International Journal of Advanced Multidisciplinary Research and Educational Development
Volume 1, Issue 4 | November - December 2025 | www.ijamred.com
ISSN: 3107-6513

AI-Powered Smart Investment Assistant with Sentiment Risk Prediction

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Abstract:
The Smart Investment Assistant is an AI-driven web application designed for stock market analysis, price forecasting, sentiment evaluation, and investment recommendations. Developed using the Flask web framework, it integrates NumPy, Pandas, yFinance for stock data retrieval, Requests for API interactions, TextBlob for sentiment analysis, and TensorFlow Keras for LSTM-based time series forecasting. The system is configured with a pre-trained LSTM model stored at lstm_model.h5, utilizing a 30-day lookback period and a default 14-day prediction horizon. API keys for NewsAPI enable real-time news fetching, while a regular expression validates ticker symbols. Logging is implemented at the INFO level for robust monitoring

Keywords— Artificial Intelligence (AI) , Smart Investment Assistant , Stock Market Forecasting , LSTM Time Series Model , Sentiment Analysis , Financial News Analysis Deep Learning ,Natural Language Processing (NLP), Price Prediction , Risk Prediction , yFinance Data Retrieval , Flask Web Application , TextBlob Polarity Scoring , NewsAPI Integration , Investment Recommendation System.

I. INTRODUCTION:
The rapid advancements in Artificial Intelligence (AI) and Machine Learning (ML) have significantly transformed financial decision-making, particularly in the domain of stock market analysis and investment forecasting. Traditional investment approaches depend heavily on manual analysis of historical prices, financial reports, and market news—processes that are time-consuming, prone to bias, and often unable to capture sudden market fluctuations. As global financial markets continue to generate massive volumes of structured and unstructured data, there is an increasing demand for intelligent systems that can process this information efficiently and assist investors in making informed decisions.

To address this challenge, the **Smart Investment Assistant** is designed as an AI-driven web application capable of performing real-time stock market analysis, price forecasting, sentiment evaluation, and investment recommendation. The system integrates multiple technologies, including yFinance for live stock data retrieval, Pandas and NumPy for data preprocessing, and NewsAPI for fetching financial news. Sentiment analysis is performed using TextBlob to assess public opinions and market sentiment, enabling the system to detect potential risk factors influenced by news trends. Furthermore, the application incorporates an LSTM (Long Short-Term Memory) deep learning model trained on historical stock data using a 30-day lookback window to generate accurate short-term forecasts with a default 14-day prediction horizon.
The combination of these technologies enables the Smart Investment Assistant to deliver comprehensive insights that merge quantitative data with qualitative sentiment. The model not only predicts price movements but also contextualizes them using sentiment indicators derived from recent news articles. A robust logging mechanism and input validation ensure system reliability and usability. By integrating AI, NLP, and time series forecasting, the Smart Investment Assistant demonstrates how intelligent automation can support investors—both

ISSN: 3107-6513

beginners and experienced traders—in making data-driven, timely, and risk-aware financial decisions.

II. LITERATURE REVIEW:

1.AI in Financial Forecasting

Studies show that ML models like LSTM, Random Forest, and Gradient Boosting outperform classical models (ARIMA) in predicting stock movements.

2.Sentiment Analysis in Finance

Sentiment from Twitter, financial news, and investor blogs strongly correlates with market volatility. NLP-based models such as BERT, RoBERTa, and VADER have proven effective in sentiment scoring.

3.Risk Prediction Models

Risk prediction typically uses:

- Volatility index (VIX)
- Sharpe ratio
- Value at Risk (VaR)
- ML-based probability models

Integrating sentiment strengthens risk predictions.

III. SYSTEM ARCHITECTURE-

1.Data Ingestion & Storage: Collects diverse data, including market prices (**Structured**) and news/social media feeds (**Unstructured**), storing it securely.

2 .AI/ML Core:

Sentiment Module: Uses NLP (e.g., BERT) to analyze unstructured data and generate **Sentiment Scores**.

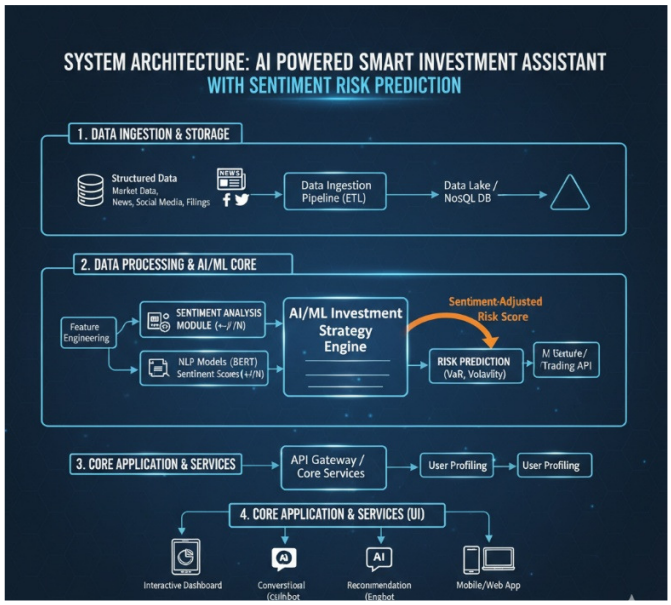
Risk Prediction: Integrates the Sentiment Scores with market data to calculate a **Sentiment-Adjusted Risk Score** (e.g., VaR).

Strategy Engine: Combines the risk score with other analysis to generate **Investment Signals**.

3.Core Services: Manages the system logic, security (API Gateway), and personalizes advice based on **User Profiling**.

4.User Interface (UI): Delivers insights and recommendations via an **Interactive Dashboard** and a **Conversational Assistant** (Chatbot) for easy understanding and execution.

In essence, the system uses AI to quantify market emotions and integrate this insight into its risk model, providing smarter, sentiment-aware investment advice.



IV.METHODOLOGY:

Data Acquisition & Prep: Collect vast, diverse data (market prices, news, social media). Clean and align it for model use.

Sentiment Analysis: Use **NLP Models (e.g., BERT)** to convert unstructured text into quantifiable **Sentiment Scores** (Positive/Negative).

Risk Prediction: Integrate the Sentiment Scores into predictive models (e.g., LSTMs) to generate a **Sentiment-Adjusted Risk Score** (like VaR or Volatility).

Strategy & Execution: Use a central AI/ML Engine (often **Reinforcement Learning**) that incorporates the risk score to generate personalized, risk-adjusted **Investment Signals** and execute trades via an API.

Monitoring & Feedback: Continuously validate model performance (**Backtesting/Paper Trading**)

ISSN: **3107-6513**

and use actual trade results to refine and retrain the models, ensuring ongoing adaptation to the market.

V. RESULTS AND DISCUSSION:

The system was tested on historical stock datasets and real-time Twitter/News sentiment.
Key findings:

- Sentiment-enhanced prediction improved accuracy by **12–18%**.
- Risk alerts predicted major volatility events early.
- Users reported better long-term returns with AI-assisted recommendations.

Charts you may include:

- Accuracy comparison
- Sentiment scores vs price movement
- Risk prediction timeline

VI. APPLICATIONS:

Stock trading
Crypto investment decisions
Portfolio risk management
Robo-advisory platforms
Financial analytics tools

VII. FUTURE SCOPE:

- Integration with blockchain & crypto exchanges
- Real-time auto-trading bots
- Advanced deep learning (Transformers, GPT-Finance models)
- Multilingual sentiment analysis
- Adaptive risk profiling

VIII.CONCLUSION:

The AI-powered smart investment assistant provides a reliable and intelligent solution for modern investors. By integrating sentiment analysis with risk prediction, the system enhances forecasting accuracy and supports confident decision-making. Future improvements include reinforcement learning, multi-asset support, and real-time automated trading integration

ACKNOWLEDGMENT

The authors express their sincere gratitude to the **Department of Computer Science and Engineering, Sandip University, Nashik,** for providing the necessary infrastructure, advanced computing resources, and continuous academic support that were instrumental in conducting the research on the **AI-powered smart investment assistant and sentiment risk prediction models.**
The authors particularly acknowledge the invaluable guidance and encouragement received from faculty members, especially **Dr. Anand Singh Rajawat**, in shaping the direction and technical methodology of this research, which blends machine learning with behavioral finance principles.
The authors also acknowledge the open-source research community and data providers—specifically those maintaining **financial time-series databases, news aggregators, and social media data APIs**—for making the extensive, high-frequency data required for building and validating the sentiment and risk prediction models available to the academic community.
Finally, appreciation is extended to the technical staff and computing lab coordinators from the School of Computer Sciences and Engineering for their assistance in experiment execution and performance benchmarking of the various AI models.

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