Cracking the market code with AI-driven stock price prediction using time series analysis

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Date of Submission: 28-04-2025

1.Problem Statement

Stock prices has always been a challenging and fascinating problem due to the volatile and complex nature of financial markets. Investors, companies, and individuals need reliable methods to forecast stock trends for better financial decisions. This project addresses the problem of stock price prediction using AIdriven models combined with time series analysis techniques. Solving this can help in minimizing risks, Predicting optimizing investment strategies, and understanding market behavior more accurately.

2.Objectives of the Project

- Build a predictive model capable of forecasting future stock prices based on historical data.

- Analyze stock market trends and detect patterns using time series methods.

- Implement and compare different AI models like LSTM and ARIMA to determine the best approach

- Provide visual insights into stock price movement to aid decision-making.

3.Scope of the Project

- **F to analyze**: Stock price (Open, High, Low, Close), Volume, Market Indicators (e.g., Moving Average).
- **Models**: Focus primarily on LSTM (Deep Learning) and ARIMA (Statistical).
- **Limitations**:
  - Only historical data will be used (no external financial news sentiment).
    - Deployment will be limited to a local dashboard or notebook visualization.
  - Real-time prediction beyond historical data testing will not be part of the Phase-1 scope.

4.Data Sources

- Dataset: Public stock price data (e.g., S&P 500, individual company stocks).
- Source: Yahoo Finance (accessed via yfinance API) and Kaggle. - Data Type: Public, Static (download)

5.High Level Methodology

Data collection

- Retrieve historical stock data using the `yfinance` Python library or download from Kaggle.

Data cleaning

- Handle missing values (interpolation or forward fill).
- Remove duplicates if any.

- Normalize formats for date and time consistency.

Exploratory Data Analysis (EDA)

- Plot stock price trends over time.
- Analyze moving averages, volatility.
- Identify seasonal patterns using decomposition techniques.

Feature Engineering

- Create lag features (previous days' prices).
- Calculate technical indicators like RSI, MACD, and Moving Averages.

Model Building   - ARIMA for traditional time

series forecasting.

- LSTM (Long Short-Term Memory Networks) for deep learning-based forecasting.
- Models selected due to their strengths in handling time-dependent data.

Model Evaluation

- Use metrics such as RMSE (Root Mean Square Error), MAE (Mean Absolute Error), and MAPE (Mean Absolute Percentage Error).
- Compare models based on performance on validation data.

Visualization & Interpretation

- Line plots showing actual vs predicted prices.
- Interactive dashboards (if feasible).
- Feature importance for any engineered variables.

Deployment

- No live deployment; results will be presented via Jupyter Notebook/Google Colab visualizations.

6.Tools and Technologies

Programming Language

o *Python*

Notebook/IDE

o *Google Colab*

o

Jupyter Notebook (optional)

Libraries

o Data Processing: pandas, numpy
o Visualization: matplotlib, seaborn, plotly
o Modeling: scikit-learn, statsmodels (for ARIMA), TensorFlow/Keras (for LSTM)
o API Access: yfinance

Optional Tools for Deployment

o Streamlit (if we later extend to interactive dashboard)

7.Team Members and Roles

Name	Role	Responsibilities
ABINAYA K	**Project Lead**	Organizes the work, gudies the team, and makes
NISHA S	**Data collector**	*Collect and manage stock market data from APIs (e.g., Yahoo Finance, Alpha Vantage), clean and preprocess time series data, and ensure data quality for modeling.*
PRIYADHARSHINI S	Data Analyser	Conduct exploratory data analysis (EDA), generate insights, and develop visualizations such as word clouds, emotion trends, and sentiment dashboards.

Name	*Role*	*Responsibilities*

AFRINISHA BEGUM A	*Model improver*	Adjusts and improves the model to make them more accurate and better at predictions
SHARMILA D	*Model developer*	Build sentiment and emotion classification models, perform feature engineering, and evaluate model performance using suitable metrics.