Stock Market Prediction

Reference: www.wikipedia.org

What is it?

- Act of determining the future value of a company stock or other financial instrument traded on a financial exchange.

- Why?
  - Profitable for investors

Random Walk Hypothesis

- A financial theory stating that stock market prices evolve according to a random walk and thus cannot be predicted
- Burton G Malkiel – “A Random Walk Down Wall Street”
  - Stock price increases if heads, decreases if tails
  - Took results to chartist who suggested that stock must be bought immediately
- Andrew W Lo, Archie Craig MacKinlay – presented evidence that this theory was wrong in their book “A Non-Random Walk Down Wall Street”

Prediction Methods

- Fundamental Analysis
- Technical Analysis
- Technological Methods

Fundamental Analysis

- Concerned with the “company” that underlies the stock itself
- Evaluates past performance and credibility of its accounts
- Based on performance ratios such as the P/E ratio (Ratio of company’s stock price to the company’s earning per share)
- Warren Buffet – a famous Fundamental Analyst

Technical Analysis

- Not concerned with company's fundamentals
- Solely based on potential trends in the past price of the stock
- Head and Shoulders pattern, Cup and Saucer Pattern, Candle Stick Patterns
- Statistical techniques such as the Exponential Moving Average (EMA) are also employed
  - $S_1 = Y_1$
  - $t > 1, S_t = a.Y_t + (1-a).S_{t-1}$

Technological Methods (1)

- Data Mining Technologies – Eg: Artifical Neural Networks
  - Most common is feed forward network with back propagation
  - However, RNNs are more suitable
  - ANNs can predict a class (buy or sell) better than a quantitative value (high or low price)

Technological Methods (2)

- Internet based sources
  - Tobias Preis et al. introduced method to identify online precursors for stock market moves using trading strategies based on search volume data provide by Google Trends
  - Analysis of 98 terms of varying financial relevance suggested that an increase in search vol. for financially relevant search term tend to precede large losses in financial markets

Technological Methods (3)

- Applications of Complexity Science
  - Researchers at New England Complex Systems Institute(NECSI) – stock market crashes
  - Indicated that the internal structure of market was responsible for crashes, not external crises

KNN Algorithm for stock market prediction

(Ida Vainionpää and Sophie Davidsson)

```
Function knn
Input: A finite set D of points to be classified
       A finite set T of points
       A function c: T -> {1,...,m}
       A natural number k
Output: A function r: D -> {1,...,m}
Begin
 Foreach x in D do
  Let U <- {}
  Foreach t in T add the pair ( d(x,t) , c(t) ) to U
  Sort the pairs in U using the first components
  Count the class labels from the first k elements from U
  Let r(x) be the class with the highest number of occurence
 End Foreach
 Return r
End
```

Basic KNN Algorithm

KNN Algorithm (Cont.)

- knnsearch function - returns the nearest neighbors of the values within a matrix based on values within another matrix (the training data)
- Training Data(second matrix) – Historical data set (used to choose neighbors)
- Test Data(first matrix) – Current day’s data (used to predict next day’s value)
- Prediction made only one day at a time so that values do not converge and fall off from the actual value

KNN Algorithm (Cont.)

- To make the prediction
  - For every price in the first matrix, k nearest neighbors from the second matrix are found
  - The indices of all the k nearest neighbors are increased by one
  - The values of the elected next day neighbors are then averaged in order to make a prediction of how the closing price would be on the next day

Summary

- What is stock market prediction? Why?
- Random Walk Hypothesis
- Prediction Methods
  - Fundamental
  - Technical
  - Technological
- KNN Algorithm

Thank You!