FINAL PROJECT REPORT

MET CS 677 – DATA SCIENCE WITH PYTHON

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Introduction:

Stock market analysis involves the examination and evaluation of the stock market to predict its future movements and to make informed investment decisions. Traditional approaches to stock market analysis include technical analysis, which examines historical market data to spot trends and patterns, and fundamental analysis, which examines economic and financial variables influencing the value of companies. However, more advanced methods like LSTM networks have gained popularity since the development of machine learning. Because LSTMs can identify temporal relationships and patterns that other algorithms might miss—a critical skill in the highly unpredictable world of the stock market—they are especially well-suited for this task.

Applications of LSTM in Stock Market Analysis

Price Prediction: By studying historical price sequences, volume trends, and other relevant data, LSTMs can forecast future stock prices.

Risk Assessment: Long Short-term memory models (LSTMs) can assist in evaluating the risk attached to various stocks by examining trends and volatility in past data.

Portfolio management: By simulating different portfolio scenarios and allocating assets optimally to maximize returns and minimize risk, LSTMs can be used to optimize portfolio management.

Objective:

We'll find and examine stock market statistics, especially those related to certain technology stocks (Apple, Amazon, Google, and Microsoft). In this project, we'll learn how to retrieve stock information from yfinance and utilize Seaborn and Matplotlib to visualize various parts of it. We'll examine many methods for assessing a stock's risk based on its historical performance. We'll also be using the Long Short-Term Memory (LSTM) approach to forecast future stock values.

In this project, we will cover the following points:

1.) How much did the stock price fluctuate over time?
2.) What was the stock's average daily return?
3.) What was the different stocks' moving average?
4.) How did various stocks correlate with one another?
5.) How much of our money is at danger when we buy a certain stock?
6.) How can we try to forecast the behavior of stocks in the future? (Using LSTM to forecast Apple Inc.'s closing stock price)

Get the Data :

Obtaining the data and loading it into memory is the first stage. Our stock data will come from the Yahoo Finance portal. Yahoo Finance provides a wealth of information about the financial markets and tools for identifying profitable ventures. We will use the yfinance module, which provides a threaded and Pythonic method of downloading market data from Yahoo Finance, to obtain the data from Yahoo Finance.

1.) How much did the stock price fluctuate over time?

[35]:

Date	Open	High	Low	Close	Adj Close	Volume	company_name
2024-04-04	184.000000	185.100006	180.000000	180.000000	180.000000	41624300	AMAZON
2024-04-05	182.380005	186.270004	181.970001	185.070007	185.070007	42335200	AMAZON
2024-04-08	186.899994	187.289993	184.809998	185.190002	185.190002	39221300	AMAZON
2024-04-09	187.240005	187.339996	184.199997	185.669998	185.669998	36546900	AMAZON
2024-04-10	182.770004	186.270004	182.669998	185.949997	185.949997	35879200	AMAZON
2024-04-11	186.740005	189.770004	185.509995	189.050003	189.050003	40020700	AMAZON
2024-04-12	187.720001	188.380005	185.080002	186.130005	186.130005	38554300	AMAZON
2024-04-15	187.429993	188.690002	183.000000	183.619995	183.619995	48052400	AMAZON
2024-04-16	183.270004	184.830002	182.259995	183.320007	183.320007	32891300	AMAZON
2024-04-17	184.309998	184.570007	179.820007	181.279999	181.279999	31151861	AMAZON

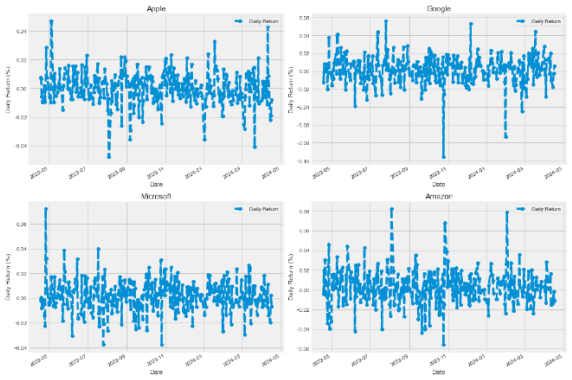
The analysis of the stock price fluctuations for Amazon (AMZN) over several days in April 2024 shows daily variations between the highest and lowest prices. Here are the details:

- April 4, 2024: The stock price fluctuated between a high of $186.15 and a low of $180.00.
- April 5, 2024: The fluctuation was between $187.27 (high) and $185.07 (low).
- April 8, 2024: The price ranged from $187.29 (high) to $184.81 (low).
- April 9, 2024: The fluctuation was between $187.34 (high) and $185.67 (low).
- April 10, 2024: The stock price varied between $187.27 (high) and $185.95 (low).

2.) What was the different stocks' moving average?

There are four graphs corresponding to each company, displaying the stock price movements along with their moving averages. The analysis from the image shows the moving averages for different stocks over specified periods (10, 20, 50 days).

3.) What was the stock's average daily return?



There are four plots corresponding to each company, showing the daily returns over a specified period. The y-axis of each plot represents the daily return in percentage, and the x-axis represents the date.

4.) How did various stocks correlate with one another?

Correlation is a statistic that measures the degree to which two variables move with each other which has a value that must fall between -1.0 and +1.0. Correlation measures association, but doesn't show if x causes y or vice versa — or if the association is caused by a third factor. The image shows the correlation between different stocks based on their daily returns.

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[**********************100%%**********************]  4 of 4 completed
Ticker          AAPL      AMZN      GOOG      MSFT
Date
2023-01-03       NaN       NaN       NaN       NaN
2023-01-04  0.010314 -0.007924 -0.011037 -0.043743
2023-01-05 -0.010605 -0.023726 -0.021869 -0.029638
2023-01-06  0.036794  0.035611  0.016019  0.011785
2023-01-09  0.004089  0.014870  0.007260  0.009737
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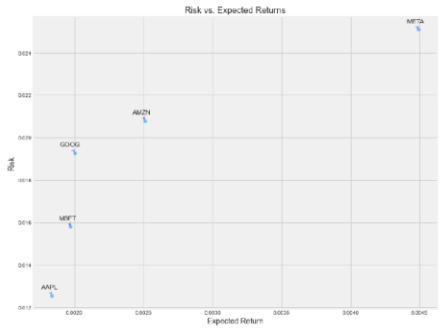
These observations indicate that there is a general positive correlation among the daily returns of these tech stocks during the analyzed period.

5.) How much of our money is at danger when we buy a certain stock?

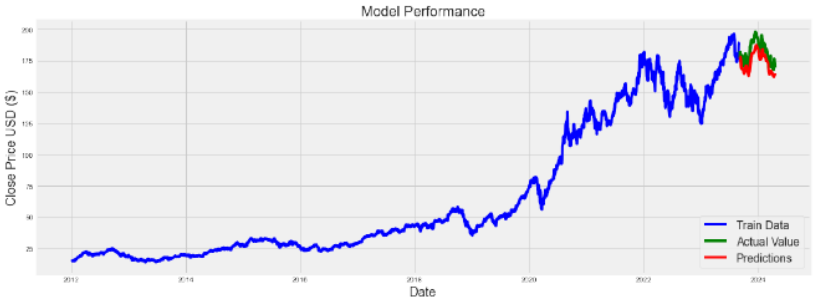
Risk may be evaluated in a variety of ways, but one of the simplest is to compare the expected return and the standard deviation of the daily returns using the data we've collected on percentage returns.



The scatter plot clearly illustrates the fundamental investment principle that higher potential returns are associated with higher risks. Each stock's position on the plot indicates its risk-return profile, with the x-axis representing expected returns and the y-axis representing risk (measured as the standard deviation of returns). Investors can use this analysis to align their stock selections with their individual risk tolerance and return expectations. The plot serves as a visual aid to quickly assess which stocks might fit an investor's portfolio based on their comfort with volatility and their return objectives.

6.) How can we try to forecast the behavior of stocks in the future? (Using LSTM to forecast Apple Inc.'s closing stock price)

The LSTM model can make predictions about future stock prices. These predictions are based on the learned patterns and the most recent data points.
The plot in the image shows three key components:
Train Data: Historical data used for training the model.
Actual Values: Real stock prices after the training period, used to validate the model's predictions.
Predictions: The model's forecasts for the stock prices, plotted to compare against the actual values.



The visualization in the image demonstrates the model's performance, highlighting its predictive capabilities and potential discrepancies between predicted and actual values.

Conclusion:

This project effectively utilized data analysis and machine learning to provide valuable insights into stock market dynamics. The combination of correlation analysis, risk assessment, and predictive modeling with LSTM allows for a comprehensive understanding of market behaviors, aiding in better investment decisions. While the tools and methods used here provide significant insights, it's important to consider the inherent uncertainties and volatilities in the stock market, which can impact the accuracy and reliability of predictions.