FORECAST ANALYSIS OF GREGGS STOCKS USING LSTM

GROUP NO 7

AAN SARAH ZACHARIAH
(21077794)
(Technological implication of using AI)

AARON MODIYIL JOSEPH
(22018497)
(Coding, Data Processing, Architecture, Methodology, Result)

ABEL ABRAHAM
(22019717)
(Economical implication of using AI)

SAM PHILIP SOLO
(22013137)
(Coding ,Company History, Ethics of AI, References slide)

VISHAL PHILIP
(22020190)
(Coding, PPT, Company History, Limitations of LSTM Model and its overcoming, Result, Stock Analysis, economic technological and ethical implications of AI)

Code: https://colab.research.google.com/drive/1MXDPUs9Tw253l-HIflwJz8-KGUDdPY5p?usp=sharing

Greggs was founded by John Gregg, who delivered fresh eggs and yeast . Greggs has grown into one of the most popular food-on-the-go brands in the UK. What sets Greggs apart is not just their delicious food, but also their commitment to the community. They provide free breakfasts to primary school children and support children's cancer research.
Looking to the future, Greggs has a clear vision. They aim to be the customers' favorites and provide friendly customer experience.

((GREGGS ORD GBP0.02, 2023) , (Yahoo! Finance, 2023),
(Greggs Corporate., 2023),
(Greggs Corporate, 2023))

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GREGGS

Owns manufacturing Centers

Over 2300 shops

Committed to charity

More than 28000 colleagues

FINANCIAL HIGHLIGHTS*

Total sales

£1,513m

2021: £1,230 million

Total ordinary dividend

59.0p

2021: 97.0p**

Like-for-like (LFL) sales *

+17.8%

Diluted earnings per share

117.5p

2021: 114.3p

Pre-tax profit

£148.3m

2021: £145.6m profit

Colleague profit-sharing

£16.6m

2021: £16.6m

LSTM OVERVIEW

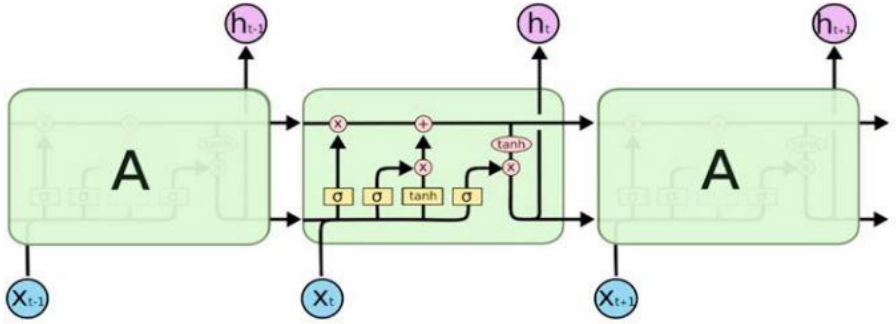
Stock data contains a huge variety of data. A highly efficient model is required to identify the hidden patterns in this data. The LSTM model would be most suitable for predicting stock prices since it is efficient and can hold a large amount of information .

Long Short-Term Memory (LSTM) is a variant of Recurrent Neural Network (RNN) that has the ability to remember past data for making future predictions.

LSTM based on "memory line" is useful for making predictions with huge data.

LSTM is considered unique kind of RNN since it can memorise data sequence

Every LSTM node is made up of cells that hold the data from previous sequences. The top line in each cell connects the models, moving data from the past to the present.



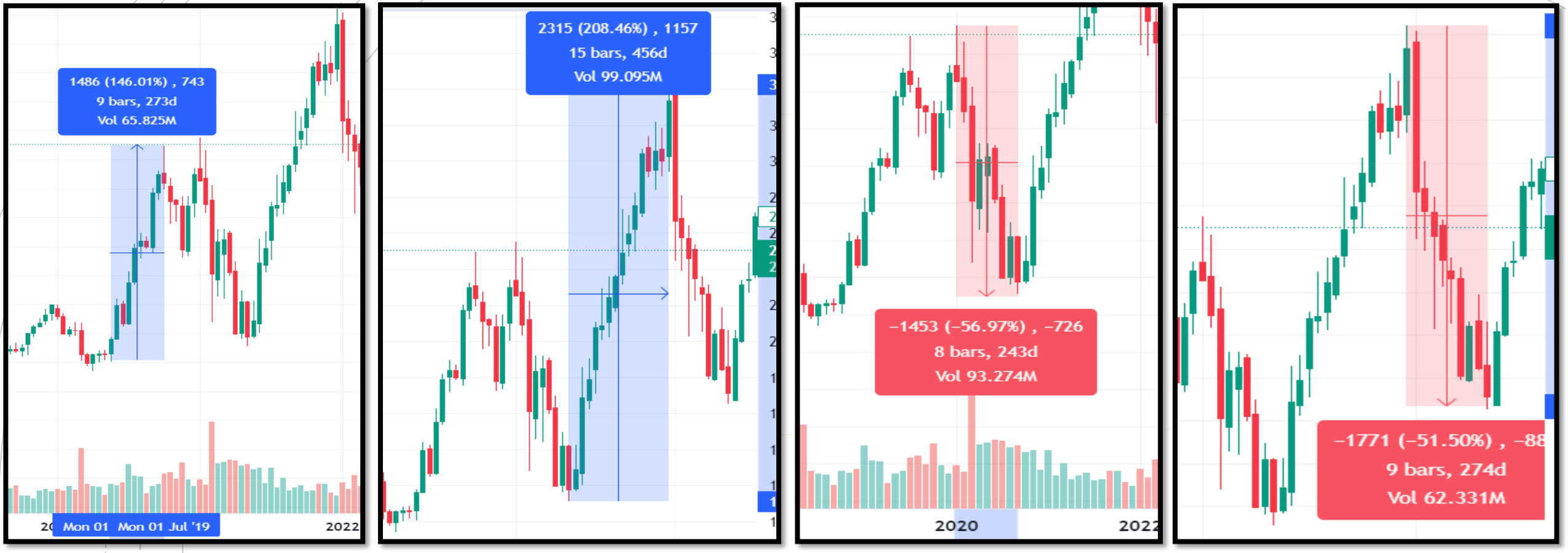
Gates:The gates in a neural network are made up of sigmoidal layers, which guide the cell to an optimal value by filtering the data. Each of these sigmoid layers has a binary value (either 0 or 1).

Forget Gate: It produces a number in the range of 0 to 1, where 1 signifies "retain this entirely" and 0 signifies "completely ignore this"

Memory Gate: Determines which new data will be stored in the cell. An "input door layer" determines which values are modified, and a tanh layer generates a vector of new candidate values that could be inserted to the state.

Output Gate: Determines what each cell's output will be. The output will be dependent on the cell state, filtered data, and the most recently added data.

((Chandola, 2022), (Moghar, 2020))



High volatility indicates a higher risk, but also the potential for significant returns. The given diagrams show how the share price of Greggs fluctuates significantly. The first two graphs show a significant growth in the share price by 146% and 208%, respectively. The company's growth phase indicates a bullish tendency in the market, as investors have significant faith in the company's future. Nonetheless, the following two graphs show that the share price has decreased by 51% and 56%, respectively. This bearish trend could be attributed to a variety of factors, such as changes in market sentiment, economic indicators, or company-specific news.

(GREGGS ORD GBP0.02, 2023)

Data Preprocessing

Fetch and Analyse the data

- The stock data of Greggs plc is fetched from yahoo finance from January 1, 2006, to January 1, 2023 through the yf.download function from yfinance library.
- Basic information and statistics of the data are shown using the data.head, data.info, and data.describe methods.

Extract closing prices

- Extract only the Close prices from the data as it captures the most relevant information about the stock movements.
- Display and analyse this new dataframe, close_df, using the same methods as before and plots them using the close_df.plot method.

Scale the data

- Scale the data between 0 and 1 using the MinMaxScaler class. Fit and transform the close_df data using the scaler.fit_transform method and reshape the data using the reshape method and assigns it to a new variable called scaled_data.
- By scaling the data, the variance of the data is reduced and the model's learning speed and performance are enhanced.

Create time series data structure

- Create batches of data with 60 previous Close prices as input and the next Close price as target using the TimeseriesGenerator .
- Split the data into train and test sets with 80 percent and 20 percent of the data, respectively.
- Creating a time series data structure helps to capture the temporal dependencies of the data.

Methodology

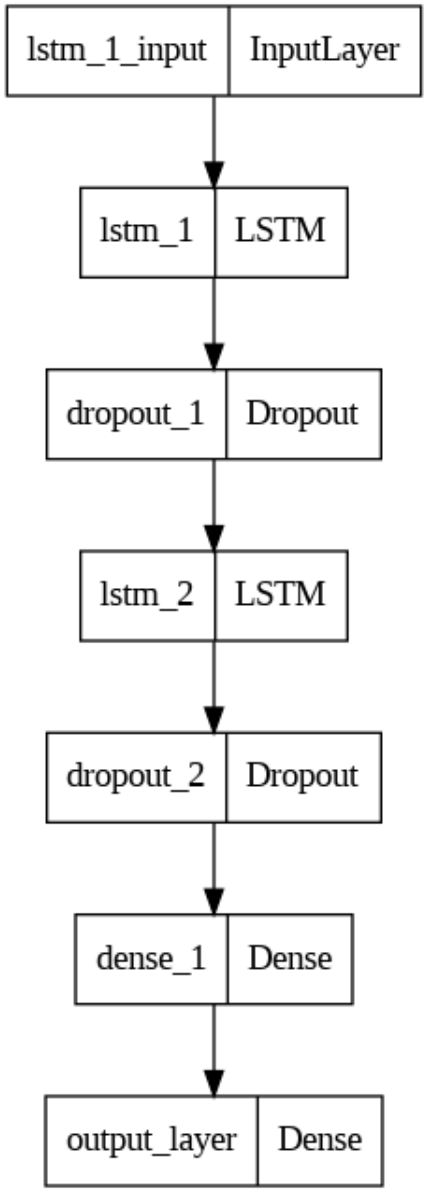
Build the model: The model is a sequential model, which is a linear stack of layers. The model has six layers: two LSTM layers, two Dropout layers, and two Dense layers. Each layer has exactly one input tensor and one output tensor. Different combinations of layers, number of units were experimented with to find an optimal architecture.

Compile the model: The model is compiled with adam optimizer, as it is suitable for problems with large and noisy data, and mean squared error as the loss function, as it is suitable for regression problems.

Fit the model: The model is fit with the train data and test data as validation data. We run this for 30 epochs and with a batch size of 30, which are chosen based on the size and the variability of the data. We also plotted the train loss and validation loss for each epoch to visualize the performance of the model and check for overfitting or underfitting.

((Ahmed, 2022), (Sayah, 2023))

Architecture



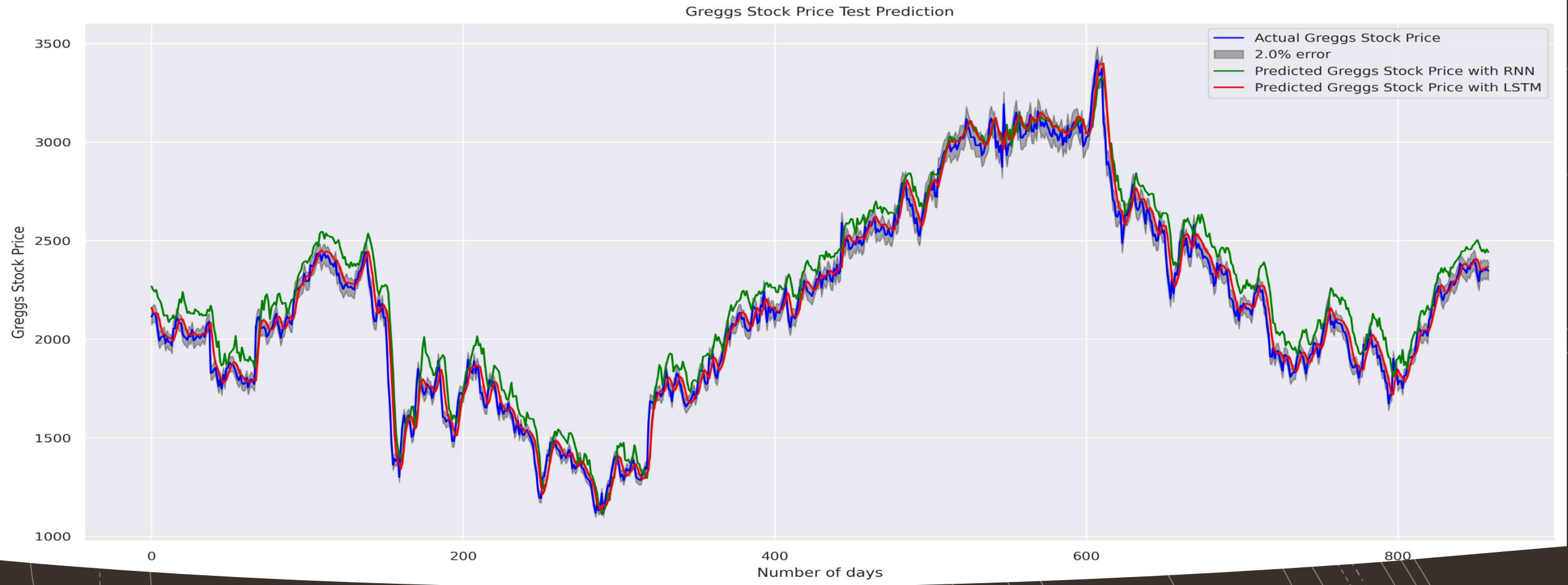
The first LSTM layer has 100 units. The return_sequences parameter is also set to True in the layer to ensure that the output sequence remains the same length. The input_shape option is set to (look_back, 1), which is the shape of the input data.

The first Dropout layer has a rate of 0.2, so that 20 percent of the input units are randomly dropped out during training to prevent overfitting.

The second LSTM layer has 50 units. The layer does not have the return_sequences parameter set, which means that the layer returns only the last output.

Two Dense layers with 25 units and 1 unit respectively, with the second dense layers being the output layer which specifies a single output to predict the next Close price.

((Ahmed, 2022), (Sayah, 2023))



	RMSE	MAE	MAPE
RNN	123.6828	102.6455	0.0514
LSTM	69.707	50.8815	0.0251

- LSTM appears to be better than RNN in terms of prediction accuracy and error rates. This is indicated by the lower values of RMSE (Root Mean Square Error), MAE (Mean Absolute Error), and MAPE (Mean Absolute Percentage Error) for LSTM compared to RNN.
- Lower values in these indicators imply greater performance since they represent narrower gaps between expected and actual values.. Therefore, LSTM seems to provide more accurate predictions and lower error rates than RNN.
- LSTM predicts within a 2% error all the time, while RNN fails to in most days.

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(Kang Zhang, 2019)

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Results

- The model has successfully predicted the closing prices of the stock for the upcoming 35 days
- The model's predictions were compared to the actual values for each day, and a percentage error was calculated. The errors ranged from as low as 0.1231% to as high as 8.6998%. This range gives an indication of the model's performance, with lower errors indicating more accurate predictions.
- The model demonstrated a high level of accuracy in predicting stock prices, achieving over 91% accuracy on all the days for which predictions were made
- The model's success in predicting the direction of stock price movements can be extremely valuable for stock analysis. This means that the model is not only able to predict the specific closing prices, but also whether the stock prices will go up or down.

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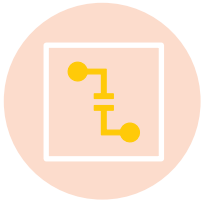
Limitations of LSTM Models for Stock Prediction

Dataset Requirements: To capture long-term patterns, LSTM models need a lot of data that is reliable and relevant.. Insufficient or low-quality data can significantly affect prediction results.



Inability to Handle Sudden Events: LSTM models, which learn and predict based on past data, struggle to react to unpredictable events such as natural disasters or wars that can greatly affect the market.

Limited Input Data: LSTM models typically only include historical stock price data as input, ignoring other influential factors like recent policy information and international situations

Overcoming LSTM Shortcomings

Optimize LSTM models to combine them with other models for prediction. For example, text data from news events, social media, and policy information can be analyzed with Natural Language Processing (NLP) models. This not only diversifies the input data but also improves the reliability of predictions.

(Huang, 2023)

Economic and Technological Implication of Using AI in Stock Prediction

1. Enhanced Data Analysis : AI is fast at analyzing big datasets, finding trends, and extracting insightful information that might influence investment strategies. AI-driven technologies enable investors to monitor business performance, analyze risk factors, and analyze market patterns more effectively than in the past.

2. Algorithmic Trading: Artificial intelligence algorithms are capable of making split-second trading judgments by analyzing sentiment in the news, market data, and a host of other variables. These algorithms can effectively manage risks and give more profit to customers.

3. Fraud Detection And Risk Management: AI algorithms can detect anomalous trading patterns, detect probable market manipulations, and uncover fraudulent activity faster than humans.

4. Access To Advanced Investment Strategies: AI-powered investing platforms have made sophisticated investment methods accessible to regular investors. Based on a user's risk tolerance, financial objectives, and market conditions, these platforms use AI algorithms to generate customized investment portfolios.

(Ligon, 2023)

Ethical implications of using AI for stock predictions

1. Data Integrity: Data should be obtained from reliable and legal sources. The sampling methods used should be robust and random to avoid selection bias, ensuring a representative sample of the population. Ensure the model doesn't unfairly favor certain features or groups. Data sourcing initiatives must respect data privacy laws.

2.Accuracy : Ensure that the data is accurate, reliable, and obtained from reputable sources. Ensuring accuracy in predictions is not just about having a good model, but also about using valid data, refining the model as needed, and conducting regular reviews

3.Transparency and Interpretability : Data should be described and referenced accurately in reporting to clients and supervisors. This ensures transparency . The factors the AI uses to make its predictions should be understandable to humans

4.**Accountability:** Have clear guidelines and procedures for data sourcing to ensure the data used is reliable and ethically obtained. Input data should be securely stored and maintained to protect sensitive information and prevent unauthorized access.

(CFA Institute , 2022)

REFERENCES

- Ahmed, Z., 2022. *Stock Price Prediction with Keras: A Comprehensive Guide.*. [Online]
  Available at: https://medium.com/@zahmed333/stock-price-prediction-with-keras-df87b05e5906#id_token=eyJhbGciOiJSUzI1NiIsImtpZCI6ImU0YWRmYjQzNmI5ZTE5N2UyZTExMDZhZjJjODQyMjg0ZTQ5ODZhZmYiLCJ0eXAiOiJKV1QifQ.eyJpc3MiOiJodHRwczovL2FjY291bnRzLmdvb2dsZS5jb20iLCJhenAiOiIyMTYyOT
  [Accessed 09 December 2023].
- CFA Institute , 2022. *Ethics and Artificial Intelligence in Investment Management, ETHICS AND ARTIFICIAL INTELLIGENCE IN INVESTMENT MANAGEMENT A FRAMEWORK FOR PROFESSIONALS.*. [Online]
  Available at: https://www.cfainstitute.org/-/media/documents/article/industry-research/Ethics-and-Artificial-Intelligence-in-Investment-Management_Online.pdf
  [Accessed 12 December 2023].
- Chandola, D. e. a., 2022. *Forecasting directional movement of stock prices using deep learning - annals of data science, SpringerLink*.. [Online]
  Available at: https://link.springer.com/article/10.1007/s40745-022-00432-6
  [Accessed 09 December 2023].
- Greggs Corporate., 2023. *Our history*. [Online]
  Available at: https://corporate.greggs.co.uk/about-us/our-history
  [Accessed 07 December 2023].
- Greggs Corporate, 2023. *Greggs Corporate | Investors*. [Online]
  Available at: https://corporate.greggs.co.uk/investors/
  [Accessed 07 December 2023].
- GREGGS ORD GBP0.02, 2023. *TradingView*. [Online]
  Available at: https://in.tradingview.com/chart/twMYkdZM/?symbol=LSE%3AGRG
  [Accessed 07 December 2023].
- Huang, M., 2023. *Effectiveness validation of LSTM for stock prices prediction on four stocks*. [Online]
  Available at: https://www.researchgate.net/publication/372823280_Effectiveness_Validation_of_LSTM_for_Stock_Prices_Prediction_on_Four_Stocks
  [Accessed 08 December 2023].
- Kang Zhang, G. Z. J. D. S. W. Y. W., 2019. *Stock Market Prediction Based on Generative Adversarial Network*. [Online]
  Available at: https://www.sciencedirect.com/science/article/pii/S1877050919302789
  [Accessed 10 December 2023].
- Ligon, M., 2023. *How artificial intelligence is revolutionizing stock investing, Forbes.*. [Online]
  Available at: https://www.forbes.com/sites/forbesbusinesscouncil/2023/07/17/how-artificial-intelligence-is-revolutionizing-stock-investing/?sh=1c0353346485
  [Accessed 10 December 2023].
- Moghar, A. a. H. M., 2020. *Stock market prediction using LSTM recurrent neural network, Procedia Computer Science.*. [Online]
  Available at: https://www.sciencedirect.com/science/article/pii/S1877050920304865
  [Accessed 09 December 2023].
- Sayah, F., 2023. *Stock Market Analysis + Prediction using LSTM*. [Online]
  Available at: https://www.kaggle.com/code/faressayah/stock-market-analysis-prediction-using-lstm
  [Accessed 09 December 2023].
- Yahoo! Finance, 2023. *Greggs plc (GRG.L) stock price, news, Quote & History.*. [Online]
  Available at: https://uk.finance.yahoo.com/quote/GRG.L/?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAN4sh5Gt0lVHs2G2ixui5S11S-s0ZvQeCh-YZuQ4515d1zRA8lrqUcpe27iicdN4LSZFR2pLMIe9p7zTyL_F7RXiHe8y-HO-CFZjuR8tDPmKKz6yrV0oBCpNcgV6kCXZGea2
  [Accessed 08 December 2023].