Time Series Modeling vs Neural Network Modeling for Stock Prices

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OVERVIEW

- Use time series methods to forecast stock price and to see which stock has the highest growth in the next 90 days
- Use neural networks to predict stock prices for 2021
- The process is semi automated to find the best RMSE for both sets of stock predictions
- The purpose is to streamline and to find quantitative data for supporting the growth or decline of the two upcoming stocks

- Coca-Cola is the largest nonalcoholic beverage entity in the world, owning and marketing some of the leading carbonated beverage brands.

- Operationally, the firm focuses its manufacturing efforts early in the supply chain, making the concentrate (or beverage bases) for its drinks that are then processed and distributed by its network of more than 100 bottlers. Concentrate operations represent roughly 85% of the company's unit case volume.

- American Airlines is the world's largest airline by scheduled revenue passenger miles. The firm's major hubs are Charlotte, Chicago, Dallas/Fort Worth, Los Angeles, Miami, New York, Philadelphia, Phoenix, and Washington, D.C.

- After completing a major fleet renewal, the company has the youngest fleet of U.S. legacy carriers.

Source of Data

- 6 years of adjusted close historical stock prices from Yahoo Finance and the Alpha Vantage Api for The Coca-Cola Company (KO) and American Airlines (AAL).

Pros and Cons of Using Adjusted Close Data

- The adjusted closing price helps investors understand how much they would have made by investing in a given asset.

- Using the adjusted closing price is essential when comparing the returns of different asset classes over the long term.

- The nominal closing price of a stock or other asset can convey useful information. This information is destroyed by converting that price into an adjusted closing price.


American Airlines (AAL), Daily Stock Prices
Daily Price
60
50
40
30
20
10
2016
2017
2018
2019
2020
2021
Date
Open
High
Low
Close
Adj Close


The Coca-Cola Company (KO), Daily Stock Prices
Daily Price
60
55
50
45
40
35
30
2016
2017
2018
2019
2020
2021
Date
Open
High
Low
Close
Adj Close

Modeling:

- Fit ARIMA, Auto-ARIMA and Facebook Prophet models to the stock being analyzed. The model with the lowest RMSE on the test data was then fit on the entire stock price data set to forecast the next 90 days. Growth rates were recorded for each.

- The Recursive Neural Network (RNN), Long Short-Term Model (LSTM) and Gated Recurrent Unit (GRU) are part of an important branch of deep learning that deliver superior predictions for sequential data. We will these models on the stocks being analyzed. I was able to record models with the lowest RMSE on the test data.

KO Results

- The best forecast was from the Traditional ARIMA Model
  - Which expects a growth of 3.66 % after 90 days
- The best Time Series Model for predictions was the Traditional ARIMA Model, for the log transformed data
  - RMSE = 2.08
- The best Neural Network Model for predictions was the LSTM
  - RMSE = 0.71

AAL Results

- The best forecast was from the Faceboolk Prophet Model
  - Which expects a growth of 41.96 % after 90 days
- The best Time Series Model for predictions was the Auto ARIMA Model, for the log transformed data
  - RMSE = 3.93
- The best Neural Network Model for predictions was the LSTM
  - RMSE = 0.62

Next Steps

- We I could use the window method to complete the AutoRegressive Forecasting Method for the RNN's, LSTM's and GRU's for comparison

- Instead of Stock Price Prediction, I would transition this project to predict stock price movement

- Provide additionally factors that could influence stock price or stock price movement:
  - Sentiment analysis (Consumer Sentiment, Reddit's API or Twitter's API)
  - Economic Indicators (GDP, CPI and/or Treasury Yields)
  - Fundamental Data (Balance Sheet, Cash Flows and/or Income Statement)

Considerations and Thoughts

- Stock price/movement prediction is an extremely difficult task. Personally I don't think any of the stock prediction models out there shouldn't be taken for granted and blindly rely on them. However models might be able to predict stock price movement correctly most of the time, but not always.

- ARIMA are designed for time series data while RNN-based models are designed for sequence data. Because of this distinction, it’s harder to build RNN-based models out-of-the-box.

- ARIMA models are highly parameterized and due to this, they don’t generalize well. Using a parameterized ARIMA on a new dataset may not return accurate results. RNN-based models are non-parametric and are more generalizable.

- Depending on window size, data, and desired prediction time, LSTM models can be very computationally expensive.

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