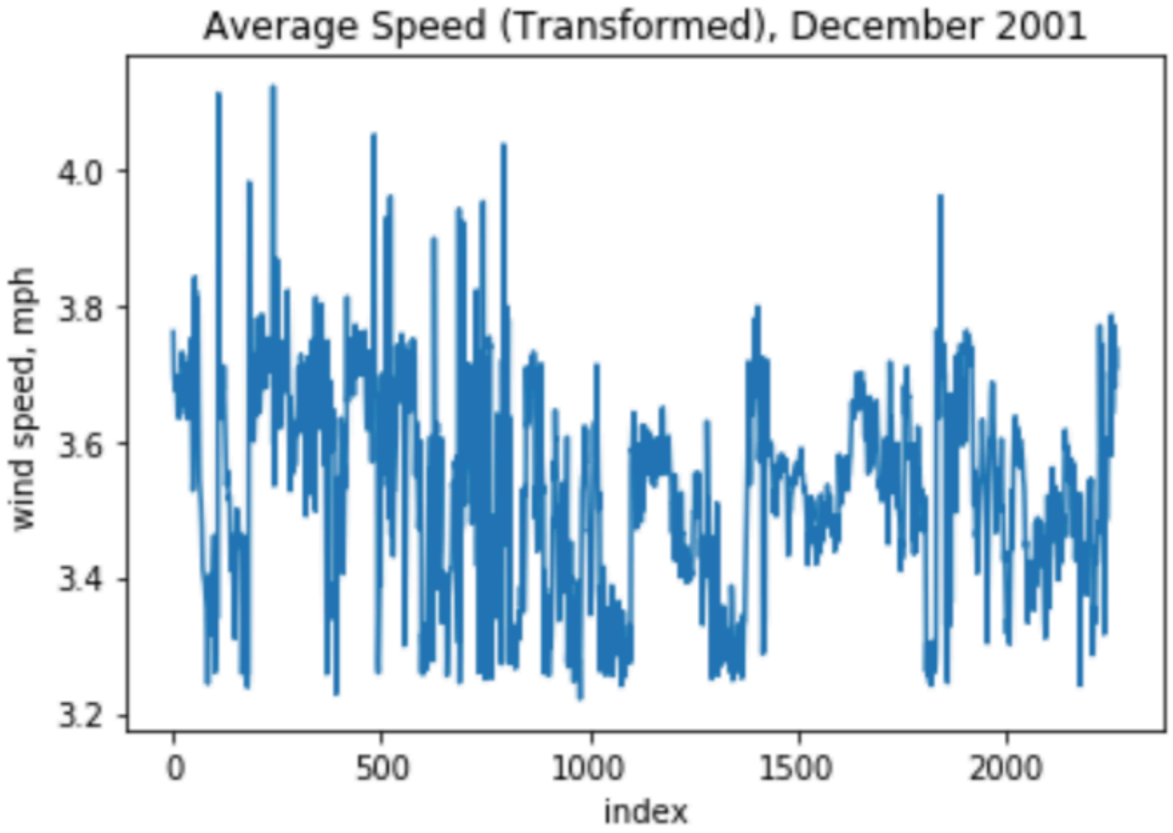
-I will be using data obtained from ASOS devices (Automated Surface Observing Systems) developed by the National Weather Service (NWS) for forecasting weather.

- The ASOS devices return wind speeds at 1 minutes intervals to the motherboard.¶

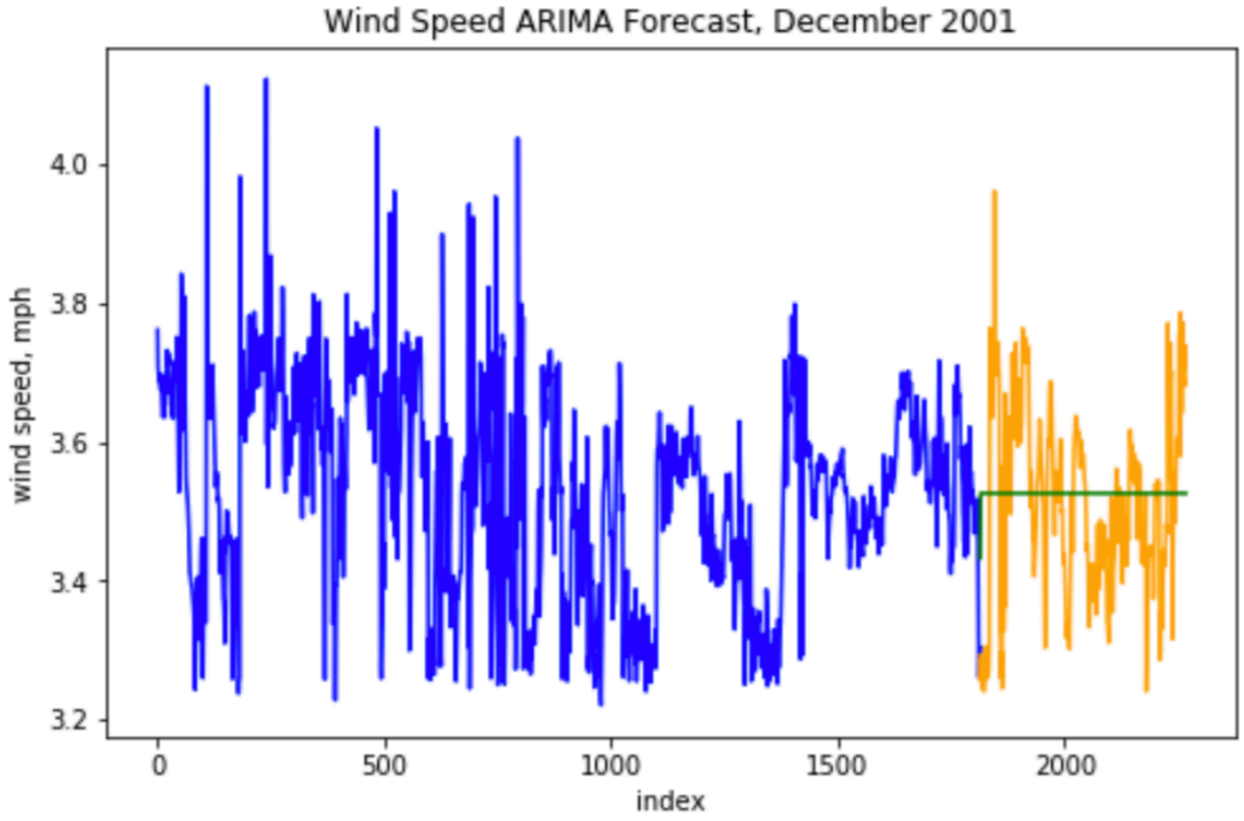
Read in CSV

	coef	max_speed	max_dir	avg_speed	avg_dir	month	avg_speed_regression_imputed	avg_speed_imputed_transform
0	0.146	211.0	7.0	198.0	8.0	12	200.108448	3.761113
1	0.481	202.0	3.0	198.0	3.0	12	188.698452	3.706313
2	0.478	199.0	3.0	197.0	3.0	12	186.432626	3.695136
3	0.630	197.0	3.0	196.0	3.0	12	184.985096	3.687943
4	0.983	197.0	3.0	197.0	3.0	12	185.129551	3.688663

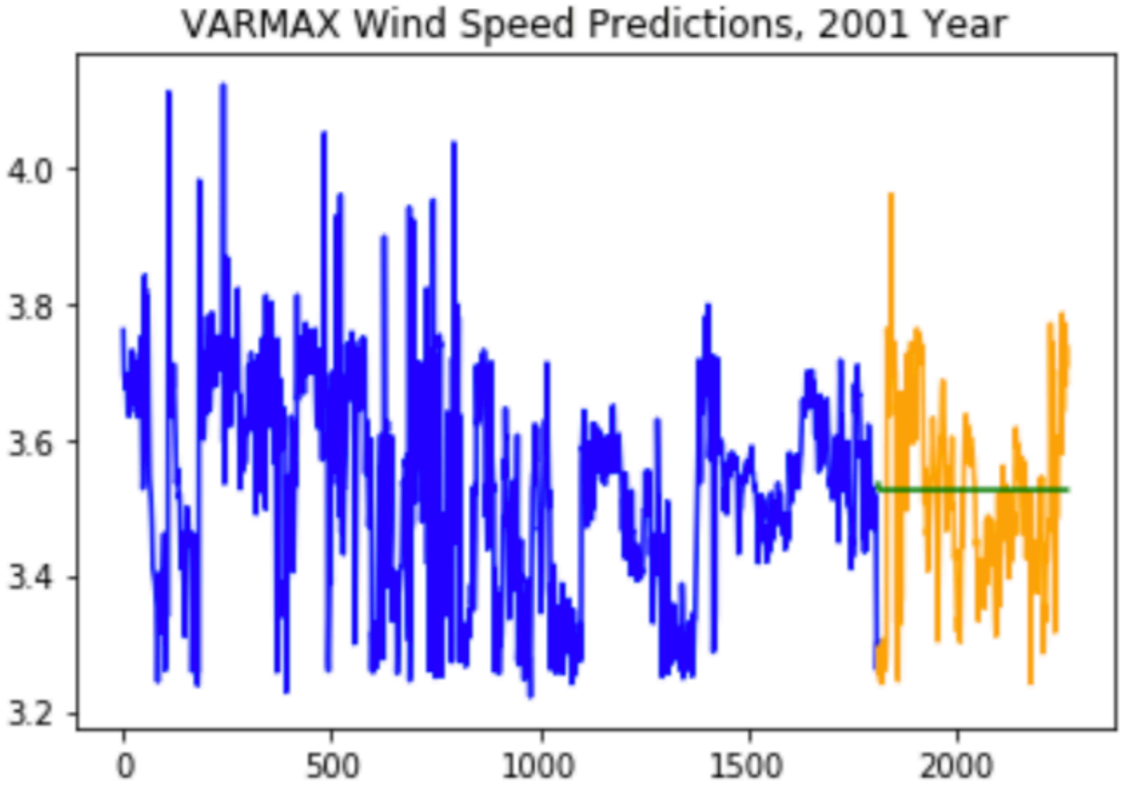
Plot of Wind Speed vs Time



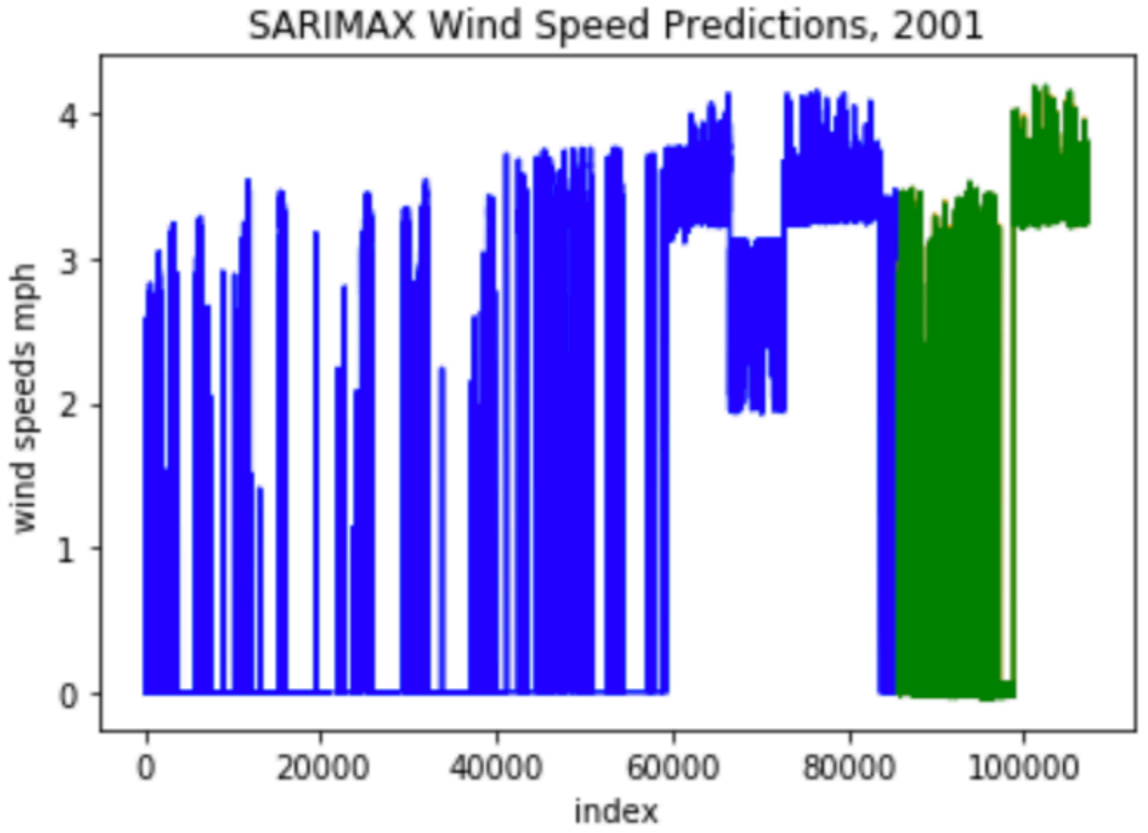
Wind Speed ARIMA Forecast



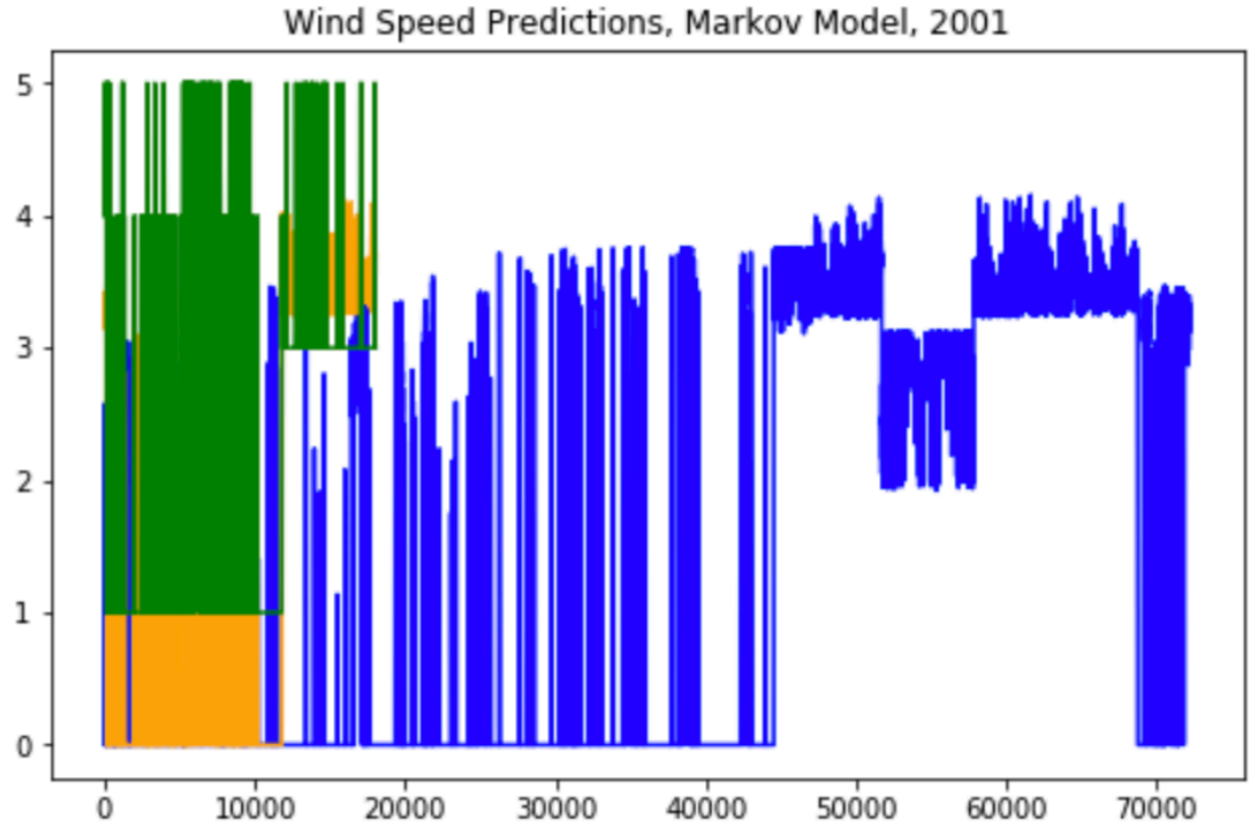
Wind Speed VARMAX Forecast



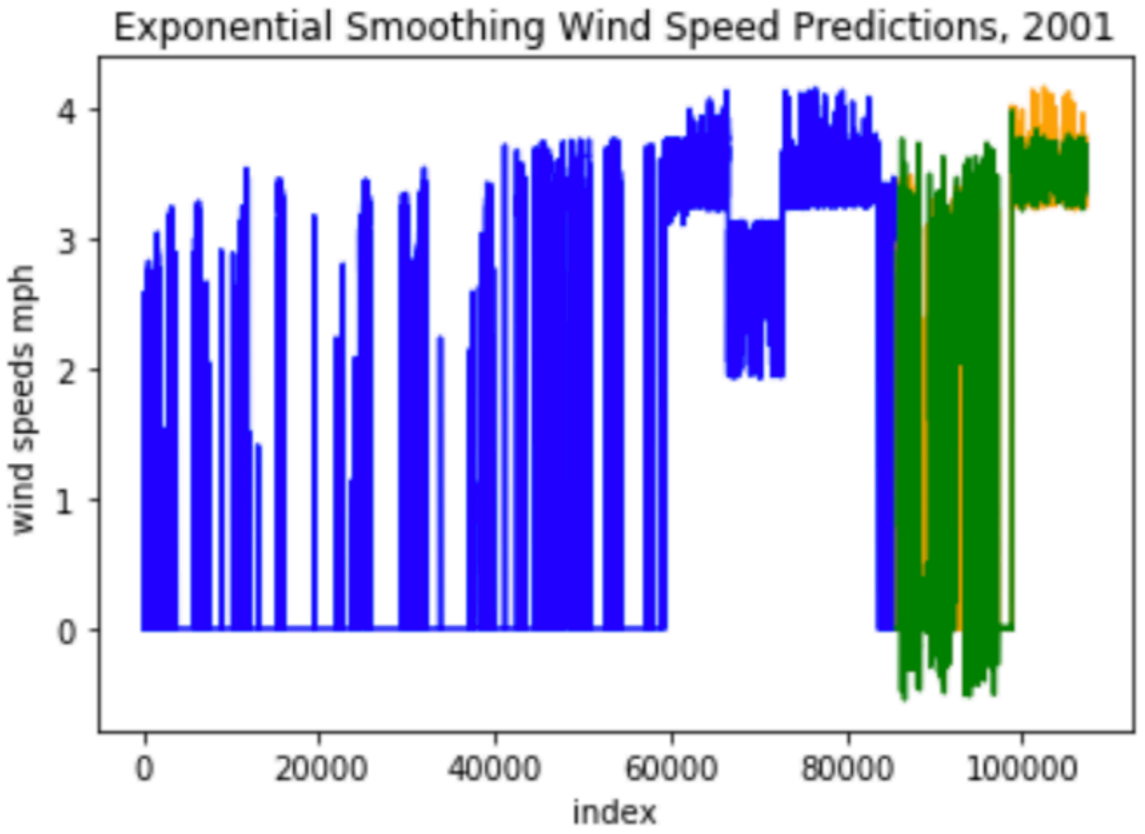
Wind Speed SARIMAX Forecast



Wind Speed Hidden Markov Model Forecast



Wind Speed Exponential Smoothing Forecast



Summary of MSE and RMSE Scores

	ARIMA	VARMAX	SARIMA	Hidden Markov	Exponential Smoothing	Exponential Smoothing
MSE	0.01555	0.02144	0.1598	2.614	NaN	1.922
RMSE	0.1247	0.1464	0.3998	1.617	NaN	1.387
Mean Actual	3.523	3.523	2.236	3.393	NaN	1.985
Mean Predicted	3.524	3.526	2.26	4.032	NaN	1.446
Month	2001 Dec (Winter)	2001 Dec (Winter)	2001 Full Year	2001 Oct-Dec(Fall)	NaN	2001 Full Year

Executive Summary/ Results:

-The ARIMA, VARMAX, SARIMAX, Hidden Markov, and Triple Exponential Smoothing models did well in predicting wind speeds

-We obtained low RSME and MSE scores below 0.5 for all the models except the Hidden Markov model (HMM)!

-Even the HMM model achieved low MSE and RMSE scores below 2!

-We were also able to accommodate for cyclic trends and seasonal influence on high and low wind speeds every year with the SARIMAX and Triple Exponential Smoothing models.