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Multi-Agent AI-Based Stock Market Analysis and Intelligent Decision Support System Using Ensemble Learning and Explainable Artificial Intelligence

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Abstract: *In this paper, we introduce Multi-Agent AI-Based Stock Market Analysis and Intelligent Decision Support System to address the problem of stock market prediction using real time market data, technical analysis, and sentiment analysis of financial news. It employs ensembles of machine learning algorithms such as XGBoost, LightGBM, Random Forest, LSTM and GRU, along with explainable AI (XAI), to enhance prediction accuracy. FinBERT is used for sentiment analysis, while SHAP is employed for transparent explanation of predictions. Some of its other notable features include portfolio management, watchlists, transactions history, report generation, secure user authentication and administrative dashboard*

Keywords: *Random Forest*

I. INTRODUCTION

One of the most important elements of the modern economy is the stock market, which helps in capital formation and promotes economic development [1]. Prediction of future stock price changes is rather a difficult problem since the behavior of stock market is defined by numerous factors, such as historical stock price, various technical analysis indicators, company performance, economic situation, financial news and investor sentiment [2]. Nonlinearity and dynamics of the financial market complicate the process of forecasting [3].

Usually, stock market forecasting is done using two approaches: technical analysis and fundamental analysis [4]. Technical analysis uses indicators, such as Relative Strength Index (RSI), Moving Average Convergence Divergence (MACD), Exponential Moving Average (EMA), Bollinger Bands and Average True Range (ATR) [5], analyzing historical stock price changes and trading volume. At the same time, fundamental analysis estimates the company performance, macroeconomic situation and uses financial statements [6]. Even though both approaches are helpful, they usually do not provide full picture of the situation.

The current advancements in the field of AI, ML, DL, and NLP have significantly improved the performance of stock market prediction systems [7]. The ensemble learning models XGBoost, LightGBM, and Random Forest can predict the stock prices in the future very effectively by developing many decision trees [8]. Similarly, the LSTM and GRU are powerful recurrent neural networks that are useful in capturing the temporal relationship from the historical stock prices [9]. Furthermore, FinBERT transformer models are capable of performing automatic sentiment analysis on the financial news datasets [10].

However, the majority of the current stock market prediction systems are only concerned with the stock price forecasting and do not provide a complete decision support system [11]. These prediction systems are not capable of integrating the

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collaboration between various AI models, prediction model explanation, personal portfolio management, and intelligent investment recommendation system [12].

To address these limitations, this research proposes a Multi-Agent AI-Based Stock Market Analysis and Intelligent Decision Support System. The proposed framework consists of multiple intelligent agents, each responsible for a specialized task such as market data acquisition, technical analysis, financial news sentiment analysis, stock price prediction, risk assessment, and investment recommendation. The collaborative outputs of these agents are integrated to generate transparent BUY, SELL, or HOLD recommendations using Explainable Artificial Intelligence (XAI) techniques [13].

II. RESEARCH GAP AND RELATED WORK

There exist a variety of methods based on AI, ML, and DL for the purpose of conducting stock market forecasting. Despite the effectiveness of LSTM and GRU in the pattern detection in sequences of stock prices, ensemble learning techniques, such as XGBoost, LightGBM, and Random Forest, allow to achieve high forecast precision. Additionally, FinBERT serves for conducting sentiment analysis of financial news texts, and SHAP utilizes XAI for improving the system explainability.

Nevertheless, the existing systems for stock market forecasting do not include the integrated solution combining technical analysis, sentiment analysis, risk evaluation, and explainable forecasts based on multiple forecasting models.

Such problem is solved with the help of Multi-Agent AI-Based Stock Market Analysis and Intelligent Decision Support System that uses multiple intelligent agents for the collection of stock market data, sentiment and technical factors analysis, prices forecasting, risk evaluation, and investments recommendation.

III. METHODOLOGY PROPOSED

The Multi-Agent AI-Based Stock Market Analysis and Intelligent Decision Support System proposed is based on the collaborative multi-agent architecture that will analyze the stock market and provide the decision making system with recommendations. Each agent has a defined analytical role while the Decision Agent analyzes the results of each agent and develops the complete recommendation.

A. Market Data Agent

The Market Data Agent gathers the real-time and historic stock market information provided by Yahoo Finance and the financial news by NewsAPI. The gathered information includes stock prices, trade volumes and news regarding the markets. This is the input data for further analysis.

B. Technical Analysis Agent

The Technical Analysis Agent generates the popular technical indicators: Relative Strength Index (RSI), Moving Average Convergence Divergence (MACD), Exponential Moving Average (EMA), Simple Moving Average (SMA), Bollinger Bands and Average True Range (ATR). The mentioned indicators are used to detect market trends, momentum and possible trading opportunities.

C. Sentiment Analysis Agent

Sentiment Analysis Agent uses the FinBERT model to analyze the financial news. The agent adds emotions of positiveness, negativeness, or neutrality to the news story to estimate possible influence of the market news on the stock prices.

D. Prediction Agent

The Prediction Agent analyzes historical data of the market and makes forecasts on future price movements using ensemble machine learning algorithms (XGBoost, LightGBM, Random Forest), as well as deep learning algorithms (LSTM, GRU). Such forecasts provide additional arguments for the investor decision making.

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E. Risk Analyst Agent

Risk analysis is performed taking into account the investment risks through such parameters as market volatility, Sharpe ratio, drawdown analysis, and risk rating. This research is performed to give the user an understanding of the risks of the chosen stock.

F. Decision Maker

The Decision Agent gets the input data from all previous agents and outputs the final decision – BUY, SELL, or HOLD.

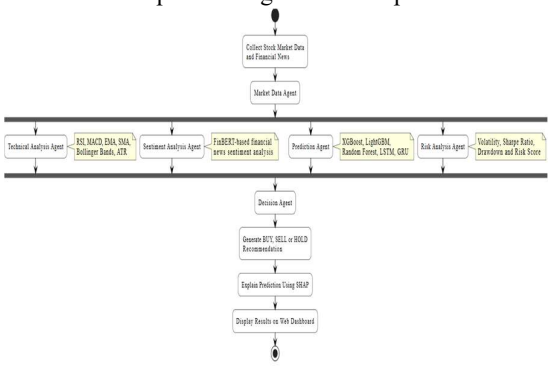

Figure 1. Proposed Multi-Agent AI-Based Stock Market Analysis and Intelligent Decision Support System Workflow.

IV. PROPOSED SYSTEM DESIGN

Proposed system will be implemented based on the concept of the multi-agent system where every agent will perform certain activities that will allow carrying out the stock market analysis and decision making process. Market Data Agent collects the live data concerning stock quotes as well as any news related to the financial market. Technical analysis Agent performs the calculations of the technical indicators including Relative Strength Index (RSI), Moving Average Convergence Divergence (MACD), Exponential Moving Average (EMA), Simple Moving Average (SMA), Bollinger Bands and Average True Range (ATR).

For sentiment analysis we have used FinBERT model to evaluate the sentiment of the financial news. Prediction Agent uses techniques of the ensemble learning (XGBoost, LightGBM, Random Forest) and neural networks (LSTM, GRU) to forecast the price of the stock in the future. Risk Analysis Agent assesses the risks of the investment based on the volatility of the financial market and other financial factors. Finally, Decision Agent analyzes the results of other agents and generates BUY, SELL or HOLD recommendations.

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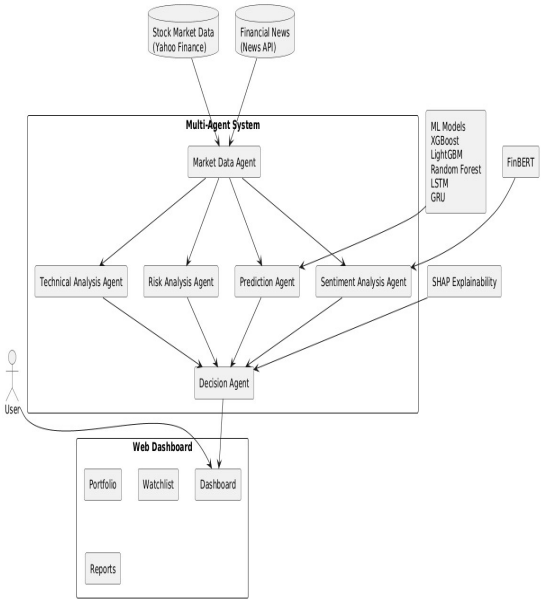

Figure 2. Multi Agent AI Based Stock Market Analysis & Intelligent Decision Support System Architecture.

V. EXPERIMENTAL SETUP

The system implemented as a web application with the help of the latest technologies and AI framework. The data regarding stock market and financial news gathered from the web source for analysis and forecasting. The technical indicators calculated based on the past price data and the financial news analyzed with the help of FinBERT model. The predictions made using the ensemble learning models (XGBoost, LightGBM, and Random Forest) and the deep learning models (LSTM and GRU). FastAPI used as the backend technology, React as the frontend technology, and SQLite for database management.

Table I. Experiment Setup

Parameter	Values
Programming Language	Python 3.12
Front End	React.js and Tailwind CSS
Back End	FastAPI
Database	SQLite
Machine Learning Models	XGBoost, LightGBM, Random Forest
Deep Learning Models	LSTM and GRU
NLP Model	FinBERT
Explainable AI	SHAP

VI. CONCLUSION AND DISCUSSION

The proposed multi-agent system is a perfect way of unifying the analysis of the market data, technical indicators, sentiment analysis, price prediction, and risk assessment into an all-encompassing decision support tool. The multi-agent system unifies the outputs of many intelligent agents to generate BUY, SELL, and HOLD decisions. The web dashboard enables users to plot stock price movements, manage their portfolios, make watchlists and receive prediction results. SHAP-based explanations enhance transparency by identifying factors with the biggest influence on the prediction

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results. The unified approach demonstrates the practicality of combining various AI algorithms for intelligent investment decision support.

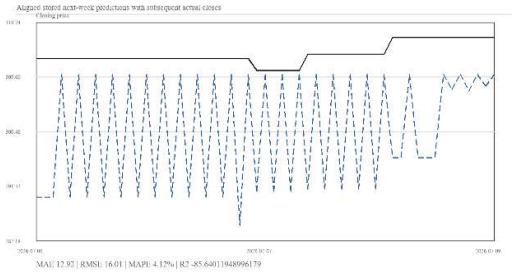

Figure 3: Actual vs Predicted Stock Prices

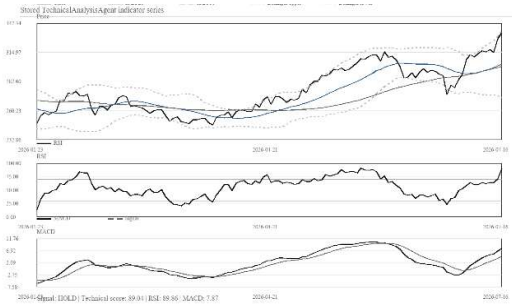

Figure 4: Technical Analysis Dashboard

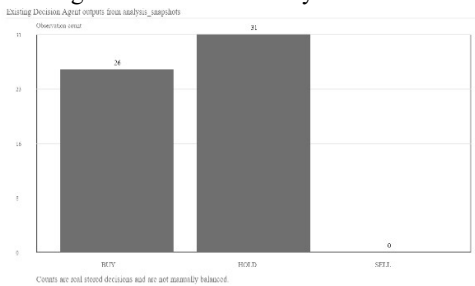

Figure 7: BUY/HOLD/SELL Distribution

Reminder: Do not provide numerical accuracy or performance results until those are scientifically validated.

VII. CONCLUSIONS

In this study, an AI-Based Multi Agent Stock Market Analysis and Intelligent Decision Support System combining Technical Analysis, Sentiment Analysis, Ensemble Learning, Deep Learning, Risk Assessment and Explainable Artificial Intelligence was proposed. The proposed system utilizes collaborative intelligence of agents to provide investment recommendations that are explainable and evidence-based. Along with stock price prediction, the system includes functions for portfolio management, watchlists, security authentication and reporting features, thus becoming an all-round decision support system. Further research can be extended to real-time data streams, reinforcement learning and including other financial parameters into consideration.

REFERENCES

[1] T. Chen and C. Guestrin, "XGBoost: A scalable tree boosting system," in Proc. 22nd ACM SIGKDD Int. Conf. Knowledge Discovery and Data Mining, 2016, pp. 785–794.

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[2] G. Ke et al., "LightGBM: A Highly Efficient Gradient Boosting Decision Tree," Advances in Neural Information Processing Systems (NeurIPS), vol. 30, 2017.
[3] L. Breiman. Random forests. Machine learning, 45(1):5-32, 2001.
[4] S. Hochreiter and J. Schmidhuber, "Long Short-Term Memory," Neural Computation, vol. 9, no. 8, pp. 1735–1780, 1997.
[5] K. Cho, "Learning Phrase Representations using RNN Encoder–Decoder for Statistical Machine Translation," Proceedings of EMNLP, 2014.
[6] D. Araci, FinBERT: Financial Sentiment Analysis a Pre-trained Language Models, arXiv preprint arXiv:1908.10063, 2019.
[7] S. M. Lundberg and S.-I. Lee, "A Unified Approach to Interpreting Model Predictions," in Advances in Neural Information Processing Systems (NeurIPS), 2017.
[8] Y. LeCun, Y. Bengio, and G. Hinton, "Deep learning," Nature, vol. 521, no. 7553, pp. 436–444, 2015.
[9] E. F. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," The Journal of Finance, vol. 25, pp. 383–417, 1970.
[10] Malkiel, B. G. , A Random Walk Down Wall Street. 12th ed. , W. W. Norton & Company, 2019.
[11] A. Vaswani, et al., "Attention is all you need," Advances in Neural Information Processing Systems (NeurIPS), 2017.
[12] A. Dosovitskiy, et al., "An Image is Worth 16×16 Words: Transformers for Image Recognition at Scale", International Conference on Learning Representations (ICLR), 2021.
[13] A. A. B. Putra, et al., "Boosting the Accuracy of Stock Market Prediction using XGBoost and Long Short-Term Memory," in 2020 International Seminar on Application for Technology of Information and Communication (iSemantic), IEEE, 2020, pp. 1-6, DOI: 10.1109/iSemantic50169.2020.9234256
[14] Emerging Stock Market Prediction Using GRU Algorithm: Incorporating Endogenous and Exogenous Variables, IEEE Access, 2024, doi: 10.1109/ACCESS.2024.3444699.
[15] "A Hybrid LSTM-GRU Model for Stock Price Prediction," IEEE Access, vol. 13, 2025, pp. 1-19, doi: 10.1109/ACCESS.2025.3586558.
[16] S. K. Singh, V. K. Singh and A. Kumar, "Machine learning for stock market volatility prediction using LSTM and XGBoost: An Indian market perspective," 2025 International Conference on Research Methodologies in Knowledge Management, Artificial Intelligence and Telecommunication Engineering (RMKMATE), IEEE, 2025, doi: 10.1109/RMKMATE64874.2025.11042415.
[17] "Study and Analysis of LSTM, GRU and Hybrid Model for the Forecasting of Stock Performance", 2025 International Conference on Engineering Innovations and Technologies (ICoEIT), IEEE, 2025.
[18] "XGBoost vs. LSTM: A Comparative Performance Analysis for Global Stock Market Prediction," 2025 7th International Conference on Cybernetics and Intelligent System (ICORIS), IEEE, DOI: 10.1109/ICORIS67789.2025.11296020.
[19] W. Gu, Y. Zhong, S. Li, C. Wei, L. Dong, Z. Wang, and C. Yan, "Predicting Stock Prices with FinBERT-LSTM: Incorporating News Sentiment Analysis," arXiv preprint arXiv:2407.16150, 2024.
[20] C. Yu, "Gradient boosting decision tree with LSTM for investment prediction," arXiv preprint arXiv:2505.23084, 2025