Predicting Stock Market Direction… Through Weather?

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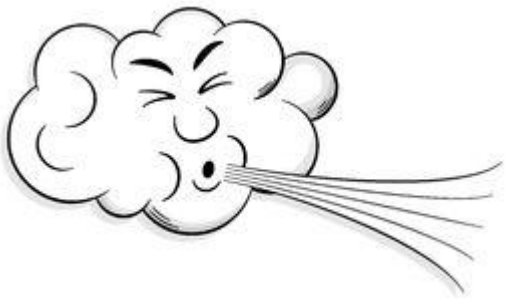
Project Question

Does weather affect the stock market?



How could the weather affect the stock market?

- Adverse weather can interrupt the economy via:
  - Supply chain management
  - Business processes
  - Consumer movements
  - Human behavior <- the branch of behavioral finance that we will be examining
- Stock market is increasingly operated by high frequency trading algorithms; however, a vast proportion of trading decisions are still controlled by humans
- Seasonal Affective Disorder is when daylight becomes scarce and the body produces less melatonin
  - Makes you feel sleepy!

Project Method

Datasets

- Financial
  - S&P 500 Index
    - Traded on the NYSE and NASDAQ
  - VIX Index
    - Traded on the CBOE
- Weather
  - National Solar Radiation Database
    - Solar radiation levels, Clear Sky DHI etc.
  - Carbon Dioxide Information Analysis Center
    - Snowfall, Snow depth, Precipitation, etc.

Testing Methodology

- Evaluate whether weather data has any effect on whether the market will move up or down
- Cross validation done on every trading day in 2004 - 2013
- Applied 7 different classification techniques
- Created a buy/sell algorithm based upon model results on 2014 using the proba function

Statistical Results

SP 500 Futures

Classification Type	Model Accuracy
K Nearest Neighbor[1]	0.5
Logistic Regression	0.5279
Decision Tree	0.5106
Extra Trees	0.4695
Random Forest	0.5106
AdaBoost	0.4907
Gradient Boosted Trees	0.5079

VIX Futures

Classification Type	Model Accuracy
K Nearest Neighbor[1]	0.5161
Logistic Regression	0.6016
Decision Tree	0.5414
Extra Trees	0.508
Random Forest	0.5
AdaBoost	0.5762
Gradient Boosted Trees	0.5789

Assumptions: 1) 9 closest points 2) Testing = 0.3 3) Random State = 4444

Portfolio Results

SP 500 Futures

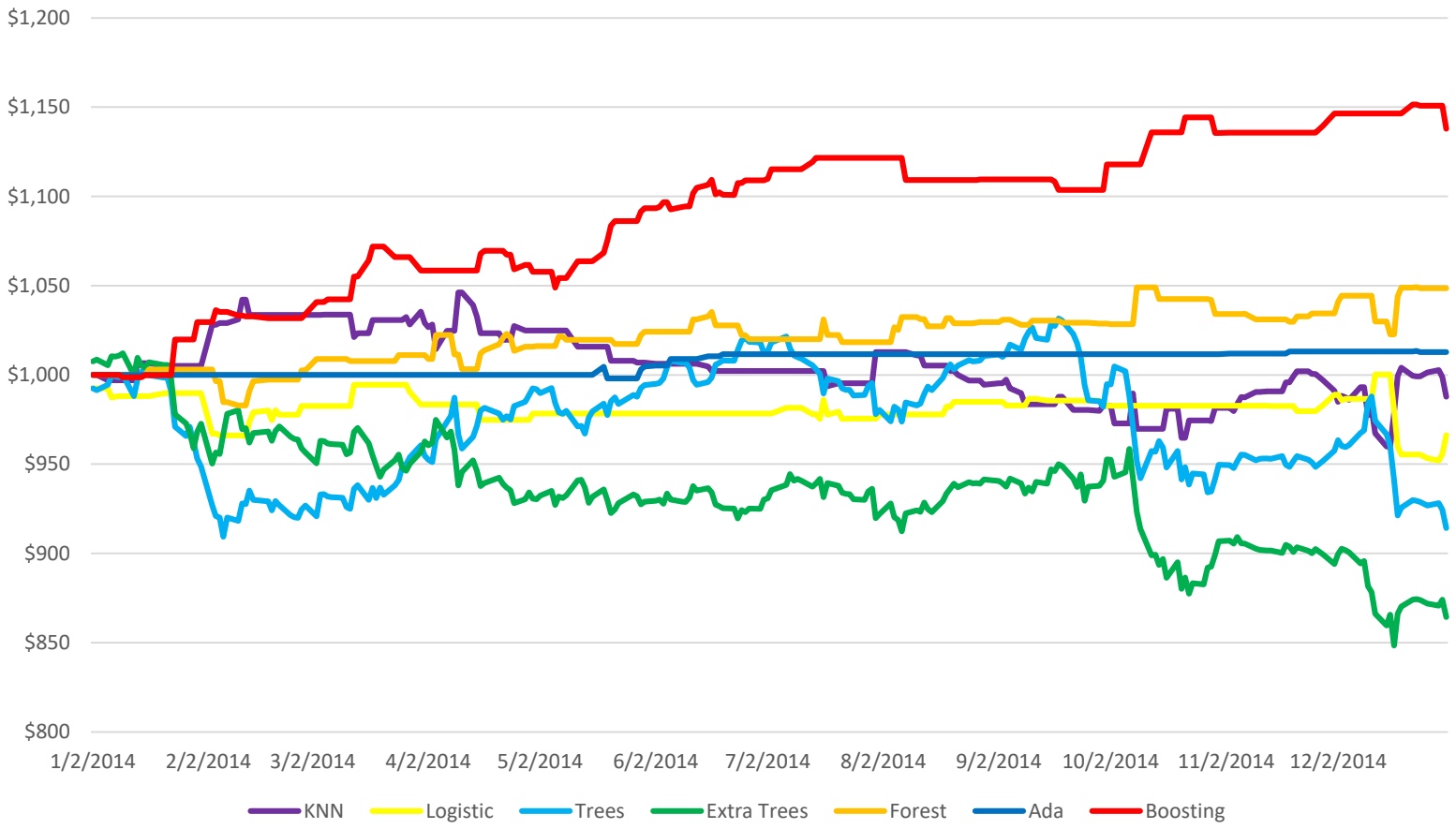
Classification Type	% Return
K Nearest Neighbor[1]	-1.22%
Logistic Regression	-3.37%
Decision Tree	-8.58%
Extra Trees	-13.56%
Random Forest	4.86%
AdaBoost	1.28%
Gradient Tree Boosting	13.79%

VIX Futures

Classification Type	% Return
K Nearest Neighbor[1]	-4.04%
Logistic Regression	211.3%
Decision Tree	-59.09%
Extra Trees	181.54%
Random Forest	-20.31%
AdaBoost	3.89%
Gradient Tree Boosting	36.59%

Assumptions: 1) Buy and Sell decision was based off of results from the proba function using the mean and 1 standard deviations from the mean

S&P 500 Algorithm Testing



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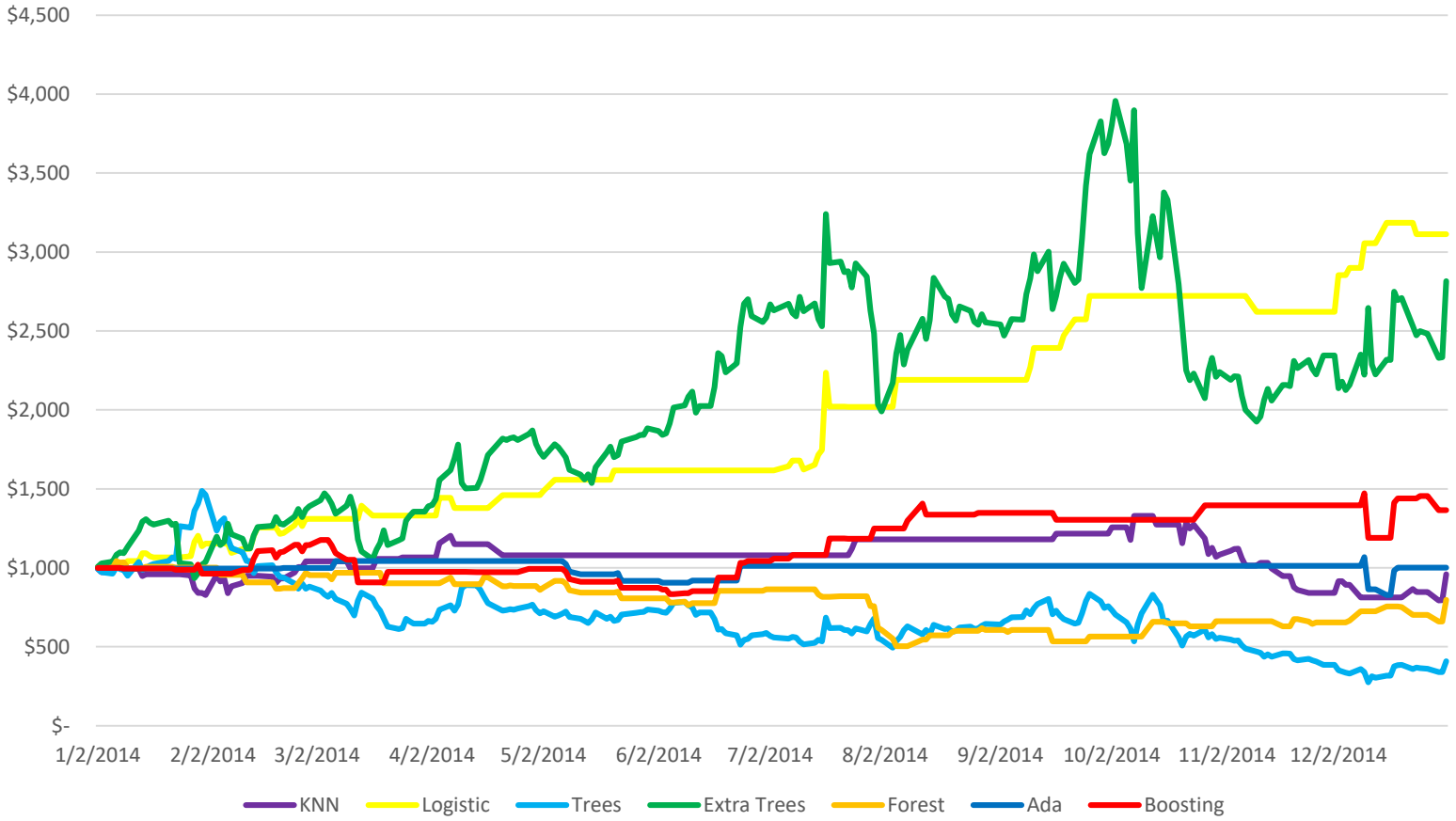
VIX Algorithm Testing



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Conclusion

- Extra Trees Classifier has the biggest variation in both futures markets
- Gradient Boosting Classifier was the only classifier to return profits on both markets
- AdaBoost Classifier has the smallest variation in both futures markets
- Don’t use Trees Classifier and KNN!
- Next Steps
  - Train test split across different years and test algorithm for different years
  - Optimize proba function parameters for buy/sell orders
  - Analyze other tradeable contracts
    - Most importantly analyze agricultural and energy commodity futures

Thank You!

References

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