Capstone Project with Moelis & Co.

Presented By
Minsuk (mk3474@columbia.edu)
Paul (hp2496@columbia.edu)
Yijia (yc3425@columbia.edu)
Jolie (jt2998@columbia.edu)
Gary (pb2632@columbia.edu)
Future Profit Warning Classification using Earnings Call Transcript
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Profit Warnings Example

1) Apple CEO Tim Cook issued the company’s first profit warning in 16 years on January 3, 2019, pointing to China’s slowing economy for the company’s revenue shortfall.

1) FedEx Corporation stated during the Q3 2019 earnings call on March 19, 2019 that they are “now forecasting fiscal 2019 adjusted earnings $15.10 to $15.90 per diluted share” from previous EPS $15.50 to $16.60.
**RTT News Profit Warning Calendar**

<table>
<thead>
<tr>
<th>Date</th>
<th>Symbol</th>
<th>Co. Name</th>
<th>Curr. Est</th>
<th>New Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/30/19</td>
<td>LLY</td>
<td>Eli Lilly And Co.</td>
<td>$25.1 - $25.6 Bln</td>
<td>$22.0 - $22.5 Bln</td>
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<tr>
<td>04/25/19</td>
<td>MMM</td>
<td>3M Co.</td>
<td>10.45 - 10.90</td>
<td>9.25 - 9.75</td>
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<tr>
<td>04/23/19</td>
<td>WAT</td>
<td>Waters Corp.</td>
<td>9.20 - 9.45</td>
<td>9.05 - 9.25</td>
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<tr>
<td>04/18/19</td>
<td>DHR</td>
<td>Danaher Corp.</td>
<td>4.75 - 4.85</td>
<td>4.72 - 4.80</td>
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<tr>
<td>04/02/19</td>
<td>USNA</td>
<td>USANA Health Sciences</td>
<td>5.25 - 5.55</td>
<td>5.00 - 5.35</td>
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<td>04/02/19</td>
<td>USNA</td>
<td>USANA Health Sciences</td>
<td>$1.25 - $1.30 billion</td>
<td>$1.21 - $1.26 billion</td>
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<td>03/26/19</td>
<td>CCL, CUK, CCL.L</td>
<td>Carnival Corp.</td>
<td>4.50 - 4.80</td>
<td>4.35 - 4.55</td>
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<td>03/19/19</td>
<td>FDX</td>
<td>FedEx Corporation</td>
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<td>15.10 - 15.90</td>
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<td>03/06/19</td>
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<td>Donaldson Company Inc.</td>
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<td>2.27 - 2.41</td>
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<td>02/06/19</td>
<td>LLY</td>
<td>Eli Lilly And Co.</td>
<td>5.90 - 6.10</td>
<td>5.55 - 5.65</td>
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<tr>
<td>01/31/19</td>
<td>ABC</td>
<td>AmerisourceBergen Corp.</td>
<td>6.65 - 6.95</td>
<td>6.65 - 6.85</td>
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<tr>
<td>01/23/19</td>
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<td>TE Connectivity Ltd.</td>
<td>$13.9 - $13.4 Bln</td>
<td>$13.45 - $13.85 Bln</td>
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<tr>
<td>01/23/19</td>
<td>TEL</td>
<td>TE Connectivity Ltd.</td>
<td>5.60 - 5.80</td>
<td>5.35 - 5.55</td>
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</tbody>
</table>

**Seeking Alpha Earnings Call Transcript**

**Pfizer Inc. (PFE) CEO Albert Bourla on Q1 2019 Results - Earnings Call Transcript**

Q1 04-30-19 Earnings Summary

EPS of $0.85 beats by $0.10 | Revenue of $13.12B (1.64% Y/Y) beats by $106.48M

Earning Call Audio

Company Participants

Chuck Triano - SVP, IR
Albert Bourla - CEO
Frank D’Amello - CFO
Data

- S&P500 Healthcare (A, ALGN, AMGN, BDX, CAH, CERN, etc.)
- 40 transcripts from future profit warning stocks and 40 transcripts from healthy companies
Exploratory Data Analysis (Wordcloud)
First Approach: Multinomial Bayes Classifier

- The train accuracy is: 0.5938
- The test accuracy is: 0.4375
More Features (NLTK VADER Library)

- VADER Library incorporates word-order sensitivity relationship so it captures more than what bag-of-words model.
- Scores are ratios for proportions of text fall in each category like positive, negative, and neutral
- \( V_{\text{neg}} \): Negative words portion
- \( V_{\text{neg,MD}} \): Negative words portion from Management Part
- \( V_{\text{neg,QA}} \): Negative words from Q&A Part

<table>
<thead>
<tr>
<th>Price Warning</th>
<th>( v_{\text{neg}} ) mean</th>
<th>( v_{\text{neg}} ) median</th>
<th>( v_{\text{neg}} ) std</th>
<th>( v_{\text{neg,MD}} ) mean</th>
<th>( v_{\text{neg,MD}} ) median</th>
<th>( v_{\text{neg,MD}} ) std</th>
<th>( v_{\text{neg,QA}} ) mean</th>
<th>( v_{\text{neg,QA}} ) median</th>
<th>( v_{\text{neg,QA}} ) std</th>
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<table>
<thead>
<tr>
<th>Price Warning</th>
<th>( v_{\text{pos}} ) mean</th>
<th>( v_{\text{pos}} ) median</th>
<th>( v_{\text{pos}} ) std</th>
<th>( v_{\text{pos,MD}} ) mean</th>
<th>( v_{\text{pos,MD}} ) median</th>
<th>( v_{\text{pos,MD}} ) std</th>
<th>( v_{\text{pos,QA}} ) mean</th>
<th>( v_{\text{pos,QA}} ) median</th>
<th>( v_{\text{pos,QA}} ) std</th>
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</thead>
<tbody>
<tr>
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<td>0.327504</td>
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<td>0.045623</td>
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</tbody>
</table>
Logistic Regression & Random Forest

Logistic Regression

Accuracy: 56.25%

Random Forest

Accuracy: 62.5%
Feature Importance (Random Forest)
Future Works

- Different Industries (Industrials, Consumer)
- More samples
- Different Features by using other libraries or complexity/readability analysis
- Other machine learning models including XGBoost and neural networks
Stock Predictions Using News Sentiments
Project Overview

Hypothesis

● News articles have impact on stock market
● We are assuming news article sentiment is a significant signal for predicting a company’s stock return

Goal

● Use daily average news article sentiment score to predict the future daily stock return
● We are using Apple Inc’s news and stock price to test our hypothesis
News Data

Data Sources

- ProQuest Historical Newspapers
- News sites include: New York time, Wall Street Journal, CNN, Forbes, etc.

Date Range

- April 21st, 2016 - March 15th, 2019

Notes:

- News Relevance is calculated by applying TF-IDF on key words of Apple Inc.
- TF-IDF refers to term frequency-inverse document frequency.
- Tf-idf weighting are often used by ranking a document’s relevance given a word.

Data Preprocessing

- Data Cleaning
- Data Processing
  - News article text tokenization
  - Word embedding
- Feature Engineering
  - Content Sentiment Score
  - Headline Sentiment Score
  - News Relevance(1)
  - Weighted Content Sentiment Score
  - Weighted Headline Sentiment Score
  - Competitors’ stock returns (Microsoft, HP, Google)

Apple Stock Price Data

- **Data Resource**
  - Yahoo Finance

- **Variables**
  - Date and time
  - Open, close, high, low price

- **Date Range**
  - April 21st, 2016 to March 15th, 2019

- **Augmented Dickey Fuller Test (ADF)**
  - Goal: check stationarity of time series
  - Conclusion: time series of log daily return is stationary
Apple Market Price and News Sentiment Score of the Day

From April 21st, 2016 to March 15th, 2019

Data Sources
ProQuest Historical Newspapers
## Model Performance

### Regression Task

<table>
<thead>
<tr>
<th>Models</th>
<th>RMSE (% of Return)</th>
<th>Correct Signs (% Correct)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrent Neural Network (LSTM)</td>
<td>1.41</td>
<td>50.98</td>
</tr>
<tr>
<td>Gaussian Process Regression</td>
<td>1.40</td>
<td>55.33</td>
</tr>
<tr>
<td>Vector Autoregression (VAR)</td>
<td>1.39</td>
<td>55.56</td>
</tr>
<tr>
<td>ARMA Model</td>
<td>1.40</td>
<td>53.46</td>
</tr>
</tbody>
</table>

### Classification Task

<table>
<thead>
<tr>
<th>Models</th>
<th>Accuracy (% Correct)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaussian Process Classification</td>
<td>55.34</td>
</tr>
<tr>
<td>Support Vector Machine</td>
<td>54.77</td>
</tr>
<tr>
<td>XGBoost</td>
<td>50.55</td>
</tr>
</tbody>
</table>
Model Improvement/Further Research

- Can we manipulate our data differently?
  - Can we decrease the data frequency to weekly or monthly?
    - If so, we need more data, and most of them are not publicly available
  - Can we use a more state-of-the-art model to extract some trend out of the very volatile data?
    - We tried LOESS, and it failed to extract the trend.
- Does the same effect occur when we test on other stocks?
- If we can find more up-to-date news, we can even test our hypothesis on hourly prices instead.
Question Session
Thank You