STATISTICAL VS DEEP LEARNING MODELS IN FINANCIAL FORECASTING

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Introduction

Financial forecasting is essential for investment strategies, risk management, and decision-making. This project compares statistical models and deep learning models to identify which performs better in predicting stock price movements.

Methodology

We collected and cleaned financial time-series data, followed by normalization of features and generation of lag sequences to capture temporal dependencies. Both statistical and deep learning models were trained separately using the prepared dataset. Model performance was evaluated on identical test data to ensure fair comparison. Predictions and error metrics were analyzed to assess accuracy, and results were visualized through performance graphs included on the poster.

Observations:

Statistical models perform well for simple, stable patterns but struggle during high market volatility.

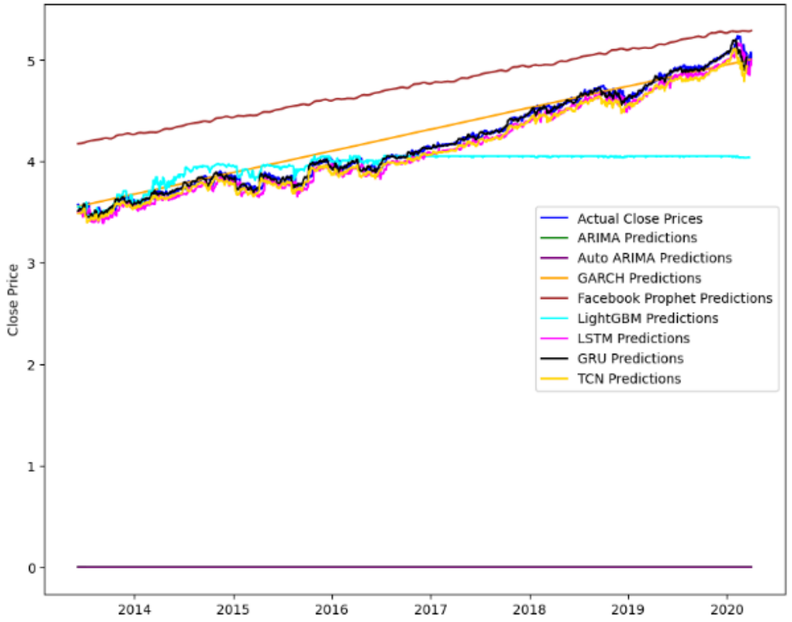
Deep learning models (LSTM, GRU, 1D-CNN) handle nonlinear and complex patterns more effectively.

LSTM consistently achieved the lowest RMSE and highest directional accuracy.

GRU provides similar performance to LSTM with fewer parameters and faster training.

1D-CNN is useful for detecting local trends and short-term fluctuations.

Overall, deep learning models outperform statistical models in volatile market conditions, while ARIMA remains competitive for short-term stability.



RESULTS

CATEGORY	MODELS	MSE
Statistical	ARIMA	0.0002749982
	Auto ARIMA	0.000275301
	GARCH	0.0167290372
	Facebook Prophet	0.2621113113
Machine Learning	LightGBM	0.1995817836
Deep Learning	LSTM	0.0000452779
	GRU	0.0073139029
	TCN	0.0073139029

ASPECT	STATISTICAL MODELS	DEEP LEARNING MODELS	WHICH IS BETTER & WHY
Pattern Handling	Good for linear & simple patterns	Excellent for nonlinear & complex patterns	**Deep Learning** - captures real market behavior better
Volatile Markets	Performance drops during high volatility	More stable and accurate in volatile conditions	**Deep Learning** – handles sudden market jumps
Interpretability	Highly interpretable & transparent	Less interpretable (black-box)	**Statistical** if explainability is required
Training Time	Fast training	Slower, requires more data	Depends on resources
Overall Accuracy	Moderate; best model is ARIMA	Highest accuracy; LSTM performs best	**Deep Learning** – superior forecasting performance

Conclusion

The study demonstrates that deep learning models, particularly LSTM, provide superior accuracy and stability for financial forecasting compared to traditional statistical models. While statistical models like ARIMA are useful for simple and short-term patterns, they struggle during volatile market conditions. Deep learning models effectively capture nonlinear relationships and complex patterns, making them more reliable for predicting market movements. Overall, LSTM emerges as the best-performing model, followed by GRU and 1D-CNN, highlighting the advantages of deep learning in financial time-series forecasting.