PREDICTING MARKET VOLATILITY USING MACRO HEADLINES

INTRODUCTION

On June 26th, 2015, months of debt negotiations between the Greek government and its creditors broke off abruptly. Prime Minister Tsipras called for a snap referendum regarding bailout terms. Within hours, the S&P had fallen significantly. Large market movements as a consequence of political and economic headlines are hardly uncommon; liquid markets are most susecptible to swings when news breaks.

Using the VIX as a proxy for market volatility, we investigate how macreconomic news headlines affect changes in the VIX. We predict equity market vol using tweets from major news sources, hedge funds and investment banks, and notable economists.

OBJECTIVES

Twitter provides a plethora of market data. In this project, we will use over 200,000 tweets from various accounts to predict upward movements in the VIX. We use three different supervised learning methods:

1. Naive Bayes
2. Support Vector Machines
3. Logistic Regression with PCA

In order to create a viable trading strategy, we need to accurately predict an increase in market volatility at least 51% of the time.

MACHINE LEARNING APPROACH

Figure 1: Tweet corresponding to 14% change in VIX

We used three different techniques to predict movements in the VIX: Naive Bayes, SVM, and logistic regression. The three techniques performed similarly, with prediction accuracy between 60-64%. We used a universe of 742 clusters of tweets, and therefore performed leave-k-out cross-validation to maximize our use of data.

Our dictionary contains over 10,000 tokens, so in order to reduce the dimension of our covariates, we performed a PCA analysis on our tweets. By selecting the first 100 loadings, we reduce our model by a factor of 100. We subsequently performed a logistic regression on the training set, and predict using the 100 coefficients on the test-ing set.

Method	Naive Bayes	SVM	Logistic
Accuracy	0.624	0.5586	0.6461

Figure 2: Accuracy from Three Methods
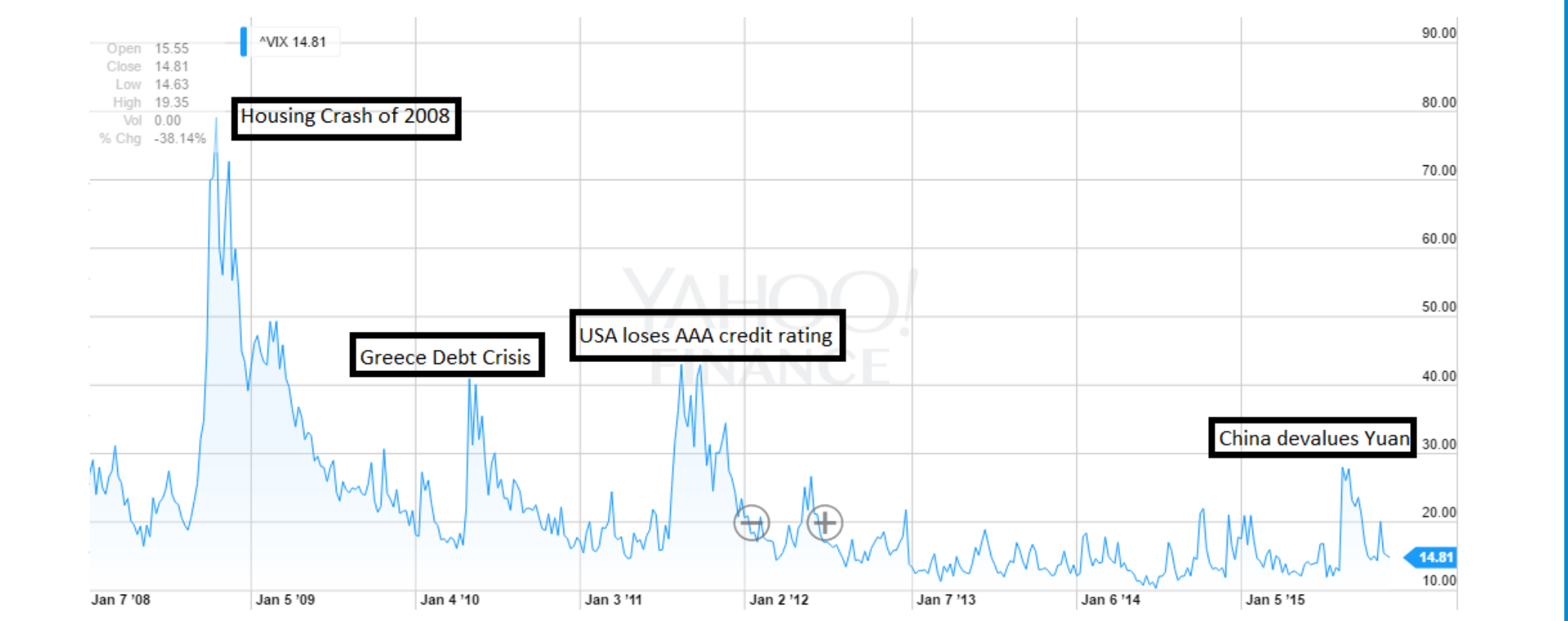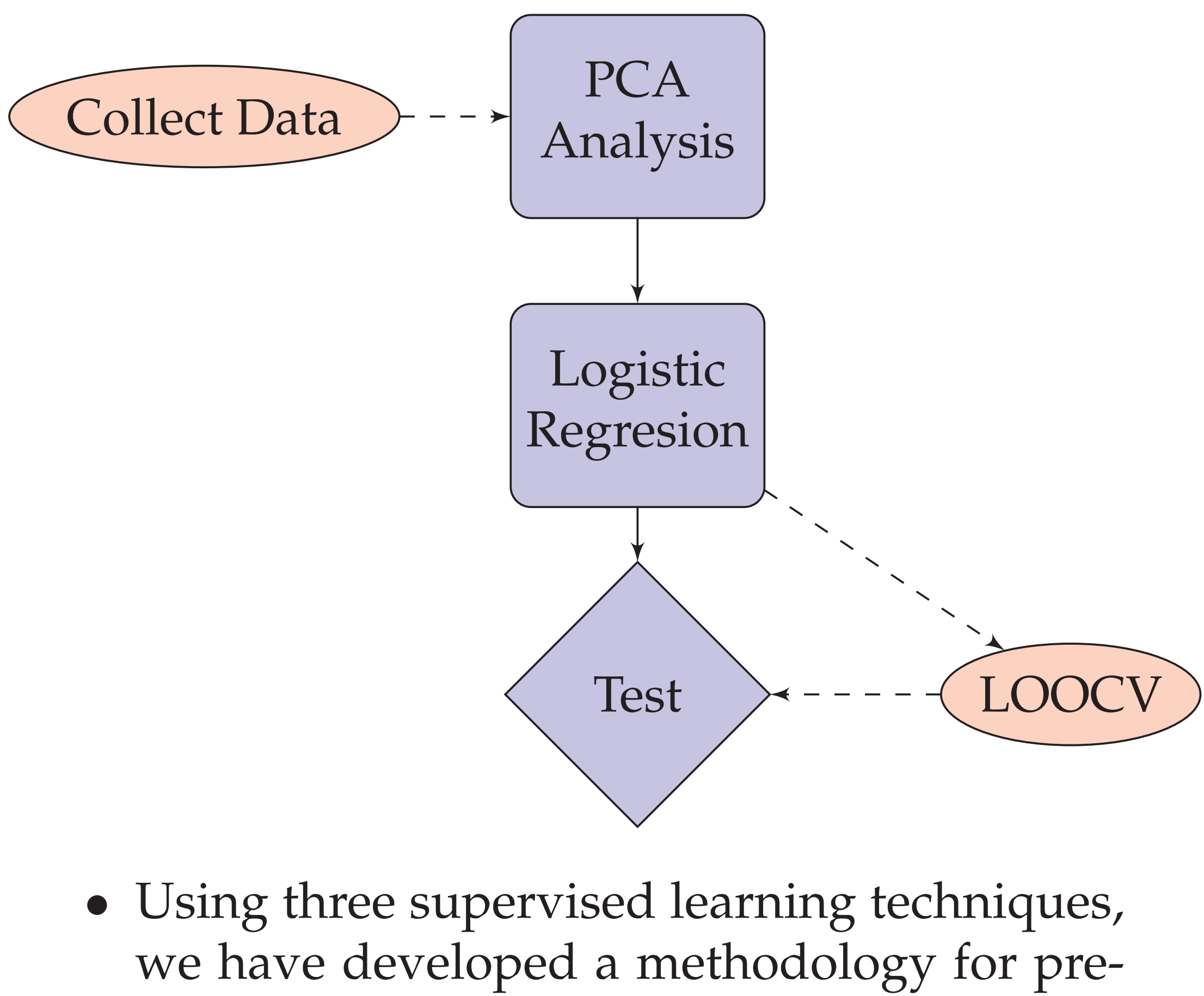
EVENT-DRIVEN VIX

Figure 3: The VIX

Figure 3 shows a graph of the VIX over the past 10 years. We have marked key economic events including the default of Lehman Brothers in 2008, both Greek crises, USA losing its AAA credit rating, and the devaluation of the yuan in 2015.

We say that a set of tweets causes a **significant** increase in market volatility if within a 30 - minute window, the VIX increases by at least one-fifth of a standard deviation.

DATA PROCESSING

We pulled 180,000 tweets from 70 accounts, including:

- Financial Newspapers
- Breaking News Sources
- Hedge Funds and Investment Banks
- Notable Economists and Analysts

Using a subset of tweets, we created a dictionary of 10,000 words. We including tokens that result from the '#' feature of twitter to ensure that trending events are included.Tweets were grouped together in 30-minute increments, to align with intraday VIX data.

Both Twitter data and market data is pulled over a maximum of 6 months. The Twitter API allowed for the 3200 most recent tweets per account to be collected.

CONCLUSION AND FUTURE STEPS

- Using three supervised learning techniques, we have developed a methodology for predicting volatility movements, with an accuracy between 56-64%.
- By implementing a 2:1 stop-loss ratio, this can be transformed into a trading strategy, using options on the VIX.
- We believe that with more concentrated tweets, the accuracy would greatly increase.
- By eliminating tweets that are not macroeconomic headlines, or headlines unrelated to the S&P500 movements, we foresee higher prediction accuracy.
- Alternatively, by modifying and shortening the dictionary to include exclusively market-related words and tokens, we would see an increase in accuracy.

REFERENCES

[1] Bollen, Johan; Mao, Huina; Zeng, Xiaojun. *Twitter mood predicts the stock market*, (2011).
[2] M.S.A Wolfram, *Modelling the stock market using twitter*, School of Informatics, University of Edinburgh, (2010).

TRADING VOL BASED ON PREDICTIONS

We have created a strategy that predicts movements in the VIX with above a 60% accuracy. The simplest strategy to trade based on this prediction is to invest in options on the VIX. Alternatively, we can trade vol by buying options on equities and hedging the underlying. Using a stop-loss ratio of 2:1, this should be a viable strategy.