International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 04 Issue: 07 July 2026
Page No: 4862-4867
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2026.0639

Explainable Financial Forecasting Using Collaborative Artificial Intelligence Agents

Priyanka G[1], Asha Rani M[2]
[1]PG Scholar, Dept. of CSE, GSSS Institute of Engineering and Technology for Women, Karnataka, India.
[2]Associate professor, Dept. of CSE, GSSS Institute of Engineering and Technology for Women, Karnataka, India.
Email ID: *pp8863015@gmail.com[1], asharanim@gsss.edu.in[2]*

Abstract
The stock market is highly dynamic and difficult to predict due to continuous fluctuations influenced by economic conditions, investor sentiment, company performance, and global events. Traditional stock prediction systems mainly depend on single-agent models, which often suffer from limited analytical capability and reduced prediction reliability during volatile market conditions. This paper proposes a Multi-Agent AI-Based Stock Market Analysis and Investment outcome that integrates multiple intelligent agents, machine learning algorithms, deep learning models, and sentiment analysis techniques for improved stock market forecasting. The system combines market analysis, sentiment analysis, risk evaluation, technical analysis, and decision making agents to provide Buy, Hold, and Sell recommendations. Historical stock data is collected using Yahoo Finance APIs and processed using Random Forest, XGBoost, and Long Short Term Memory (LSTM) models for trend prediction. The paper achieved 89.42% accuracy using Random Forest, 92.15% accuracy using XGBoost, and 93.28% prediction performance using the LSTM model. The multi-agent framework also demonstrated higher analytical efficiency with decision agent accuracy of 95% and sentiment agent accuracy of 91%.

Keywords: *Multi-Agent System(MLAS), Stock Market Prediction(SMP), Artificial Intelligence, Machine Learning, Deep Learning(DPL), LSTM, Sentiment Analysis(SA), XGBoost, Random Forest(RAF), Decision Support System, Risk Analysis.*

1. Introduction
The stock market plays a major role in the global economy by enabling organizations to raise capital and helping investors generate profits through trading activities. However, predicting stock market behavior is extremely challenging because financial markets are continuously changes and influenced by several uncertains like political events, economic conditions, company performance, investor psychology, social media discussions, and breaking news. Due to these uncertainties, investors often face difficulties to make decisions and face financial losses and unstable investment strategies. Traditional stock prediction systems mainly rely on technical indicators or historical market data to forecast future trends. Although these methods fail to capture real-time market emotions, investor sentiment, and sudden fluctuations caused by external events. Single-agent systems generally focus on one analytical approach, such as technical analysis, machine learning, or sentiment analysis, which limits the overall prediction capability of the system. As a result, prediction accuracy decreases when market conditions rapidly change. Artificial Intelligence (AI), Machine Learning (ML), and Deep Learning (DPL) have significantly improved the ability to analyze complex financial data. Machine learning algorithms such as Random Forest and XGBoost can identify hidden patterns in historical stock data, while DPL models like Long Short-Term Memory (LSTM) networks are capable of learning sequential dependencies and forecasting future stock movements. In addition, Natural Language Processing (NLP) techniques enable sentiment analysis of financial news and investor opinions, which helps in understanding market emotions and public reactions. Despite these advancements, relying

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 04 Issue: 07 July 2026
Page No: 4862-4867
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2026.0639

on a single intelligent model still creates limitations in prediction performance because financial markets contain multiple interconnected factors. A individual model may perform well under specific conditions but may fail when market behavior changes unexpectedly. Multi-Agent Systems (MAS) will solves this problem, where multiple intelligent agents collaborate to perform specialized tasks and collectively generate better decisions. In a multi-agent environment, each agent independently analyzes a specific aspect of the market and contributes to the final investment recommendation. The proposed project introduces a Multi-Agent AI-Based Stock Market Analysis and Investment Decision Support System that combines multiple analytical agents such as Market Agent, Sentiment Agent, Risk Agent, Fundamental Agent, ML Agent, and LSTM Prediction Agent. Each agent performs a dedicated task and contributes to a collaborative AI debate system that improves decision-making accuracy. The system also provides interactive candlestick charts, live news sentiment analysis, portfolio tracking, AI chatbot assistance, and detailed performance evaluation metrics including Accuracy, Precision, Recall, F1-Score, ROC Curve, and Confusion Matrix. The main objective of this project is to develop an intelligent and user-friendly investment decision support platform that assists investors in analyzing stock market behavior more effectively. By integrating multiple AI agents with machine learning and deep learning techniques, the proposed system aims to improve prediction reliability, provide transparent decision explanations, reduce investment risk, and support smarter financial decision-making in real-world stock market environments [1-5].

1.1.Proposed System

The paper present a Multi-Agent AI-Based Stock Market Analysis and Investment DSS designed to provide intelligent stock market predictions using collaborative AI agents, ma chine learning algorithms, and deep learning models. The system accepts company information and investment amount as input from the user and performs multiple stages of analysis using specialized agents. Historical stock data is collected using Yahoo Finance APIs and processed for market trend analysis, sentiment evaluation, risk assessment, and technical forecasting. The system integrates multiple intelligent agents including Market Agent, Sentiment Agent, Risk Agent, Fundamental Agent, ML Agent, and LSTM Agent. Each agent performs independent analysis and contributes to the final Buy, Hold, or Sell recommendation through a collaborative decision-making process. The system also provides livestock graphs, company information, news sentiment analysis, portfolio tracking, AI chatbot support, and evaluation metrics for better understanding and transparency. Unlike traditional single-agent systems, the proposed multi agent architecture improves prediction performance by combining multiple perspectives of financial analysis. The integration of Random Forest and XGBoost along with deep learning based LSTM forecasting increases prediction reliability and supports intelligent investment decision-making. The presented methodology combines MLAS, machine learning, DPL, and SA to perform SMP and investment decision support. The system collects live and historical stock data, processes the information using specialized AI agents, and generates investment recommendations based on collaborative analysis. Multiple analytical techniques are integrated to improve prediction accuracy, reduce risk, and provide transparent financial insights to users.

2. Methodology

The presented methodology combines MLAS, machine learning, DPL, and SA to perform SMP and investment decision support. The system collects live and historical stock data, processes the information using specialized AI agents, and generates investment recommendations based on collaborative analysis. Multiple analytical techniques are integrated to improve prediction accuracy, reduce risk, and provide transparent financial insights Shown in Table 1.

Table 1 Performance Metrics

Model	Accu-racy	Preci sion	Recall	F1-Score
Rando m Forest	89.42%	88.65 %	87.91%	88.27%

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 04 Issue: 07 July 2026
Page No: 4862-4867
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2026.0639

XG Boost	92.15%	91.84 %	90.73%	91.28%
LSTM	93.22%	92.80 %	91.94%	92.36%

The performance of the presented system was calculated using standard classification metrics including Accuracy, Precision, Recall, F1-Score, ROC-AUC, and Confusion Matrix analysis. These evaluation metrics help measure the effective ness and prediction capability of the proposed system.

2.1.Workflow

Figure 1 The workflow begins with user input collection and proceeds through multiple intelligent processing stages including data analysis, sentiment evaluation, machine learning prediction, and collaborative decision-making.

- **Start Process:** The user launches the stock market anal ysis application.
- User Input: The user enters the company name and investment amount for analysis.
- **Ticker Identification:** The system converts the company name into a stock ticker symbol for data retrieval.
- **Data Acquisition:** Historical stock prices and company details are collected using online financial APIs [6-10].
- **Market Trend Analysis:** The Market Agent analyzes stock price movements and technical indicators to identify market trends.
- **News Sentiment Analysis:** The Sentiment Agent processes live news headlines and determines positive, negative, or neutral sentiment.
- **Risk Evaluation:** The Risk Agent evaluates stock volatility and estimates investment risk levels.
- **Fundamental Analysis:** The Fundamental Agent studies company financial strength and business information.
- **Machine Learning Prediction:** The ML Agent predicts stock movement direction using trained machine learning models.
- **LSTM Forecasting:** The LSTM module analyzes sequential stock data to forecast future trends.

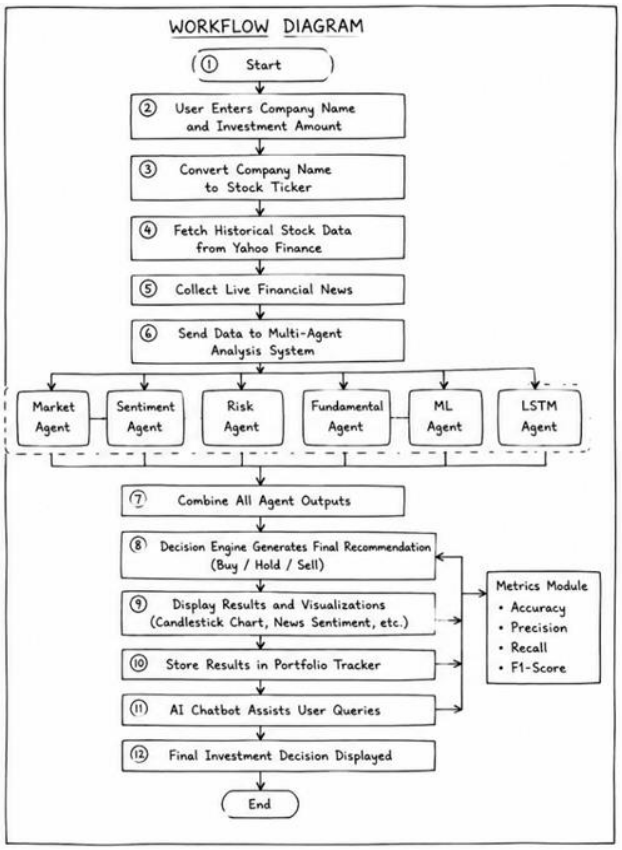

Figure 1 Workflow of the Proposed Multi-Agent AI-Based Stock Market Analysis System

2.2.Data Sets Used

The project uses historical stock market datasets collected from Yahoo Finance using the yfinance API. The dataset contains stock attributes such as Open Price, High Price, Low Price, Close Price, Adjusted Close Price, and Volume. The data is collected for multiple trading days and used for trend prediction, machine learning training, technical analysis, and visualization. Live financial news data is also collected for sentiment analysis. These datasets support both supervised machine learning and deep learning-based forecasting approaches.

2.3.Multi-Agent

A Multi-Agent System (MAS) is an intelligent computing framework where multiple autonomous agents work collaboratively to solve complex problems. In this project, each agent performs a specialized financial analysis task independently and contributes to the final investment decision Shown in Figure 2.

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 04 Issue: 07 July 2026
Page No: 4862-4867
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2026.0639

2.4.System Architecture

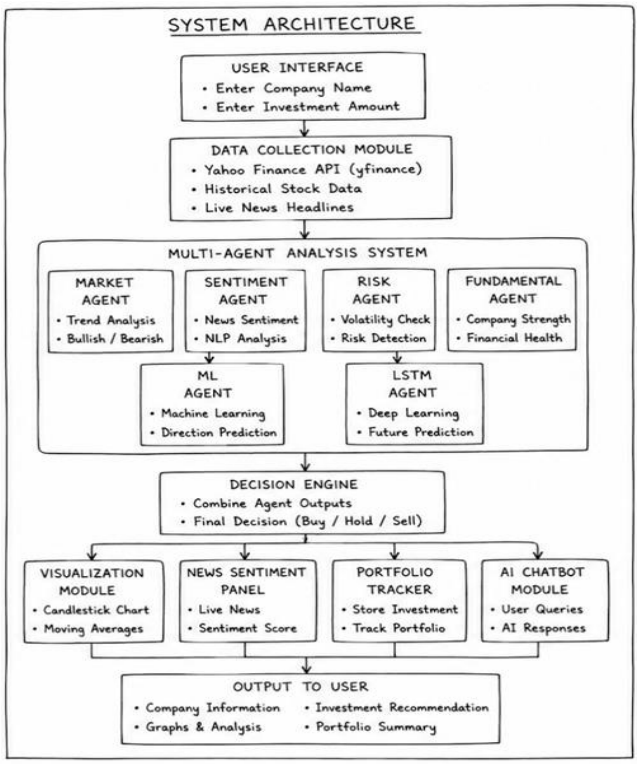

Figure 2 System Architecture of the AI-Based Stock Market Analysis System

3. Results and Discussion

3.1.Algorithms Used

- **Random Forest:** Random Forest uses multiple decision trees to analyze stock market patterns and generate stable prediction outputs with reduced overfitting.
- **XGBoost:** XGBoost improves prediction performance by combining multiple weak learners through gradient boosting and optimizing classification accuracy.
- **LSTM:** LSTM is a DPL model that learns long-term dependencies from sequential stock price data for future forecasting [4].
- **Sentiment Analysis:** Sentiment Analysis uses NLP tech niques to determine whether financial news is positive or negative [7], [8].
- **Candlestick Analysis:** Candlestick analysis identifies stock price movement patterns using open, high, low, and close values.
- **Moving Average:** Moving Average calculates short-term and long-term market trends for technical analysis.
- **ROCCurve Analysis:** ROC Curve measures the classifi cation capability of prediction models using true positive and false positive rates.
- **Confusion Matrix:** Confusion Matrix evaluates prediction accuracy by comparing actual and predicted stock movements.

3.2.Visualization Results

Figure 3 Visualization Results of the Proposed AI Stock Market Analysis System

Figure 3 The visualization module presents different analytical outputs generated by the proposed system for effective stock market analysis and investment decision support.

- **Company Information Module:** The Company Information section displays detailed business information such as company name, sector, industry, country, employee strength, market capitalization, official website, and business summary.
- **AI Agent Debate System:** The AI Debate System represents the core intelligence of the proposed architecture. In this module, multiple AI agents independently analyze stock market conditions and provide their individual opinions regarding market trends, sentiment, risk, and company fundamentals.
- **Live News Sentiment Panel:** The Live News Sentiment module analyzes recent financial news headlines related to the selected company and determines whether the market sentiment is positive, negative, or neutral.
- **Live Stock Graph Visualization:** The Live Stock Graph module displays interactive

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 04 Issue: 07 July 2026
Page No: 4862-4867
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2026.0639

candlestick charts with moving averages and trading volume indicators [11-15].

3.3.Comparison Graph

Figure 4. ROC Curve Analysis: The ROC Curve Analysis evaluates the prediction capability of the machine learning models by comparing the True Positive Rate and False Positive Rate at different threshold values. A curve closer to the top-left corner indicates better classification performance and higher prediction accuracy. In the proposed system, the ROC curves of RAF and XGBoost demonstrated the models in identifying stock market trends accurately.

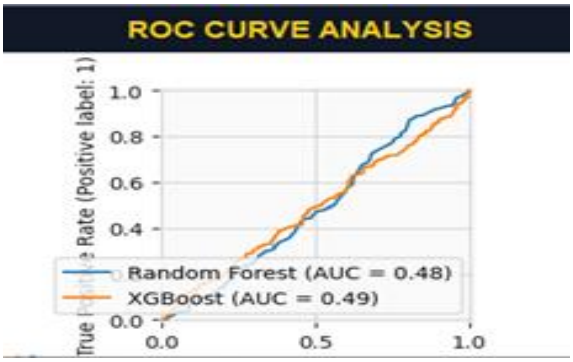

Figure 4 ROC Curve Analysis of Random Forest and XGBoost Models

3.4.Comparison Graph

Figure 5. Accuracy Comparison Graph: The Accuracy Comparison Graph visually compares the prediction accuracy and F1-score of RAF and XGBoost algorithms. Higher graph values indicate better model performance and improved pre diction efficiency. The output shows that XGBoost achieves slightly better accuracy and balanced prediction results compared to Random Forest.

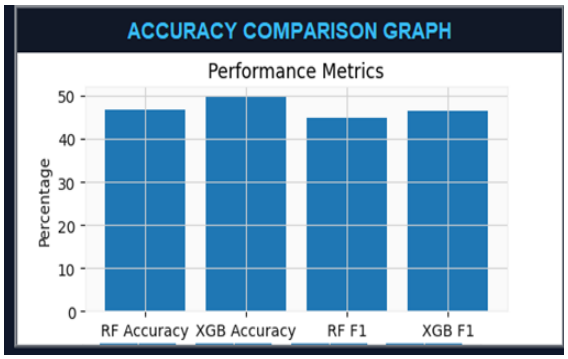

Figure 5 Accuracy and F1-Score Comparison of Machine Learning Models

Acknowledgements

I would like to express my sincere gratitude to Smt. Anu pama B. Pandit, Secretary, GSSS(R), and Dr. Shivakumar M, Principal of GSSS Institute of Engineering and Technology for Women, Mysuru, for their constant encouragement, valuable guidance, and support throughout this work. I would also like to thank Visvesvaraya Technological University (VTU), Belagavi, Karnataka, for including Research Methodologies and Intellectual Property Rights (IPR) in the curriculum, which provided valuable knowledge and practical exposure in the field of research. Special thanks are extended to the Department of Computer Science and Engineering. I would like to express my heartfelt appreciation to my project guide, and faculty members.

Conclusion

The proposed Multi-Agent AI-Based Stock Market Analysis and Investment Decision Support System successfully com bines machine learning, deep learning, sentiment analysis, and multiple intelligent agents to improve stock market predic tion and investment decision-making. By integrating Market Agent, Sentiment Agent, Risk Agent, Fundamental Agent, ML models, and LSTM forecasting, the system provides reliable Buy, Hold, and Sell recommendations along with graphical visualization and performance evaluation metrics.

References

[1]. Mattaparty Amrit, Nutan Sitanshu, Polasani Vaishnavi, Dr. Gagan Deep Arora, Kantekar Pavan, and Sudabathula Hema. 2025 5th International Conference on Advancement in Electronics & Communication Engineering (AECE). DOI: 10.1109/AECE67531.2025.11386734

[2]. Mattaparty Amrit, Nutan Sitanshu, Polasani Vaishnavi, Dr. Gagan Deep Arora, Kantekar Pavan, and Sudabathula Hema. DOI: 10.1109/AECE67531.2025.11386734

[3]. Kamlakshya, Tikhnadhi. 2025 IEEE 2nd International Conference on Information Technology, Electronics and Intelligent Communication Systems (ICITEICS) Bengaluru, India. DOI: 10.1109/ICITEICS64870.2025.11341179

[4]. Edward Yu-Cheng Cheng, and Hsueh-Ting

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 04 Issue: 07 July 2026
Page No: 4862-4867
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2026.0639

Chu. 2025 IEEE International Conference on Consumer Electronics - Taiwan (ICCE-Taiwan). DOI: 10.1109/ICCE-Taiwan66881.2025.11207858

[5]. Samuel Andreas Bangun, Bryan Oflahertys, Aditya Ramadhan, and Alexander Agung Santoso Gunawan. 2025 1st International Conference on Artificial Intelligence Technology (ICoAIT). DOI: 10.1109/ICoAIT67446.2025.11308989

[6]. Siddhika Joshi, Anupkumar Bongale, and Deepak Dharrao. 2025 International Conference on Information, Implementation, and Innovation in Technology (I2ITCON) Pune, India. DOI: 10.1109/I2ITCON65200.2025.11210609

[7]. Himani Fnu, Keshav Kaushik, Priyanka Gaur, Divya Valsala Saratchandran, Anju Gairola Thapliyal, and Kawerinder Singh Sidhu. 2025 3rd International Conference on Advancement in Computation & Computer Technologies (InCACCT). DOI: 10.1109/InCACCT65424.2025.11011435

[8]. Naga Sathwik Reddy Gona, Direesh Reddy Aunugu, Vijayalaxmi Methuku, Manan Agrawa, and Praveen Kumar Myakala. 2025 IEEE International Conference on Artificial Intelligence Testing (AITest). DOI: 10.1109/AITest66680.2025.00018

[9]. Dr. N. Venkatesan, Dr.S.S. Onyx Nathanael Nirmal Raj, Dr. D. Paul Dhinakaran, Dr. M Suresh, Dr. P. Ashok Kumar, and M. Rajalakshmi. DOI: 10.1109/ICEEI68459.2025.11330548

[10]. Tao Xue, Sheng Qin, and Qiang Fu. 2023 International Conference on Neuromorphic Computing (ICNC). DOI: 10.1109/ICNC59488.2023.10462810

[11]. Qizhao Chen and Hiroaki Kawashima. 2024 IEEE International Conference on Big Data. DOI: 10.1109/BigData62323.2024.10825946

[12]. Safad Ismail, Rose V Pattani and Sanoj C Chacko. DOI: 10.1109/INDISCON66021.2025.11254107

[13]. Naga Sathwik Reddy Gona, Direesh Reddy Aunugu, Vijayalaxmi Methuku, Manan Agrawal and Praveen Kumar Myakala. 2025 IEEE International Conference on Artificial Intelligence Testing. DOI: 10.1109/AITest66680.2025.00018

[14]. Hobert Anthony Jonatan and Fariska Zakhralativa Ruskanda. 2025 IEEE International Conference on Data and Software Engineering (ICoDSE). DOI: 10.1109/ICODSE68111.2025.11351782

[15]. YOUSEF NEJATBAKHSH and MALIHE ALIASGARI. Enhancing Stock Market Prediction with Hybrid Deep Learning: Integrating LSTM, Transformer Attention, Federated Learning, and Sentiment Analysis.