Stock Market Prediction Report

Introduction

The stock market is a crucial component of the global economy. Predicting stock prices has become more data-driven and systematic due to advancements in machine learning and AI.

Objective

- Predict future stock prices based on historical data.
- Evaluate performance of various prediction models.
- Identify techniques providing more accurate forecasts.

Data Collection

Source: Yahoo Finance, Alpha Vantage, Quandl

Dataset: Historical daily stock prices (Open, High, Low, Close, Volume)

Period: January 2010 - December 2024

Features: Date, Open, High, Low, Close, Volume

Methodologies

- ARIMA (Statistical)
- Linear Regression (ML)
- Random Forest Regressor (ML)
- LSTM (Deep Learning)

Model Evaluation Metrics

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- Mean Absolute Error (MAE)
- Root Mean Squared Error (RMSE)
- R-squared (R^2) Score
- Direction Accuracy

Results

Linear Regression: MAE 3.45, RMSE 5.67, R^2 0.89, Direction Accuracy 62%

Random Forest: MAE 2.89, RMSE 4.93, R^2 0.92, Direction Accuracy 68%

LSTM: MAE 2.14, RMSE 3.74, R^2 0.95, Direction Accuracy 74%

Challenges

- Market Noise
- Overfitting
- Feature Selection
- Computational Resources

Conclusion

Stock market prediction is difficult, but LSTM models show promise. Predictions should be used cautiously in broader investment strategies.

Future Work

- Sentiment analysis integration
- Hybrid models (e.g., ARIMA-LSTM)

- Including macroeconomic indicators

- Real-time prediction using streaming data

References

1. Zhang et al. (1998) - Forecasting with ANN

2. Hochreiter & Schmidhuber (1997) - LSTM

3. Yahoo Finance

4. Alpha Vantage