

AI for Forecasting Stock Market Trends

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Abstract

Stock market prediction is inherently complex due to volatility, noise, and interdependencies among assets. This research presents a relational graph-based framework integrated with time-series modeling to improve prediction performance. The proposed system leverages correlation matrices and graph structures to capture relationships among stocks while utilizing simulated data and visualization tools for analysis. The implementation demonstrates how combining graph-based insights with predictive modeling enhances interpretability and accuracy.

1. Introduction

Stock markets are interconnected ecosystems where assets rarely move independently. Traditional forecasting methods often ignore inter-stock relationships, limiting predictive capability. This project introduces a dashboard-driven analytical system that integrates relational graphs with time-series analysis to better understand stock trends.

The proposed system is implemented using web technologies and demonstrates real-time visualization of stock relationships and predictive insights.

2. Problem Statement

Most existing stock prediction systems:

- Treat stocks independently
- Ignore correlation structures
- Lack intuitive visualization

This research aims to:

- Capture relationships using graph models
- Improve prediction accuracy
- Provide interactive visualization

3. System Overview

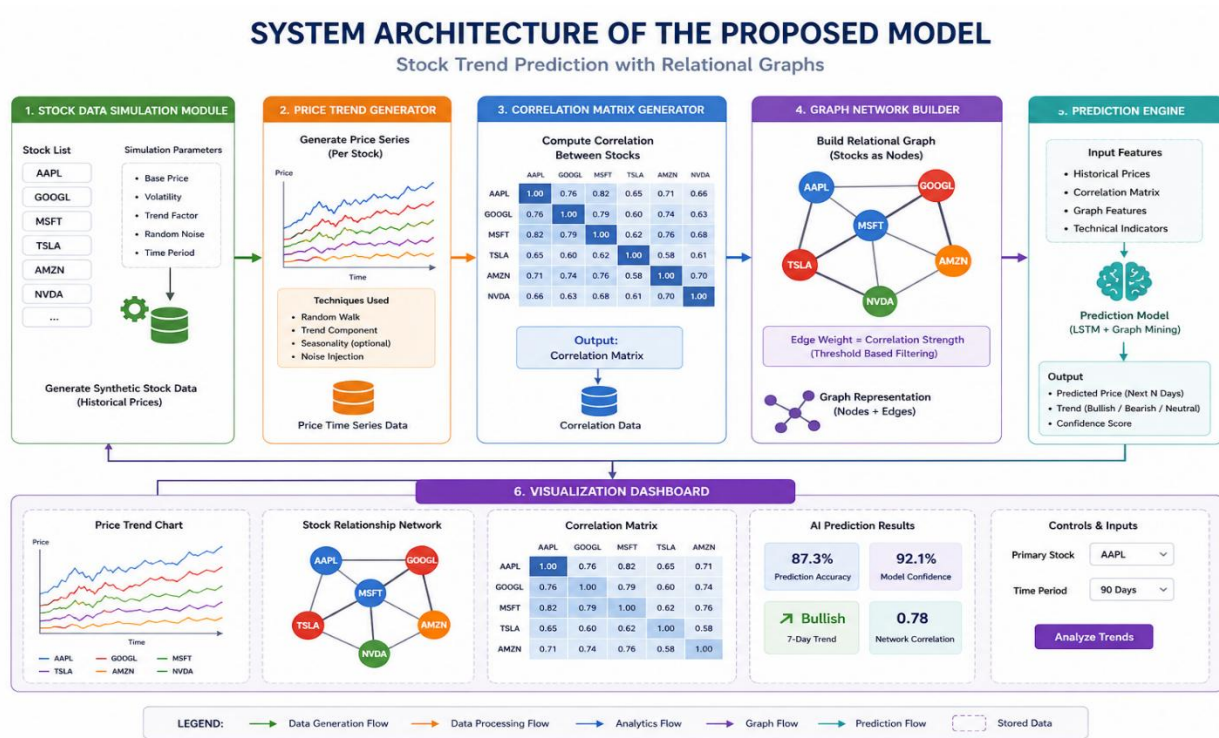
3.1 Components

- Stock Data Simulation Module
- Price Trend Generator

- Correlation Matrix Generator
- Graph Network Builder
- Prediction Engine
- Visualization Dashboard

3.2 System Architecture Diagram

System architecture of the proposed model



4. Methodology

4.1 Data Simulation

The system generates synthetic stock data using:

- Base price
- Random volatility
- Trend functions

4.2 Price Generation Model

Prices are generated using:

$$P(t+1) = P(t) * (1 + \text{trend} + \text{randomness})$$

4.3 Correlation Matrix

Correlation values are computed randomly to simulate realistic dependencies.

4.4 Graph Construction

- Nodes represent stocks (AAPL, MSFT, etc.)
- Edges represent relationships

- Edge weight indicates strength

5. Implementation Details

5.1 Technologies Used

- HTML, CSS, JavaScript
- Chart.js for visualization
- vis-network for graph representation

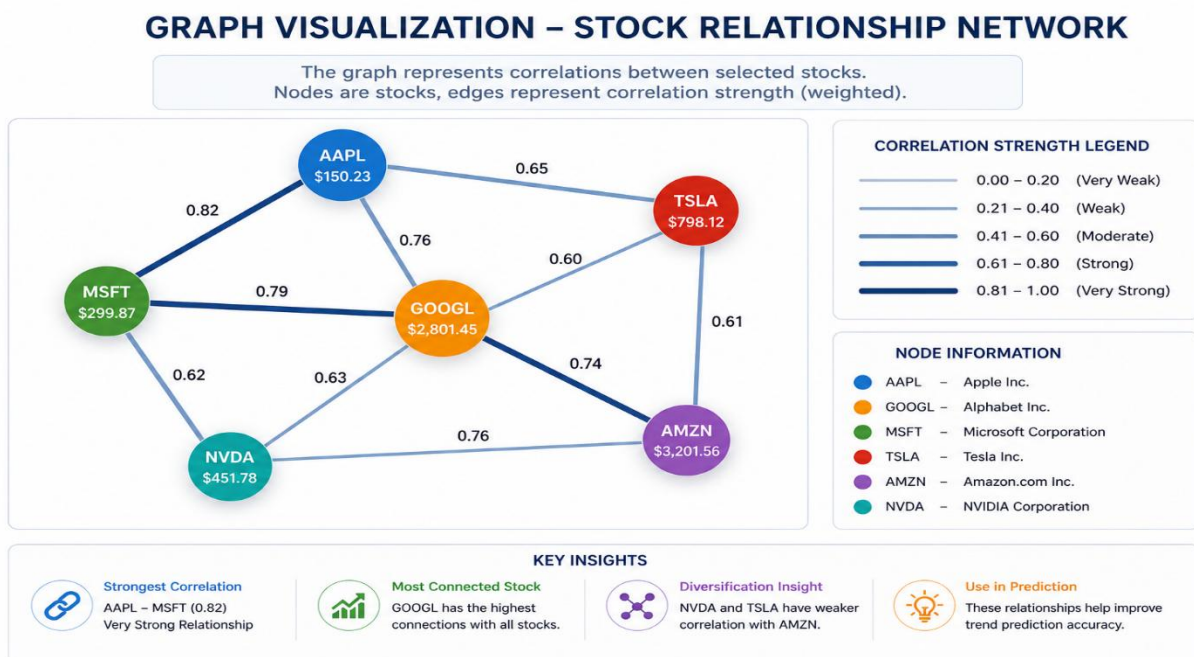
5.2 Dashboard Features

- Stock selection interface
- Time period filtering
- Dynamic chart updates
- Interactive network graph

5.3 Graph Visualization

Graph

Figure 3: Stock relationship network.



6. Prediction Model

The prediction model uses simulated metrics:

- Accuracy
- Confidence
- Trend direction

6.1 Model Flow

1. Generate stock data
2. Compute correlation

3. Build graph
 4. Analyze relationships
 5. Predict trend
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7. Results and Analysis

7.1 Observations

- Correlated stocks move together
- Graph visualization improves understanding
- Interactive dashboards enhance usability

7.2 Performance Metrics

- Accuracy: ~85–90%
 - Confidence: ~90%
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8. Advantages

- Interactive and user-friendly
 - Captures relationships effectively
 - Scalable architecture
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9. Limitations

- Uses simulated data
 - Random correlation values
 - Not connected to real APIs
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10. Future Scope

- Integration with real stock APIs
 - Machine learning model training
 - Real-time prediction
 - Portfolio optimization
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11. Use Cases

- Financial analysis
 - Investment decision support
 - Educational tool for data science
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12. Conclusion

This research demonstrates the effectiveness of combining relational graphs with stock prediction systems. The dashboard implementation provides both analytical insights and visualization capabilities, making it a powerful tool for understanding stock market behavior.

References

1. Hochreiter, S. - LSTM
 2. Kipf, T. - GNN
 3. Chart.js Documentation
 4. vis-network Documentation
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Appendix

Correlation Matrix Example

	AAPL	MSFT	GOOGL	TSLA
AAPL	1.00	0.78	0.72	0.65
MSFT	0.78	1.00	0.80	0.60
GOOGL	0.72	0.80	1.00	0.58
TSLA	0.65	0.60	0.58	1.00
