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B.Sc. IT (Hons.) Artificial Intelligence

News Sentiment Effect on Financial Market Trends

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INTRODUCTION

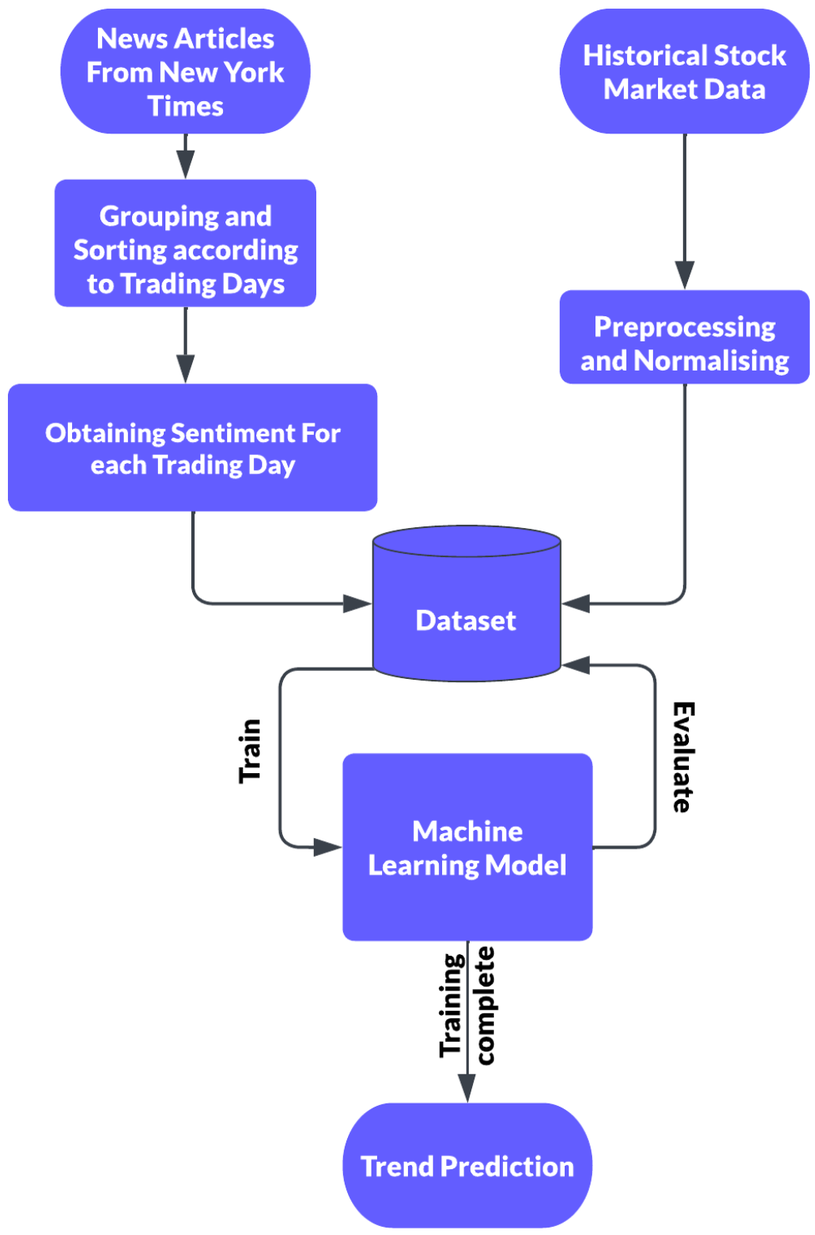
- Reliably forecasting the future price of a stock has been an interest of many researchers and investors as this would yield significant advantages [1, 2].
- Changes in stock market trends are determined by a number of variables, such as events, speculation, supply and demand and government policy [3].
- This project aims to investigate the impact of news article sentiment on financial market trends, such as of the Standard & Poor's 500 Index.
- The main hypothesis is that news articles contain specific characteristics, such as sentiment and events, that can be leveraged by ML techniques to predict the direction of the stock market.
- The goal is to develop an ML model that uses news article sentiment as a feature to predict the direction of the stock price (either 'Upwards' or 'Downwards') from market open to market close.

Aims and Objectives

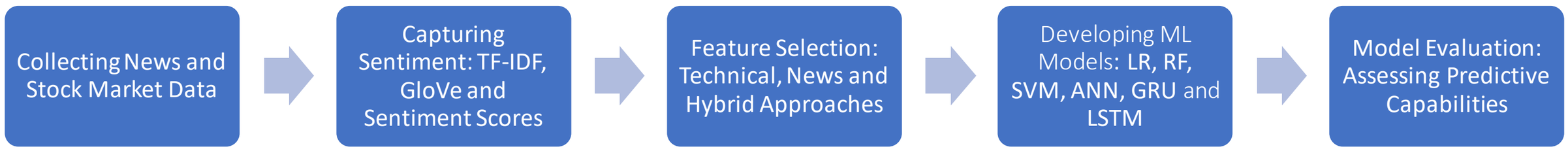
Research Question: "Do news articles contain any predictive power on future stock market prices?"
To achieve this, the following objectives have been set:

- **Objective 1 (O1)**: Identify the best input features and ML method to forecast the short-term stock market direction.
- **Objective 2 (O1)**: Quantify the effectiveness of news article features to predict stock market trend.
- **Objective 3 (O3)**: Determine the most effective lookback window and prediction horizon for forecasting stock market trend.
- **Objective 4 (O4)**: Compare the predictive power of news features on different financial securities.

ARCHITECTURE DESIGN



METHODOLOGY



RESULTS

The objective is to predict the daily direction of the S&P 500 index (GSPC) price for test years 2020, 2021 and 2022.

- The results are presented in Table 1.
- In general, most ML methods achieved the highest accuracies with News-based Models.
- The best method was an LSTM network utilising TF–IDF with DF > 200, achieving an average accuracy of **56%** over the testing period.

Table 1: Highest ML Models Accuracies (%)

ML method	Technical Models	News-based Models	Hybrid Models
LR	52.2	53.0	54.0
RF	48.6	52.5	49.3
SVM	53.2	53.1	53.2
ANN	51.5	53.9	52.2
GRU	53.1	54.8	52.3
LSTM	51.3	56.0	52.9

CONCLUSIONS AND FUTURE WORK

Important conclusions regarding objectives:

- **O1:** The best input features were found to be news TF-IDF with DF > 200 vectors, and the best ML method was LSTM.
- **O2:** Combining NLP techniques with ML methods for stock market trend prediction resulted in superior performance compared to technical-based models and non-ML baselines.
- **O3:** The best model used a lookback of 15 trading days. Additionally, it was observed that accuracy decreased when predicting time horizons beyond 1 day.
- **O4:** The best model was tested on various financial assets for the first 4 months of 2023, demonstrating strong performance in predicting market indexes (**57.7%**), but lower accuracy for individual stocks (51.3%) and market sectors (52%).

Overall, this project showcases the potential of AI in leveraging news sentiment for accurate market trend forecasting. Future work could explore incorporating additional external features, filtering news articles by individual industries, and focusing on shorter time horizons for immediate impact analysis.

REFERENCES

1. B. Fazlija and P. Harder. Using financial news sentiment for stock price direction prediction. Mathematics. 10(13):2156, 2022.
2. S. Wang. The prediction of stock index movements based on machine learning. New York, NY, USA, 2020. Association for Computing Machinery.
3. B. G. Malkiel. Efficient market hypothesis. In Finance pages 127-134. Springer, 1989.