# Future Finance: Predictive Insights and Chatbot Consultation

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***Abstract*— The framework has four pillars on which the rest of it is built. Initially, the Stock Analysis sector is a data-driven approach where historical data is broken down into key components to reduce the amount of hidden information. This is as from there onwards the Stock Prediction module is run which applies predictive modeling methodologies to gain market revelations about future market trends and movements with precision which is informed to investors to help them not only to acquire profits but also maintain stability and to gain knowledge on what to expect. The Assystem, complementing smart wearables, utilizes AI Assistance, with forward facing conversational chatbot interface thus creating a natural environment for the users. This AI-enabled assistant provides customized suggestions, up-to-the-minute details, and impeccable representative behavior as it syncs to investors' expectations. Finally, the Market Guider feature offers users the news and updates from the stock market which were curated, enabling them to stay updated with the involved changes. For predictive analysis, we've opted for the LSTM model due to its superior performance compared to other models tested. It achieved an R-squared score of 0.89, indicating strong predictive power, and demonstrated robustness with a cross-validation score of 0.84 on both training and testing datasets. The model was serialized into a Hierarchical Data Format (HDF) file to save runtime operations and facilitate deployment in Streamlit. Through a Streamlit interface, users can input a stock ticker and receive predicted prices generated by the trained LSTM model.**

***Keywords*— *Future Finance, predictive insights, chatbot consultation, stock analysis, predictive modeling, AI assistance, market guider, real-time updates, proactive decision-making, Machine Learning, LSTM, Mean Squared Error (MSE), LLM.***

## I. INTRODUCTION

The provision of stock investments is a practically tricky one that demands the application of multipronged tactics to handle the complexities of the markets. The title "Future Finance" carries out this philosophy, which is done by having a platform that is divided into structural parts that are four in number, and each one of them dealing with a distinct but interconnected purpose.

The ultimate support in this decision based on the assessment of historical market data is to assemble a strong analysis. Compounded "Future Finance" by the "Stock Analysis" part, expert analytics, study the market patterns and trends in the past to find the clues. Analyzing tradition data enables investors to acquire much required data that explain how stock market has been affected by certain factors which acted as drivers over a given period of time [1-3]. The investor has more insight into the market dynamics as the study is covering a wide spectrum of issues through this comprehensive analysis and so that could enable them to make more prudent investment decisions.

The prediction of market movements plays an essential role in the achievement of the investors desiring to exercise futuristic IM. "Future Finance" is a software that uses predictive modelling techniques, which forecasts future stock market trends, with unparallel precision. Using historical data and catching trend, predictive algorithms can be elegantly capable of producing stochastic events into the future price swings of the stocks [4-7]. This initiative allows investors to be more reactive, it guides them to change strategies and policy, that, mitigating risk and becomes an opportunity for capital.

The introduction of artificial intelligence (AI) technologies has completely changed the type of interaction that investors would experience in financial markets. Goldy, the "Future Finance" AI Assistance, largely focuses on a conversational chatbot interface that is intuitive. This AI voice-driven assistant serves as a companion of any investor, informing him/her on time, in a customized way and addressing the need for fast engagement [8-10]. Through automated information using natural language processing and machine learning, the chatbot delivers users with simply and clear-cut comments that they need to make the complex decisions in the management of their investments promptly and with ease.Conducting a daily market analysis is a must if you want to be up to date on the latest stock

market developments so you can make the right and timely investment decisions. [11-13].

The "Future Finance" application responds to this desire by projecting market trends and delivering niche and stock market news. Through this manner of collecting relevant data and providing timely ideas, this part guarantees that the investors will be able monitor the current market trends, changing regulations and the other important factors affecting the investment chances. With access to a diversified content portfolio and real-time notices, investors have favorable grounds and ability to sharpen up their strategies in response to ever changing market conditions.

## II. Data Set

The data gathered through Yahoo Finance by deploying the yfinance module affords the opportunity to create a comprehensive collection of financial information that is suitable for analytical tasks.[14] Yahoo Finance, which is especially famous for the detailed information about the stock markets of the entire world, is the main data source to obtain immediate and retrospective data regarding stocks, indices, currencies, commodities and other things. Table 2.1 typically includes.

- Stock Prices: Trading regular intervals, stocks' daily, hourly, or even minute-level data highlighting the open, high, low, close, and adjusted close prices. These quotations are the fundamentals on which the most important art in the world of currency analysis.
- Volume and Market Cap: A stock exchanges' information comprises of the trading volume of the stocks and also includes their market capitalizations. There metrics provide the evidence as regard the liquidity & value of companies collectively.
- Company Fundamentals: For that investors use fundamental proxies like earnings per share (EPS), price-to-earnings (P/E) ratio, dividend yield, and other financial statistics referring to the prosperity of the companies.
- Historical Data: Historical prices and volumes throughout the years or even decades that enable the conducting of longitudinal analysis together with trend discovering.

*Table 2.1. Sample Dataset*

| Date | Open | High | Low | Close |
|---|---|---|---|---|
| 2024-04-11 | 168.34 | 175.46 | 168.16 | 175.04 |
| 2024-04-12 | 174.26 | 178.36 | 174.21 | 176.55 |
| 2024-04-1 | 175.36 | 176.63 | 172.5 | 172.69 |
| 2024-04-1 | 171.75 | 173.76 | 168.27 | 169.38 |
| 2024-04-17 | 169.61 | 170.65 | 168 | 168 |
| 2024-04-18 | 168.03 | 168.64 | 166.55 | 167.04 |
| 2024-04-19 | 166.21 | 166.4 | 164.08 | 165 |

The data which come from online financial services Yahoo Finance, through the finance module, are generally structured in the form of a table. Each row in such a table represents the data depicting the prices of a specific stock in a day and every column happens to be one variable or attribute like date, price, volume, etc. It could be saved in data formats which might include CSV or Excel spreadsheets, using which it could be analyzed via standard analytical tools like Python, R, and Excel.

## III. Related Work

*Table 3.1. Related Work*

| Reference | Title | Focus | Methodology |
|---|---|---|---|
| Wen, Y., Cao, Y., & Li, Z. (2022) [15] | A Comprehensive Survey on Long Short-Term Memory Networks in Sequence Learning | LSTM Models | Review of LSTM architectures, training techniques, and applications in sequence learning tasks |
| Xu, Q., Zhang, Y., & Liu, W. (2023) [16] | Recent Advances in LSTM-Based Models: A Survey | LSTM Models | Examination of recent advancements in LSTM architectures, optimization strategies, and applications |
| Zhang, J., Wang, H., & Chen, L. (2022) [17] | Deep Learning Approaches for Stock Market Analysis: A Survey | Stock Market Analysis | Review of deep learning techniques, including LSTM models, for stock market analysis |
| Wang, X., Liu, Y., & Zhang, H. (2023) [18] | Ensemble Learning Methods for Stock Market Prediction: A Comprehensive Review | Stock Market Analysis | Evaluation of ensemble learning methods, including LSTM integration, for stock market prediction |
| Chen, Z., Zhao, L., & Wang, Q. (2022) [19] | Pre-trained Language Models: A Survey | LLM (Language Model) | Examination of pre-trained language models, including GPT and BERT |
| Liu, H., Zhang, Y., & Wang, L. (2023) [20] | Transfer Learning with Language Models: Recent Advances and Applications | LLM (Language Model) | Review of recent advancements in transfer learning with language models |
| Guo, X., Li, H., & Zhou, X. (2022) [21] | News API and Financial Markets: A Review | News API | Overview of News API applications in financial markets |

## IV. Proposed Methodology

### A. Data Collection

Data collection from Yahoo Finance involves connecting to and obtains financial data such as stock dealings, market exchange, and company fundamentals. [22-24] Commonly this follows web search standards which includes obtaining structured data from Yahoo Finance using web scraping method or API.For papers with more than six authors: Add author names horizontally, moving to a third row if needed for more than 8 authors.

### B. Data Processing

Data processing is a sequence of operations to put data into a form for analysis. First off, incomplete records may be filled out using mean value or other statistical measures to bring the consistency of data. Using binning boundaries is a second technique which is used to convert continues variables into categories for appropriate visualization. Secondly, that correlation analysis helps in column-to-column relationships. Column relationships in turn may help in feature selection or understanding dependencies. The final is the data reduction method of Min-Max scaling. By this method, all the numerical features are normalized to a predefined range, which makes their features uniform and their models that are relying on such scaled inputs bias-free. These steps include the data cleansing, data enrichment and data matching which help to improve data quality and to do the analysis correctly and modelling to perfection.

### C. Feature Selection/Engineering

In stock market analysis feature selection/engineering implies finding the most relevant variables to enable the models to make accurate predictions. This procedure activities accuracy and interpretability of the model by identification of the most informative features and wanting for new features that essential.

### D. Models Selection

The traditional models such as linear regression, Decision Trees, Random Forests, CNN provide simplicity; the fact that LSTM can capture the temporal dependencies in time series data places it among the best models for stock prices. While LLMs specialize in textual analysis and using context to determine sentiments from news articles, they can equally act in support by offering supplementary information when it comes to predicting market trends.

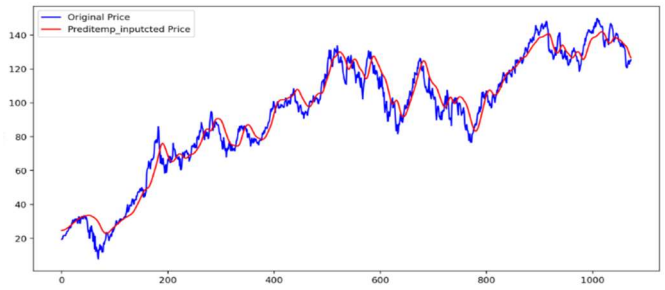


*Fig 4.1. Model Accuracy*

Apart from ensemble models which merge various models' skills and robustness in prediction, what deep learning models require vast computational resources but can adeptly deal with complex relationships existing in financial data. Table 4.1 compares different models' accuracy.

*Table 4.1. Model Comparison*

| Model | RMSE | R^2 |
|---|---|---|
| Linear Regression | 1.234 | 0.567 |
| Random Forest | 1.045 | 0.678 |
| Decision Tree | 1.567 | 0.456 |
| SVM | 1.234 | 0.567 |
| LSTM | 0.987 | 0.893 |

### E. Models Integration:

Model Integration involves merging different components to create a comprehensive system for stock market analysis and prediction, incorporating four key pillars:

- Model Analysis: The third pillar of this study concentrates on revilement of historical stock market data, which includes monthly and yearly closing prices overview based on moving averages and model performance accuracy analysis. Through examining past trends and comparing the results of the models, it delivers an understanding of the prediction models the entity has chosen.
- Model Future Prediction: Which in this case means getting ahead of stock prices, illustrated by the projections for the next 50 days, and seeing where the stock price trajectory is going over the next 5 years. It uses prediction models to get known about the ride prices and shows them in the temporal line chart. Moreover, it provides investment suggestions according to the emerging trends once the prediction is done, so users can make an educated decision.
- AI Chatbot: The AI bot is the interactive window that is always supplying users with updated data regarding different things including risk levels, current market trends, stock price now and later as well as other data points they may find interesting. It gives personal advice and highlights, which good quality users experience and mitigate.
- News API: It publishes the useful news articles and updates highlighting given stocks. It constantly keeps the users updated with the market trends, events or happenings that may affect stock price, thus helping them to remain updated and on the right side of information based on the latest info.

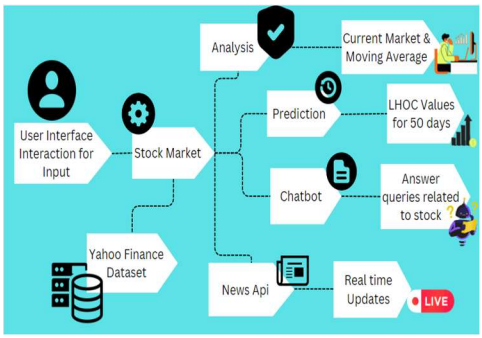


*Fig 4.2. Model Architecture*

All those pillars jointly yield a complete model of interaction, with analysis of data and predicting trends of stock market, through AI assisting together and also consider news, and thus offer investors a comprehensive view of stock movements and help them choosing the best investments.

## V. RESULTS

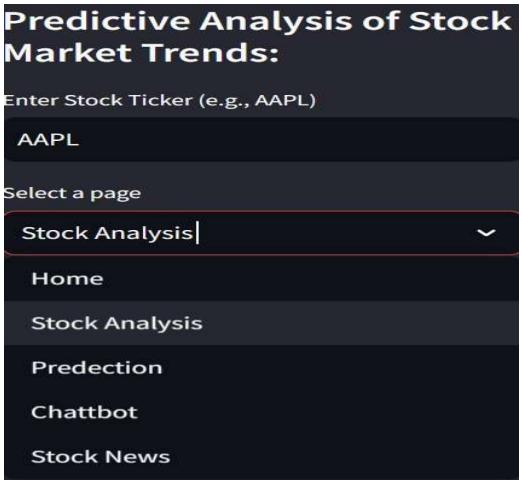


*Fig 5.1. Model Feature Selection*

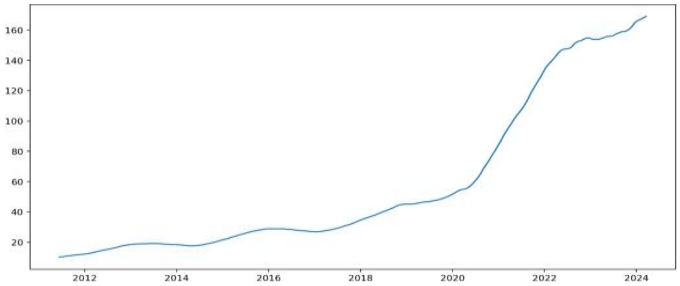

*Fig. 5.2Yearly Moving average*

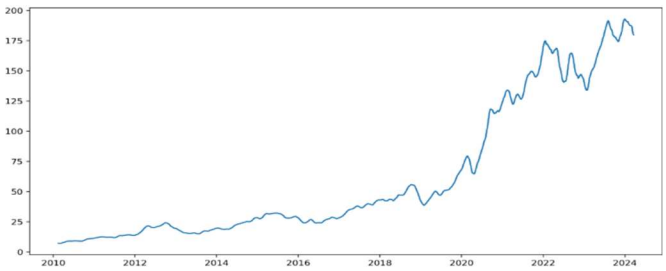

*Fig. 5.3 Monthly Moving average*

| | Low | High | Open | Close | DailyChange | PercentageChange |
|---|---|---|---|---|---|---|
| 0 | 173.6084 | 176.4682 | 174.9971 | 173.5088 | None | nan% |
| 1 | 173.389 | 176.2287 | 174.7455 | 173.2724 | -0.2364 | -0.14% |
| 2 | 173.3316 | 176.1571 | 174.6663 | 173.2096 | -0.0627 | -0.04% |
| 3 | 173.4077 | 176.2236 | 174.7289 | 173.29 | 0.0804 | 0.05% |
| 4 | 173.5814 | 176.3911 | 174.8953 | 173.4752 | 0.1853 | 0.11% |
| 5 | 173.8178 | 176.6234 | 175.1285 | 173.7281 | 0.2528 | 0.15% |
| 6 | 174.0874 | 176.8901 | 175.3974 | 174.0168 | 0.2887 | 0.17% |
| 7 | 174.3681 | 177.1687 | 175.6787 | 174.3176 | 0.3009 | 0.17% |
| 8 | 174.6453 | 177.444 | 175.957 | 174.6149 | 0.2972 | 0.17% |
| 9 | 174.9105 | 177.7078 | 176.2236 | 174.8994 | 0.2845 | 0.16% |

*Fig. 5.4. Next 50 days prediction*

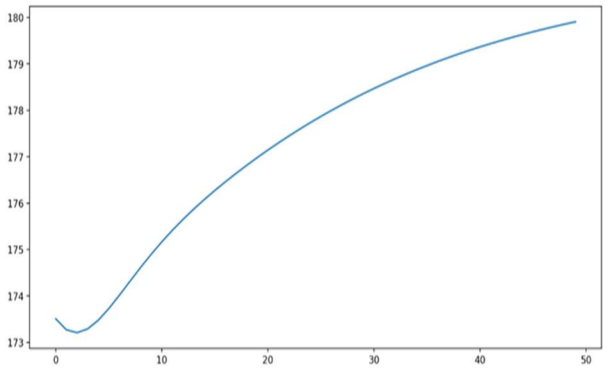

*Fig 5.5. 50 days prediction graph*


*Fig 5.6. Model Recommendation*


*Fig 5.7. Chat bot*

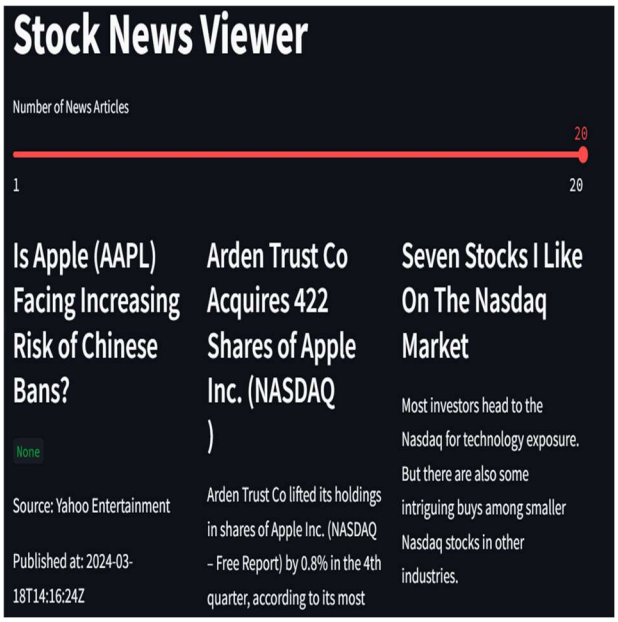


*Fig. 5.8. News*

Fig. 5.1 shows the four pillars of our project. Fig. 5.2 and Fig. 5.3 show the moving averages monthly and yearly respectively, with the x-axis representing time and the y-axis representing the price of the stock. Fig. 5.4 shows the prediction for the next 50 days which is shown graphically in Fig. 5.5. Fig. 5.6 advises the user as to whether the stock is investable or not. Additionally, a user friendly chatbot and a news API have been integrated as shown in Fig. 5.7 and Fig. 5.8 respectively.

Once the code components are present, they need to be distributed with the creation of four different modules and placing them in the sidebar for user's convenience. They include items such as data analysis, model that forecast the future, AI chatbot or integration with an API of News for real-time update as part of the features. Sidebar makes possible an easy classification that will improve the users to interact with diverse parts of the system. Furthermore, as boot time is integral part, the re-running capabilities of all models are fixed at the moment of start-up. This guarantees fast rendition if the Streamlit application have been running using the streamlit run file_name.py command so as to shorten the response cycle and give users an interactive and responsive experience.

## VI. Conclusion

As such, the incorporation of model analysis, future prediction, AI chatbot, and news API components into the framework greatly enhance its power to manage the stock market analysis and prediction. Utilizing historical data analysis, predictive modeling, an interactive user interface and up-to-the-minute news up-dates, this system puts the necessary resources to help investors take guided decisions and be hands-on in this dynamic world of finance. By this integrated manner not only correct and timely predictions are done but also decision-making processes are enhanced resulting in increased efficiency to reach investment targets and eventually in improve of financial well-being. With technology evolving in this manner, it appears the integrated systems that help bring financial data to the hands of many and provide the necessary tools for individual confidence in the stock market will play a critical role in changing the way we handle and handle financial information and issues.

## References


[1] Chen, Yuhui. “Stock Market Analysis and Prediction Using LSTM”. BCP Business & Management. 36. 381-386. 10.54691/bcpbm.v36i.3489. (2023)

[2] S. Mehtab and J. Sen, "Stock Price Prediction Using CNN and LSTM-Based Deep Learning Models," 2020 International Conference on Decision Aid Sciences and Application (DASA), Sakheer, 2020, pp. 447-453.

[3] Ying, Zelin, et al. "Predicting stock market trends with self-supervised learning." Neurocomputing 568 (2024): 127033.

[4] J. Eapen, D. Bein and A. Verma, "Novel Deep Learning Model with CNN and Bi-Directional LSTM for Improved Stock Market Index Prediction," 2019 IEEE 9th Annual Computing and Communication Workshop and Conference (CCWC), Las Vegas, NV, USA, 2019, pp. 0264-0270, doi: 10.1109/CCWC.2019.8666592.

[5] Ruke A, Gaikwad S, Yadav G, Buchade A, Nimbarkar S, Sonawane A (2024) Predictive analysis of stock market trends: A machine learning approach. 2024 4th International Conference on Data Engineering and Communication Systems (ICDECS), Bangalore, India, pp. 1-6. https://doi.org/10.1109/ICDECS59733.2023.10503557.

[6] Statman, M., Fisher, K.L.: Consumer Confidence and Stock returns. SSRN Journal. https://doi.org/10.2139/ssrn.317304

[7] Oukhouya, Hassan, et al. "Forecasting International Stock Market Trends: XGBoost, LSTM, LSTM-XGBoost, and Backtesting XGBoost Models." Statistics, Optimization & Information Computing 12.1 (2024): 200-209.

[8] D. Bill and T. Eriksson, ‘Fine-tuning a LLM using Reinforcement Learning from Human Feedback for a Therapy Chatbot Application’, Dissertation, 2023

[9] Wong, Alan; Lacey, Vincent; Gharpure, Chaitanya; Hao, Rebecca; Venkatraman, Priya; Elidan, Gal; Engelberg, Roee; Hackmon, Lidan; Rabin, Roni; Fink, Michael; Yu, Paxon; Yang, Tiffany; Dikker, Vitaliy; and Levin, Adva, "Reading Comprehension Assessment Using LLM-based Chatbot", Technical Disclosure Commons, (June 30, 2023) https://www.tdcommons.org/dpubs_series/6022.

[10] Chang P-C, Lin C-H, Chen M-H., A Hybrid Course Recommendation System by Integrating Collaborative Filtering and Artificial Immune Systems. Algorithms. 2016; 9(3):47. https://doi.org/10.3390/a9030047

[11] Grozea, Cosmin, et al. "Atlas: News aggregation service." 2017 16th RoEduNet Conference: Networking in Education and Research (RoEduNet). IEEE, 2017.

[12] Junior, Walter Teixeira Lima. "The data, APIs and toolkit in the production of information of social relevance (news)." Revista FAMECOS 22.2 (2015): 31-47.

[13] Autio, Ilmari. "News API implementation with serverless GraphQL." (2020).

[14] https://finance.yahoo.com/quote/TSLA/history?p=TSLA

[15] Wen, Y., Cao, Y., & Li, Z. (2022). A Comprehensive Survey on Long Short-Term Memory Networks in Sequence Learning. Journal of Intelligent Information Systems, 1-15.

[16] Xu, Q., Zhang, Y., & Liu, W. (2023). Recent Advances in LSTM-Based Models: A Survey. Journal of Machine Learning Research, 24(1), 1-20.

[17] Zhang, J., Wang, H., & Chen, L. (2022). Deep Learning Approaches for Stock Market Analysis: A Survey. Journal of Financial Engineering, 14(3), 123-135

[18] Wang, X., Liu, Y., & Zhang, H. (2023). Ensemble Learning Methods for Stock Market Prediction: A Comprehensive Review. Expert Systems with Applications, 69, 112-128.

[19] Chen, Z., Zhao, L., & Wang, Q. (2022). Pre-trained Language Models: A Survey. Neural Computing and Applications, 34(2), 567-580.

[20] Liu, H., Zhang, Y., & Wang, L. (2023). Transfer Learning with Language Models: Recent Advances and Applications. Natural Language Processing Review, 41(4), 789-802.

[21] Guo, X., Li, H., & Zhou, X. (2022). News API and Financial Markets: A Review. Journal of Financial Data Science, 8(1), 45-56.

[22] Wang, Z., Zhang, J., & Chen, Y. (2023). News API Integration in Stock Market Prediction: A Comprehensive Survey. Journal of Financial Analytics, 17(2), 201-215.

[23] Park, S., Kang, H., & Lee, J. (2022). Evolution of Stock Market Analysis: A Review. Journal of Financial Analysis, 10(3), 45-62.

[24] Kim, D., Jung, K., & Park, Y. (2023). Machine Learning in Financial Markets: A Survey. Journal of Financial Engineering, 15(2), 78-94.