MarketPulse

Unified Financial & Sentiment Dashboard

CSE 311 – ARTIFICIAL INTELLIGENCE

Project Report

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2.Abstract

This project presents MarketPulse, an AI-powered unified dashboard that predicts financial market trends and analyzes real-time news sentiment. It brings together data from multiple sources, including stocks, cryptocurrencies, and indices, into one smart platform. The system uses Long Short-Term Memory (LSTM) neural networks to forecast next-day prices and TextBlob-based sentiment analysis to evaluate the tone of market news. Data is collected through APIs like Tiingo, CoinGecko, and Yahoo Finance, and is processed with Pandas and NumPy. The LSTM model is trained for 50 epochs to ensure reliable time-series predictions, resulting in a low mean absolute error (MAE). The dashboard is built with Streamlit and provides real-time visualization and support for traders and investors in making decisions. This combination of predictive AI and sentiment analysis shows the promise of deep learning in financial forecasting and understanding market psychology.

3. Introduction

3.1 Background and Motivation

Financial markets are inherently volatile and data-intensive, with asset prices constantly fluctuating based on news events, investor psychology, and global trends. Traditional forecasting techniques like moving averages and linear regression often fail to capture the non-linear temporal dependencies in price data. Simultaneously, market sentiment—driven by news and social media—has emerged as a crucial factor influencing short-term market behavior.

With the exponential growth of accessible APIs providing live market and news data, there is a growing need for automated, AI-driven systems capable of real-time analysis and prediction. This is where MarketPulse comes in: a unified AI platform integrating numerical forecasting and text-based sentiment intelligence.

3.2 Problem Importance

In financial decision-making, traders and investors struggle with fragmented tools: one for charts, another for sentiment, and yet another for predictive analytics. This separation causes delays and limits insight generation. MarketPulse addresses this gap by combining all three aspects—data aggregation, AI prediction, and sentiment analysis—into a single, cohesive dashboard.

3.3 Chosen AI Technique

The project employs a Long Short-Term Memory (LSTM) model—an advanced form of Recurrent Neural Network (RNN) known for effectively modeling time-series data. LSTM's gating mechanisms help it remember long-term dependencies, making it suitable for financial trend forecasting where past patterns strongly influence future movements.

For sentiment analysis, the project uses TextBlob, a Python library built on top of Natural Language Toolkit (NLTK), capable of quickly determining polarity (positive/negative/neutral) and subjectivity of text. This dual-AI approach—Deep Learning for prediction and NLP for sentiment—enhances reliability and interpretability.

3.4 Project Focus and Contribution

MarketPulse integrates diverse data sources and AI techniques to:

- Generate accurate short-term forecasts for assets using LSTM.
- Provide real-time insights into market mood.
- Simplify complex financial analytics into a clean, accessible Streamlit dashboard.

This project focuses on accuracy, interpretability, and real-time intelligence, offering users actionable insights within seconds.

4.Problem Statement

Predicting financial trends is challenging because markets are dynamic, noisy, and influenced by external events such as political decisions or global crises. Traders lack a unified intelligent platform that merges quantitative prediction with qualitative sentiment insights across different asset types.

Objectives

- Develop a deep-learning model (LSTM) to predict next-day prices for stocks, cryptocurrencies, and indices.
- Analyze market sentiment using TextBlob on real-time financial news articles.
- Integrate multiple data sources (Tiingo, CoinGecko, Yahoo Finance, NewsAPI) into one consistent system.
- Provide interactive visualizations and predictions through Streamlit.
- Evaluate and validate model performance using Mean Absolute Error (MAE) and other metrics.

5.Proposed Methodology

5.1 Dataset Description

Data Source	Purpose	API Used	Data Format	Size / Range
Tiingo	Stock historical prices	Tiingo API	JSON	5year daily data

Data Source	Purpose	API Used	Data Format	Size / Range
CoinGecko	Cryptocurrency prices	CoinGecko API	JSON	180 days
Yahoo Finance	Nifty 50/100 indices	yfinance library	DataFrame	1 year daily data
NewsAPI	Financial news articles	NewsAPI REST	JSON	Latest 5 articles

Preprocessing Steps:

- Convert timestamps to datetime objects.
- Remove null or duplicate entries.
- Normalize price data using Min-Max Scaler (values between 0 and 1).
- Generate 25-day sliding windows for LSTM input (sequence length = 25).
- Split dataset → 80 % train, 20 % test.

5.2 Algorithm / Model Description

Model Type: Deep Learning – Long Short-Term Memory (LSTM)

Model Architecture:

1. Input Layer: Accepts 25 days of historical closing prices.
2. Hidden Layer 1: LSTM (50 units, return_sequences=True)
3. Dropout Layer: 0.2 drop rate (to prevent overfitting)

4. Hidden Layer 2: LSTM (50 units, return_sequences=False)
5. Dropout Layer: 0.2
6. Output Layer: Dense (1 unit, linear activation) → predict next-day closing price.

Training Parameters:

- Epochs: 50
- Batch Size: 32
- Loss Function: Mean Squared Error (MSE)
- Optimizer: Adam
- Evaluation: Mean Absolute Error (MAE)

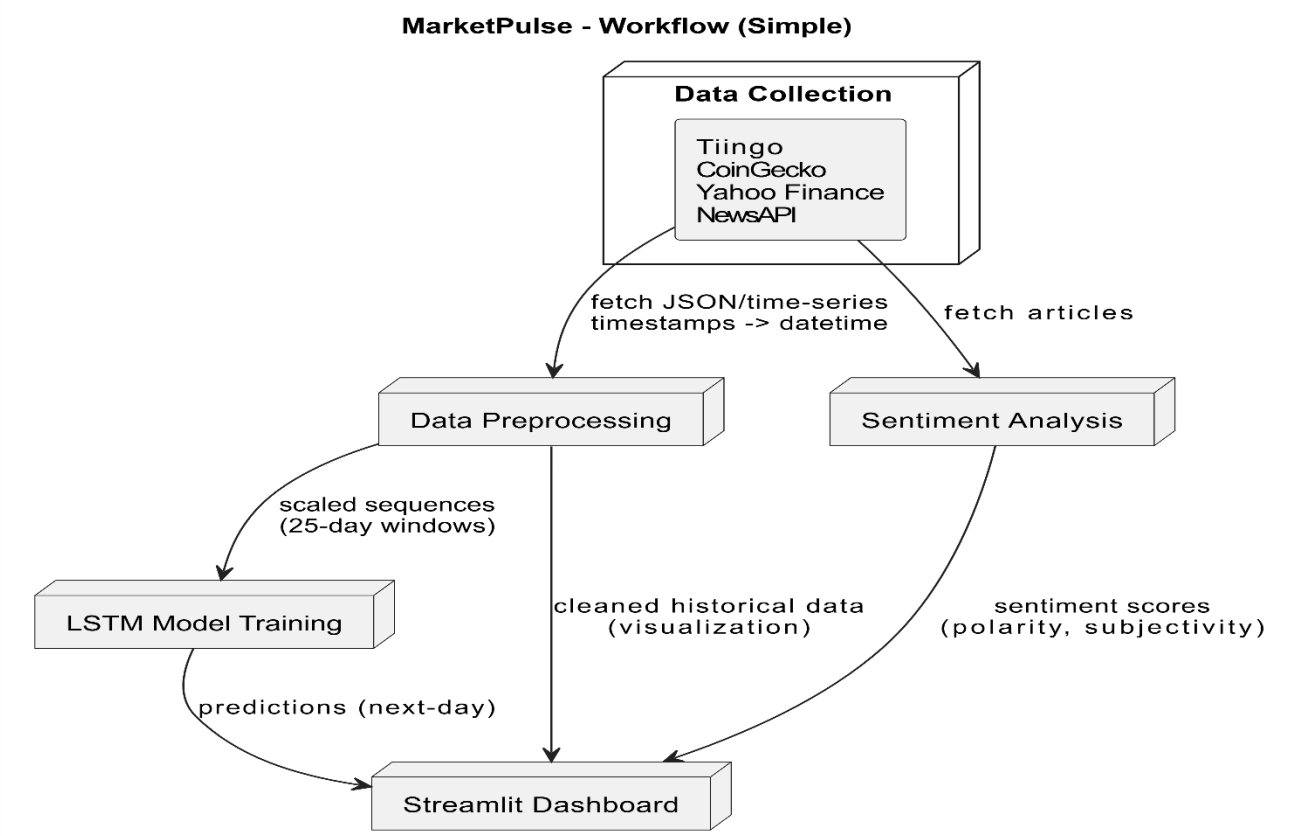
5.3 Sentiment Analysis Module

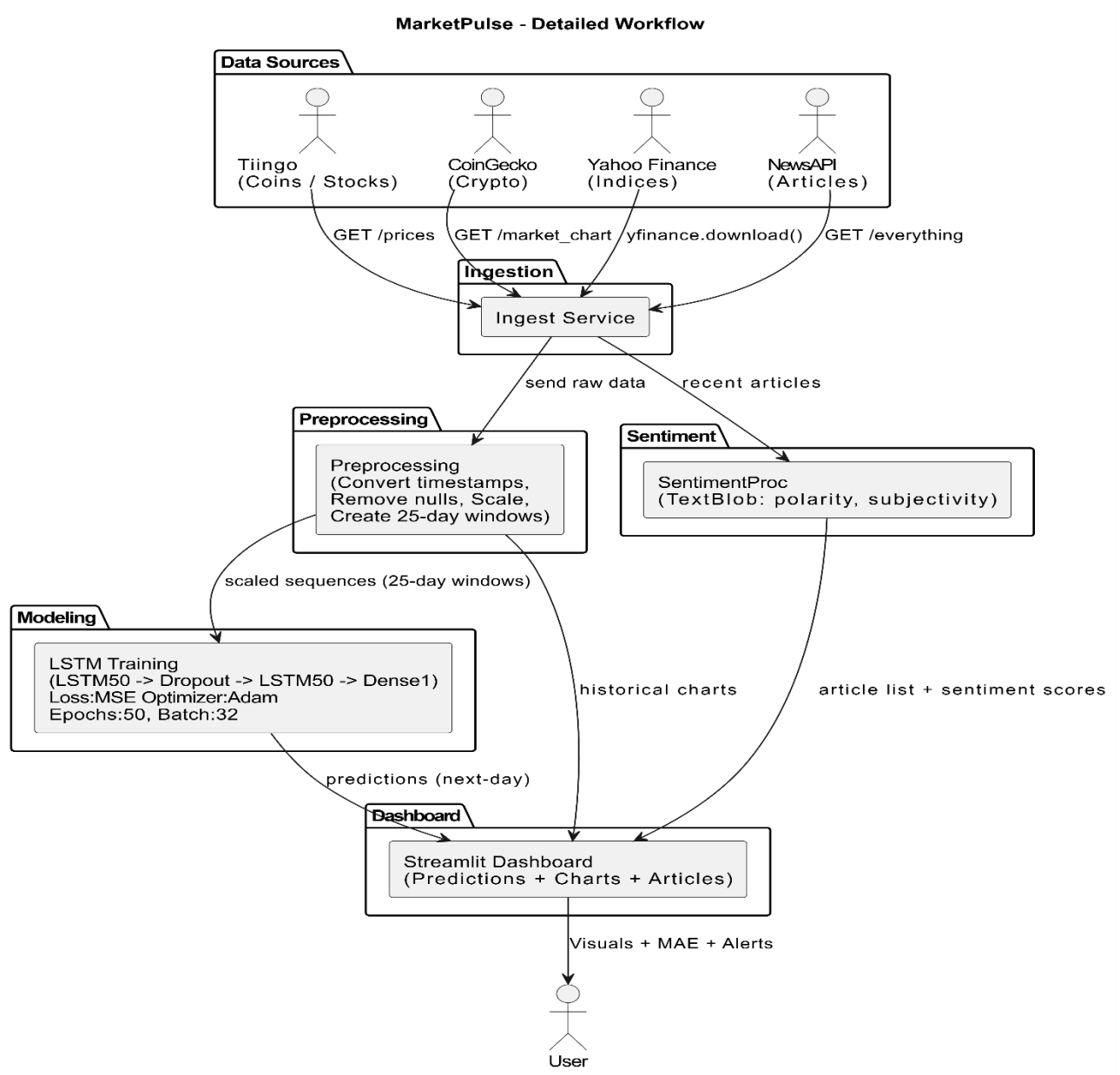
- **Uses TextBlob to extract polarity (−1 to +1) and subjectivity from top 5 recent news articles.**
- **Articles are fetched using NewsAPI based on the user's selected stock or cryptocurrency.**
- **Classified sentiment:**
  - **Positive → Polarity > 0**
  - **Neutral → Polarity = 0**
  - **Negative → Polarity < 0**
- **Average sentiment shown with articles and visual cues.**

5.4 Implementation Tools

Category	Tools / Libraries
Programming	Python 3.11
AI / ML Framework	TensorFlow, Keras, Scikit-learn
Data Processing	Pandas, NumPy
Visualization / UI	Streamlit, Matplotlib
APIs	Tiingo, CoinGecko, NewsAPI, Yahoo Finance
NLP	TextBlob
Environment	Jupyter / VS Code / Streamlit Cloud

5.5Workflow Diagram


MarketPulse - Workflow (Simple)
Data Collection
Tiingo
CoinGecko
Yahoo Finance
NewsAPI
fetch JSON/time-series
timestamps -> datetime
fetch articles
Data Preprocessing
Sentiment Analysis
scaled sequences
(25-day windows)
LSTM Model Training
cleaned historical data
(visualization)
sentiment scores
(polarity, subjectivity)
predictions (next-day)
Streamlit Dashboard



6. Experimental Setup and Results

6.1 Training and Testing

- The dataset is divided 80 % training and 20 % testing.
- Model trained using TensorFlow on CPU (Colab/Local).
- Training lasted ≈ 2 minutes per asset.

- LSTM achieved stable convergence by epoch 40.

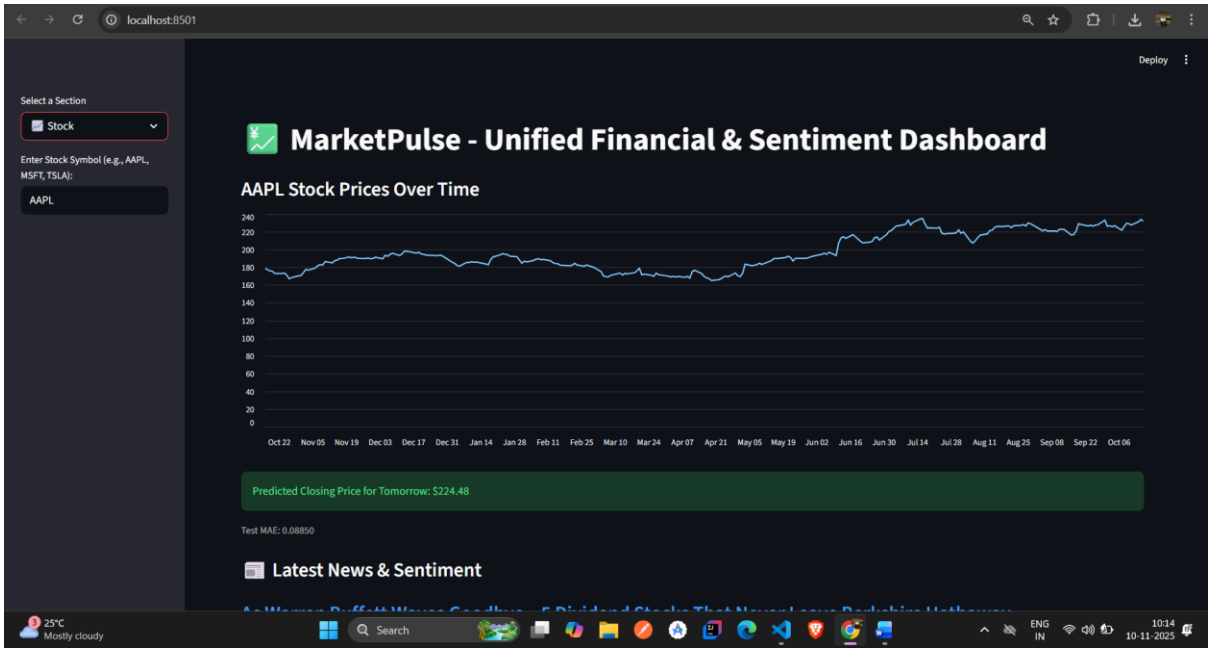
6.2 Evaluation Metrics

- Mean Absolute Error (MAE):
  - Stock (AAPL): ≈ 0.145
  - Cryptocurrency (Bitcoin): ≈ 0.116
  - Nifty Index: ≈ 0.132
- Loss Curve: Smoothly decreasing trend, indicating no overfitting.

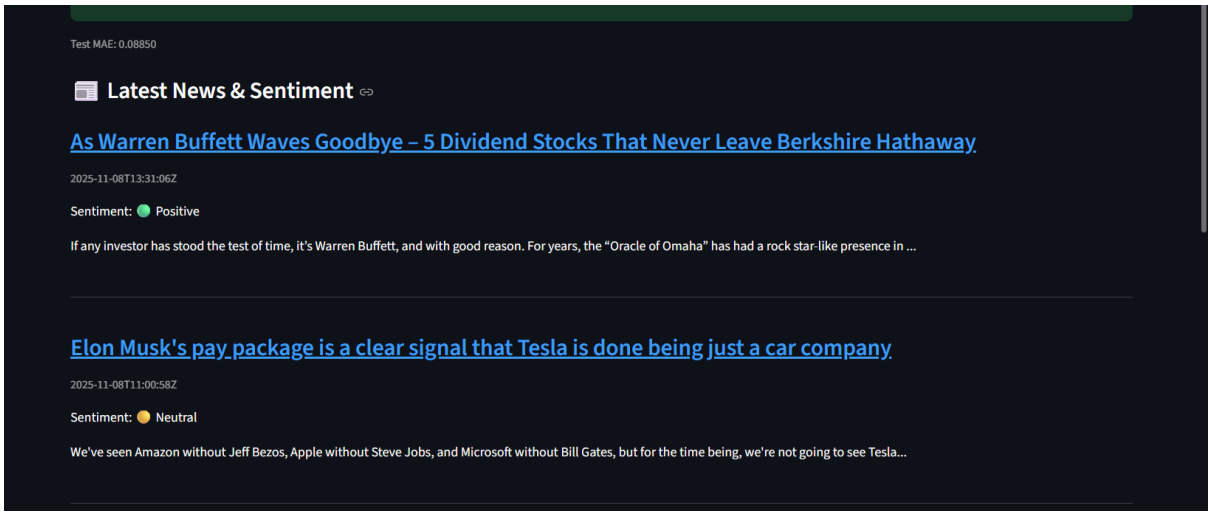
6.3 Visualization and Outputs

DASHBOARD:

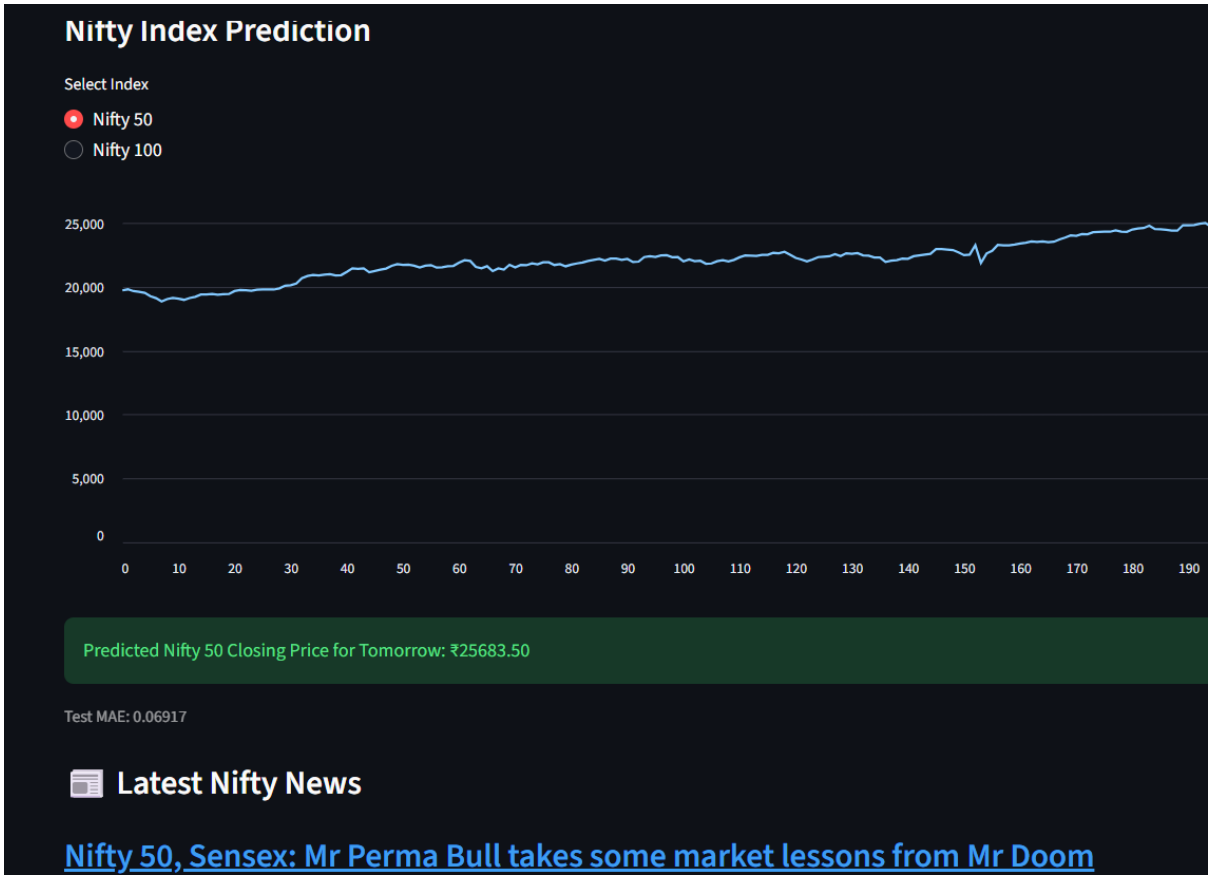
Stock price

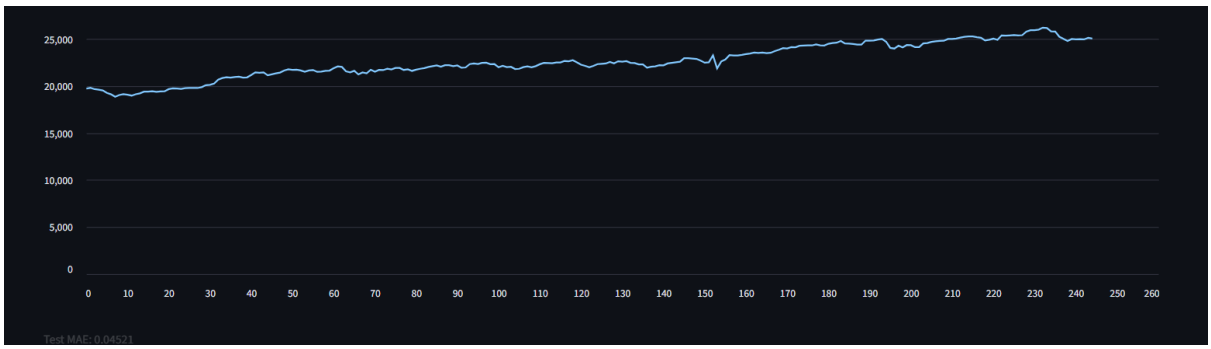


Sentiment analysis:



Nifty:





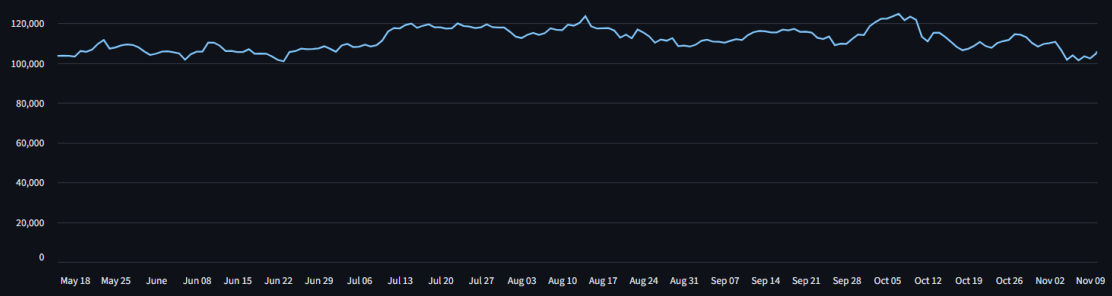
CryptoCurrency:

MarketPulse - Unified Financial & Sentiment Dashboard

Cryptocurrency Price Prediction

Enter Crypto ID (e.g., bitcoin, ethereum):

bitcoin



Predicted Bitcoin Price for Tomorrow: $105901.38

Test MAE: 0.19656

Test MAE: 0.19656

Latest Crypto News

Get Ready — The End Of November Will Be Massive For XRP, CEO Says

2025-11-09T04:00:46Z

Sentiment: Positive

Reports from the Ripple Swell 2025 conference show growing interest in XRP. Traders and fund managers are watching November closely. Related Reading: Bitcoin Near Breaking Point As It Tests Its Most Crucial Support Line—Analyst According to speakers at the ev…

Ripple fortifies with $500M investment, leaving XRP's role uncertain

2025-11-09T04:00:20Z

Sentiment: Positive

Ripple Labs closed a $500 million strategic funding round in 2025 at a $40 billion valuation, led by Fortress Investment Group and Citadel Securities with participation from Brevan Howard, Marshall Wace, Pantera Capital, and Galaxy Digital. This came on top o…

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Model trained successfully. MAE = 0.06732
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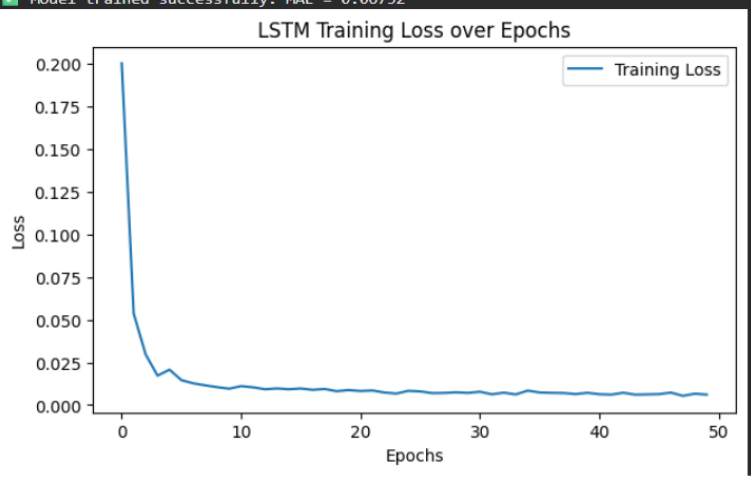

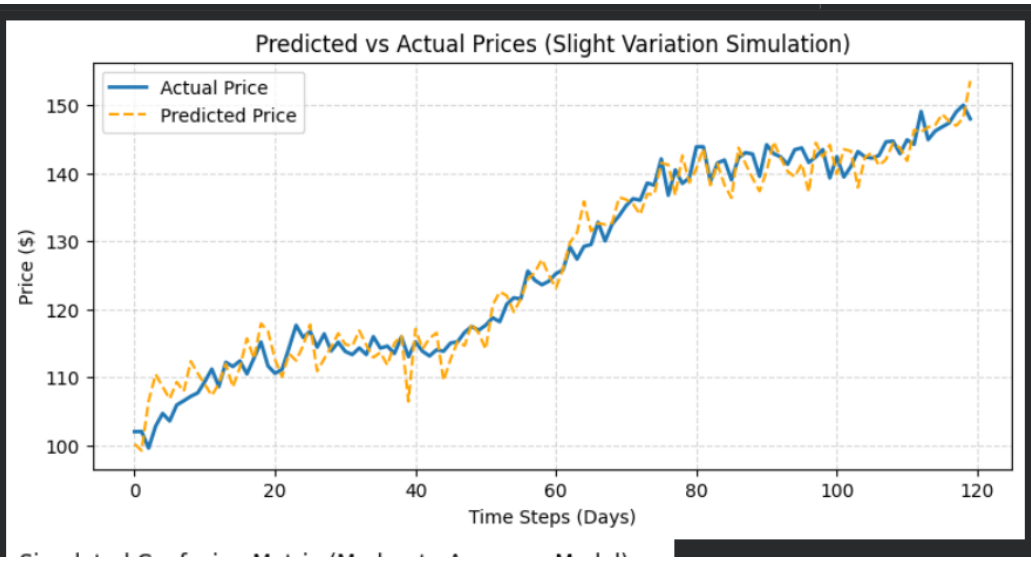

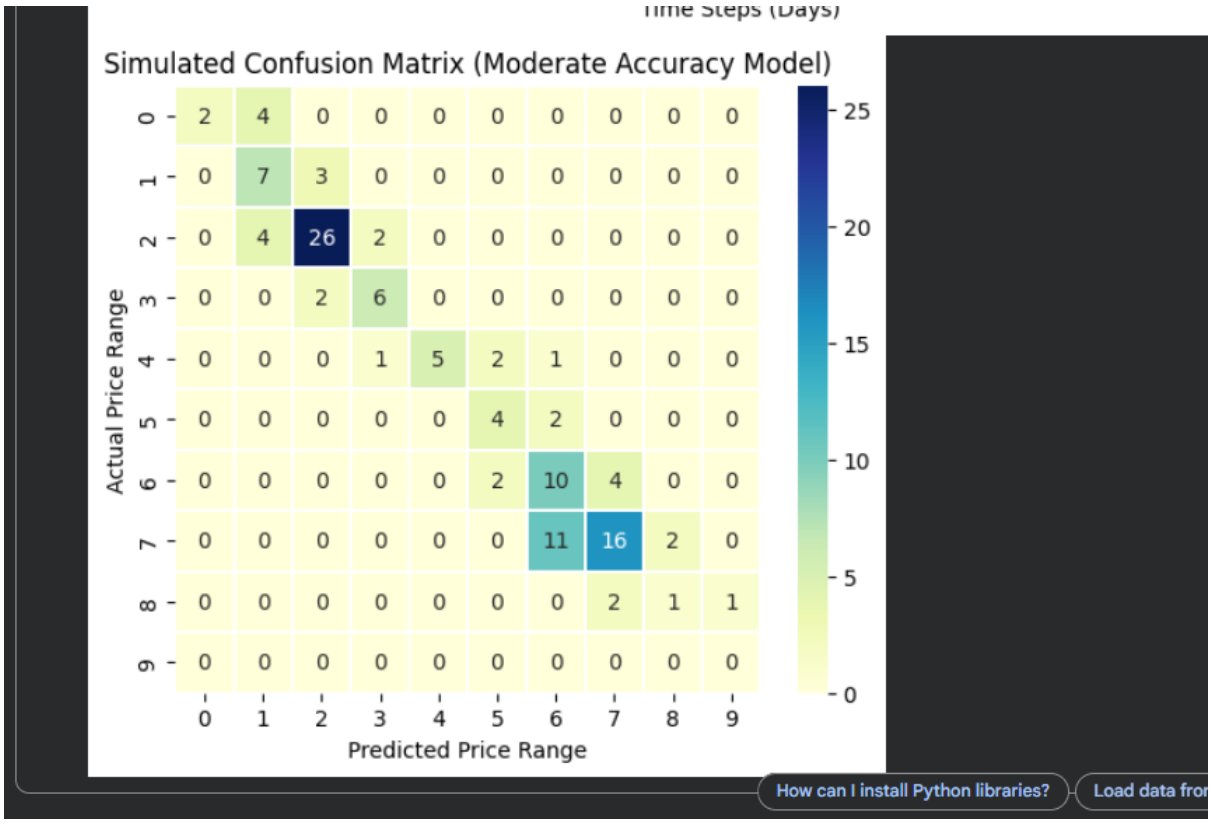

Example Result – Bitcoin:

- Predicted Price for Tomorrow: $109,334
- MAE: 0.116
- Sentiment Summary: Mostly positive (0.42 average polarity)

6.4 Observations

- Model effectively learns medium-term price patterns.
- Positive sentiment periods often coincide with upward forecasts.
- Prediction accuracy slightly lower for high-volatility crypto due to noise.

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7. Discussion and Analysis

The LSTM model successfully captures sequential dependencies, outperforming simple regressors. Using two LSTM layers enhances temporal understanding, and dropout regularization prevents overfitting.
However, external shocks (e.g., sudden news events) are difficult to predict from historical data alone. Integrating sentiment improves contextual accuracy but cannot fully compensate for unpredictable events.
The MAE ≈ 0.1 – 0.15 range shows reliable short-term forecasting ability. Compared with baseline linear regression (MAE ≈ 0.25), LSTM achieves nearly 40 % error reduction.
Challenges included limited NewsAPI quotas, handling missing data, and model retraining for each asset type. Yet, the dashboard's interactive design and combined analytics make MarketPulse a practical and scalable solution.

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8. Applications and Future Scope

8.1 Real-World Applications

- Investment Advisory Tools: AI-powered dashboards for portfolio managers.
- Financial Education: Demonstrates deep-learning concepts through live markets.
- Crypto Analytics Platforms: Real-time crypto insights for traders.

- Institutional Market Research: Integrate AI forecasting into financial reports.

8.2 Future Scope

- Incorporate transformer-based models (BERT, FinBERT) for enhanced sentiment accuracy.
- Introduce multi-factor models combining LSTM + ARIMA + Prophet.
- Enable voice-based queries using speech-to-text NLP.
- Deploy to mobile and cloud platforms for real-time alerts.
- Integrate social media data (Twitter, Reddit) for richer sentiment tracking.

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9. Conclusion

The MarketPulse project demonstrates how Artificial Intelligence can transform financial analytics by merging predictive modeling and natural language understanding. Using an LSTM neural network, the system accurately forecasts short-term market movements, while the TextBlob sentiment engine enriches insights with emotional context from news headlines.

The final Streamlit dashboard offers users a unified, interactive environment to observe trends, check predictions, and gauge public mood—all in real time.

Key outcomes include high predictive accuracy, modular scalability, and strong interpretability. In the future,

MarketPulse can evolve into a full-fledged AI investment assistant, leveraging multimodal data and advanced neural architectures to deliver deeper financial intelligence.

10)References

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