CSCI 654 Team Research Investigation
Network Investors - Stock Market Analytics

Team Member:
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Stock Movement Prediction with Historical Data

1. Collect the Daily stock price based on the 20 years of historical data.
2. SMA and EMA technical indicator Calculation.
3. Find performance ratio for each NYSE stocks and general mark trend.
4. Analyze technical indicators of each company using Relative Strength Index and Stochastic Oscillator.
   a. Measures speed and change of price movement.
   b. Determines if overbought or oversold.
5. Use different ways to understand the chart to determine price action.
   a. Head and Shoulders and Double Bottom.
      i. Indicates the process of reversal either from bullish or bearish trend.
Predicting stock price movement using machine learning

1. Evaluate the equity future price over the long time.
   a. Determine stocks that will rise over 10% in a period of one year.
   b. predict the movement of the stock price, as well as the ratio of the movement over certain fixed amount of time.

2. Data Set preprocessing.
   a. Retrieve historical financial indicators from each company.

   a. Comparing financial indicator data value between two consecutive years for a particular stock.
   b. If the current year stock price is 10% higher than the previous, label data point for a specific financial indicator as “Good”, otherwise as “Bad”.
   c. Find the probability of both good and bad data using Naïve Bayes Classifier.
   d. Compare the good and bad probability to determine the stock price movement.

## Naive Bayes Example

### Dataset of Apple Stock

<table>
<thead>
<tr>
<th>Yearly Transition</th>
<th>Sales growth</th>
<th>Price to earnings ratio</th>
<th>Stock price is 10% higher</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013 to 2014</td>
<td>Increased</td>
<td>Increased</td>
<td>Yes</td>
</tr>
<tr>
<td>2014 to 2015</td>
<td>Increased</td>
<td>Increased</td>
<td>Yes</td>
</tr>
<tr>
<td>2015 to 2016</td>
<td>Increased</td>
<td>Decreased</td>
<td>No</td>
</tr>
<tr>
<td>2016 to 2017</td>
<td>Decreased</td>
<td>Decreased</td>
<td>Yes</td>
</tr>
<tr>
<td>2017 to 2018</td>
<td>Decreased</td>
<td>Increased</td>
<td>No</td>
</tr>
</tbody>
</table>

### Sales Growth

<table>
<thead>
<tr>
<th>Stock price is 10% higher</th>
<th>Yes</th>
<th>No</th>
<th>P(Y)</th>
<th>P(N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased</td>
<td>2</td>
<td>1</td>
<td>2/3</td>
<td>1/2</td>
</tr>
<tr>
<td>Decreased</td>
<td>1</td>
<td>1</td>
<td>1/3</td>
<td>1/2</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>2</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Price to earnings ratio

<table>
<thead>
<tr>
<th>Stock price is 10% higher</th>
<th>Yes</th>
<th>No</th>
<th>P(Y)</th>
<th>P(N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased</td>
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</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>2</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
1. Find the probability that the apple stock price will increase more than 10% for next year
   a. Only select probability if the Sales growth and the Price to earnings ratio are increased.
2. $P(\text{Good Data}) = P(\text{SG}=\text{Inc}|\text{SP}=\text{Inc}) \times P(\text{PER}=\text{Inc}|\text{SP}=\text{Inc}) \times P(\text{SP}=\text{Inc}) = \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} = 0.267$
3. $P(\text{Bad Data}) = P(\text{SG}=\text{Inc}|\text{SP}=\text{Dec}) \times P(\text{PER}=\text{Inc}|\text{SP}=\text{Dec}) \times P(\text{SP}=\text{Dec}) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{3} = 0.1$
4. The accumulated Probability of each financial indicator: $P(X) = P(\text{SG}) \times P(\text{PER}) = \frac{2}{3} \times \frac{2}{3} = 0.36$
5. Good ratio = $P(\text{Good Data}) / P(X) = 0.267 / 0.36 = 74.167\%$
6. Bad ratio = $P(\text{Bad Data}) / P(X) = 0.1 / 0.36 = 27.776\%$
7. Compare both ratios and make the decision.
Predictive Analytics on Public Data

Authors:

1. Nann, Stefan, University of Cologne, Pohligstr. 1, 50969 Köln, Germany
2. Krauss, Jonas, University of Cologne, Pohligstr. 1, 50969 Köln, Germany
3. Schoder, Detlef, University of Cologne, Pohligstr. 1, 50969 Köln, Germany

Presented at the 21st European Conference on Information Systems in June 2013
Predictive Analytics on Public Data

- Aggregate data from public API’s such as Twitter, and Yahoo Finance
- Determine the sentiment of a message by first determining which stock it refers to, then determine whether it is positive or negative
- Determine sentiment threshold by looking at historical messages and then the price movement of the following day
- Resulted in a 400% ROI over a 6 month period

\[
\text{Sentiment Predictor} = \frac{\text{No. of positive messages}}{\text{SMA30 of positive messages}} - \frac{\text{No. of negative messages}}{\text{SMA30 of negative messages}}
\]
Predictive Analysis on Public Data

- Could this model be used in conjunction with technical analysis to be even more accurate?
- Does the time of year affect the effectiveness of sentiment on price action?

The Effect of Rating Changes on Stock Returns

- Dr. Imran Ahmad Khan, Assistant Professor, College of Administrative and Financial Sciences, Saudi Electronic University, Dammam, Saudi Arabia
- Published in International Journal of Research in Management, Economics and Commerce
- Published March 2018
- Looking at how stock rating changes affect around announcements of rating changes in India
- Ratings include:
  - General Buy/Sell/Hold rating
  - Expected future share price
The Effect of Rating Changes on Stock Returns

- Looked at rating changes from 2004-2017
- Concluded that rating changes had a significant effect in price volatility shortly after rating announcements
The Effect of Rating Changes on Stock Returns

- Could this analysis be extended to the United States?
- Potential to aggregate ratings of a collection of companies/analysts and provide a sentiment, similar to that of social media sentiment

http://www.academia.edu/37452762/The_Effect_of_Rating_Changes_on_Stock_Returns_An_Empirical_Investigation
Questions?