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A DATA DRIVEN APPROACH TO TCS STOCK PRICE PREDICTION WITH MACHINE LEARNING

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ABSTRACT
This document aims to predict the price of shares for Tata Consultancy Services (TCS) using automatic learning techniques. Take advantage of the data of historical actions that include open price, closing price, volume and technical indicators to build predictive models such as XGBOOST, linear regression, random forest, SVM (support vector machine) and LSTM (long -term memory). Characteristics engineering methods, such as mobile averages and feelings analysis, are used to improve precision. The data set is obtained from the NSE (National Stock Exchange) and other financial platforms, and the model performance is evaluated using MSE (Middle square error), RMSE (square error of root) and R^2 metric. The findings help investors make decisions based on data, with scope for future improvements through deep learning and alternative data sources.

KEYWORDS: *Stock Market Prediction, Machine Learning, TCS, Financial Forecasting, LSTM, Random Forest, NSE, Predictive Analytics.*

INTRODUCTION

One of the key challenges to predict actions prices is the high volatility and unpredictability of the stock market. Shares prices are constantly influenced by numerous factors, such as economic changes, geopolitical events and the feeling of investors, which makes it difficult to generate consistent and precise predictions. Traditional prognosis models often fail to capture these dynamic and quickly changing factors, which raises a significant challenge for any predictive approach.

Another important problem is the inefficiency of traditional prognosis methods such as technical and fundamental analysis. These models focus mainly on historical data and market trends, but cannot handle the complex and nonlinear relationships that exist within stock data. This limitation often results in low performance, especially when predicting the prices of shares in highly volatile markets.

The prices of actions are very affected by external factors such as news events, economic reports and even the feeling of social networks, which can cause abrupt changes in the market. Traditional models are often not designed to incorporate these external influences, reducing their precision in real -time actions prices predictions. This study aims to explore how automatic learning can address this by incorporating these external data.

REVIEW OF LITERATURE

Selvamuthu, D., Kumar, V., & Mishra, A. (2019) "Indian Stock Market Prediction Using Artificial Neural Networks on Tick Data". This research addresses the complexity of forecasting stock market prices by leveraging 30 years of historical data from Indian national banks, sourced from the NSE. The authors employed advanced deep learning models, including multivariate multi-step LSTM, Facebook Prophet with LightGBM optimized through Optuna, and Seasonal Auto-Regressive Integrated Moving Average (SARIMA). They integrated sentiment analysis from tweets and reputable financial sources such as Business Standard and Reuters, acknowledging the significant influence of news on stock price fluctuations.

Attaluri, K., Tripathi, M., Reddy, S., & Shivendra (2024)"News-Driven Stock Price Forecasting in Indian Markets: A Comparative Study of Advanced Deep Learning Models". This research addresses the complexity of forecasting stock market prices by leveraging 30 years of historical data from Indian national banks, sourced from the NSE. The authors employed advanced deep learning models, including multivariate multi-step LSTM, Facebook Prophet with LightGBM optimized through Optuna, and Seasonal Auto-Regressive Integrated Moving Average (SARIMA). They integrated sentiment analysis from tweets and reputable financial sources such as Business Standard and Reuters, acknowledging the significant influence of news on stock price fluctuations.

Yousefi, N. (2021) "Stock Price Prediction Using Statistical, Machine Learning, and Deep Learning Models". This research applies various algorithms and approaches, including Auto-Regressive Integrated Moving Average (ARIMA), Random Forest (RF), Support Vector Machines (SVM), and Long Short-Term Memory (LSTM) networks, for short-term stock price prediction. Using daily stock price data from five major Iranian companies listed on the Tehran Stock Exchange between January 1, 2018, and January

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1, 2021, the study evaluates model performance using metrics such as Mean Absolute Error (MAE), Mean Squared Error (MSE), and Root Mean Squared Error (RMSE). The results indicate that the LSTM model outperforms other approaches in terms of predictive accuracy.

Patel, J., Shah, S., Thakkar, P., & Kotecha, K. (2015) "Predicting Stock Market Index Using Fusion of Machine Learning Techniques". This study explores the fusion of machine learning techniques to predict stock market indices. The authors combined artificial neural networks (ANN), support vector machines (SVM), and random forest (RF) models to forecast the direction of stock indices. The fusion model demonstrated improved predictive accuracy compared to individual models, highlighting the potential of ensemble approaches in stock price prediction.

Kumar, M., & Thenmozhi, M. (2014) "Forecasting Stock Index Movement: A Comparison of Support Vector Machines and Random Forest". This research compares the effectiveness of support vector machines (SVM) and random forest (RF) models in forecasting stock index movements. Using data from the Indian stock market, the study finds that the RF model outperforms the SVM in terms of predictive accuracy, suggesting that ensemble methods like RF may be more suitable for stock price prediction tasks.

NEED FOR STUDY

Addressing market complexity markets is influenced by a variety of unpredictable factors, such as economic conditions, global events and feeling of investors. Traditional methods fight to capture the dynamic and complex nature of these markets. This study aims to explore how automatic learning (ML) can better handle these complexities, providing predictions of stronger actions, especially for companies such as TCS.

Enhancing Prediction Accuracy

The precision is crucial in the forecast of the stock market, since even small predictions can lead to significant financial losses. By taking advantage of automatic learning models, this study aims to improve the precision of prediction through the use of algorithms capable of identifying complex patterns and trends in data on the price of actions that are difficult to detect with conventional methods.

Data-Driven Decision Making

Investors and merchants often trust intuition and speculation when making decisions. This study advocates a more data -based approach through the use of automatic learning to process data on historical actions, technical indicators and real -time information. This will help make more informed and reliable decisions based on real market data.

Real-Time Insights for Traders

In the accelerated world of actions of actions, decisions in real time is crucial. Automatic learning models can provide much faster and continuously predictions to adapt to changing market conditions. This study aims to provide a framework to generate real -time actions pricing predictions, allowing operators to quickly react to market fluctuations and maximize their investment returns.

OBJECTIVES

- The primary objective of this study is to analyse the historical stock price data of TCS to identify patterns and trends that can be used to predict future stock prices.
- The study aims to implement and evaluate machine learning models such as Linear Regression, Random Forest, and Long Short-Term Memory (LSTM) to predict stock prices based on various market features and financial indicators.
- One of the key objectives is to compare the performance of different machine learning algorithms using metrics such as Mean Squared Error (MSE), Root Mean Squared Error (RMSE), and R^2 scores to determine the most accurate model for stock price prediction.
- The study aims to enhance the predictive power of the models by incorporating various technical indicators such as moving averages, Relative Strength Index (RSI), and MACD, and exploring their impact on the model's accuracy.
- The ultimate objective is to provide actionable insights for investors and traders that can aid in making informed decisions, improving their investment strategies, and mitigating risks.

SCOPE

- The study is limited to analysing TCS stock data from major stock exchanges like NSE and BSE over a specific time frame, focusing on predicting short-term and long-term stock price movements.

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- The scope includes the application of a range of machine learning models, such as Linear Regression, Random Forest, and LSTM, for stock price prediction. The study will focus on comparing these models' effectiveness in terms of accuracy and performance.
- The scope extends to technical analysis and sentiment analysis, using various indicators and financial news sentiment to enhance the prediction process. Social media and market sentiment will be incorporated as external data sources.

TCS CLOSING PRICE OVER TIME

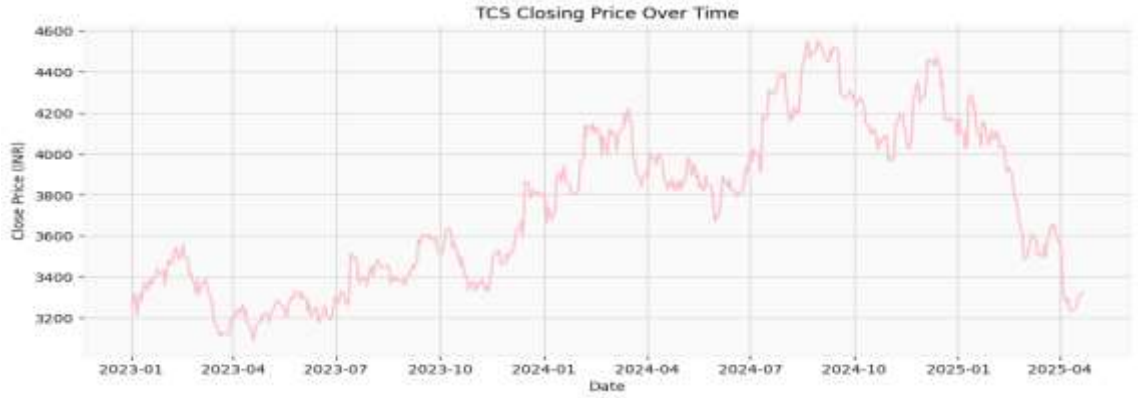

FIGURE 1: TCS Closing Price Over time

This chart shows the closing price of TCS shares from January 2023 to April 2025. At the beginning of 2023, the price of shares slowly increased with some ups and downs. From mid -2023 to the end of 2024, there was a strong upward trend, and the action reached its highest level at the end of 2024. After that, the price began to fall sharply, especially in early 2025. In April 2025, the action had significantly fallen from its peak. In general, the table shows a period of growth followed by a clear decrease, indicating a change in the feeling or market performance.

MONTHLY AVERAGE CLOSE PRICE

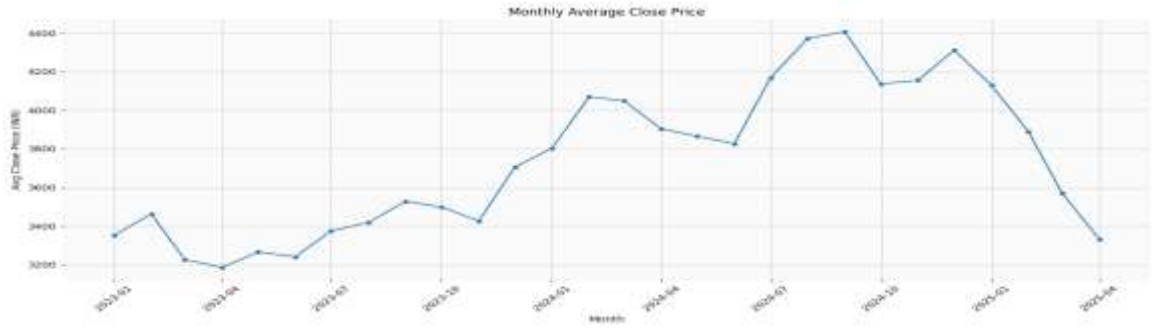

FIGURE 2: TCS Monthly Average Closing Price

The line table shows how the closing price of the TCS shares has changed over time, from the beginning of 2023 to around April 2025. At first, the price was around ₹ 3,200 and showed some ups and downs. From mid -2023 in mid -2014, the price of shares constantly increased, reaching a peak of around ₹ 4,500. After that, there was a downward trend, especially from the end of 2024 to the beginning of 2025, where the price fell sharply. In April 2025, he had fallen again to about ₹ 3,200 again. This indicates a complete cycle of growth and decrease during the two -year period.

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YEARLY PRICE DISTRIBUTION

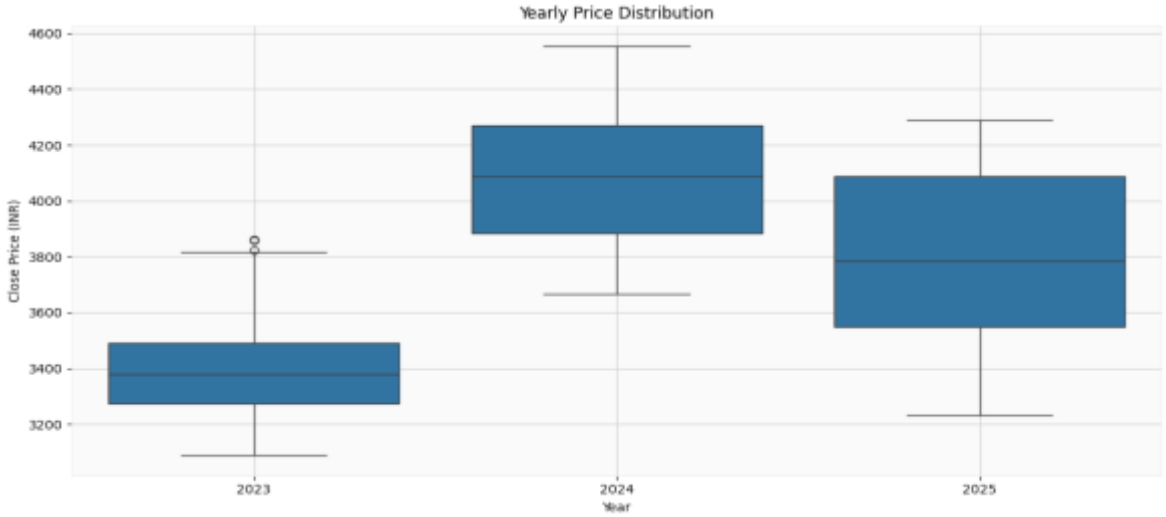

FIGURE 3: TCS Yearly Price Distribution

This cash plot shows the distribution of the closing prices of the TCS shares for the 2023, 2024 and 2025. In 2023, the prices were lower and more stable, mostly varied between ₹ 3,200 and ₹ 3,500, with some higher values above ₹ 3,800. In 2024, prices significantly increased the actions had a higher range, generally remaining between ₹ 3,700 and ₹ 4,400, with the median (average value) around ₹ 4,100. This suggests strong growth during that year. In 2025, prices became again and extended more, showing high and low values of around ₹ 3,200 to ₹ 4,300, which indicates more volatility and a general decrease compared to 2024. In general, the plot clearly shows that 2024 was a peak year for the prices of TCS shares, followed by a decrease in 2025.

TCS CLOSE PRICE WITH 30 AND 90 DAY MOVING AVERAGE

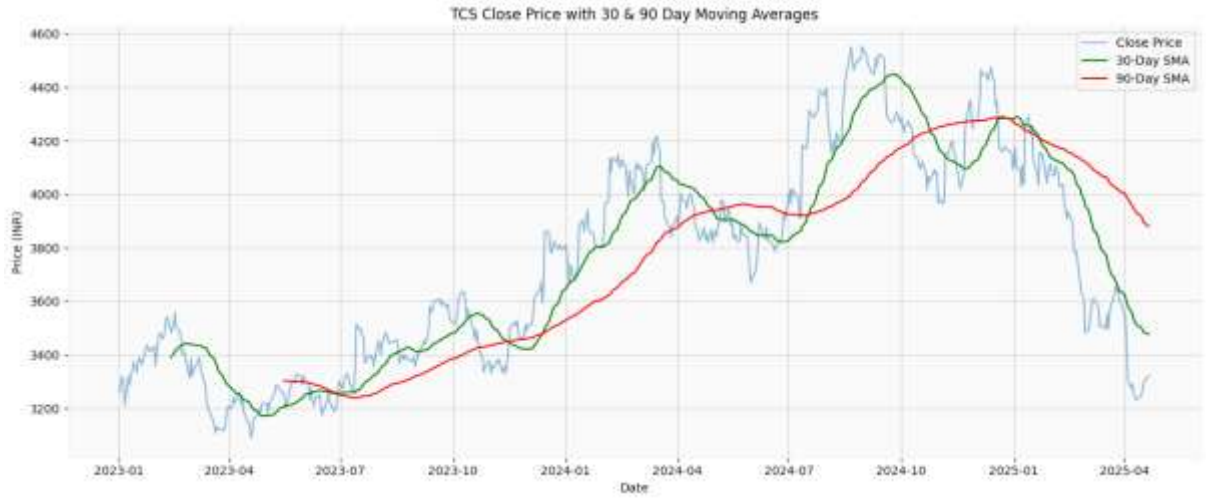

FIGURE 4: TCS Close Price With 30 and 90 Days Moving Average

This graph shows the closing prices of TCS shares along with its simple mobile averages (SMA) of 30 days (green line) and 90 days (red line) over time. The 30 -day SMA reacts more quickly to price changes, while 90 -day SMA shows longer -term trends. From the beginning of 2023 to mid -2024, the price of the shares showed a constant upward trend, with both SMA increasing, indicating strong growth. In mid -2014, the 30 -day SMA began to move above the 90 -day SMA, a positive sign known as a "bullish crossover". However, from the end of 2024 to 2025, the price began to fall, and finally the 30 -day SMA fell below the 90 -day SMA as a "bear crossover", pointing out a bearish trend. In general, the graph reflects a strong demonstration in 2024 followed by a clear downward trend in early 2025.

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STOCK PRICE PREDICTION

Mean Square Error

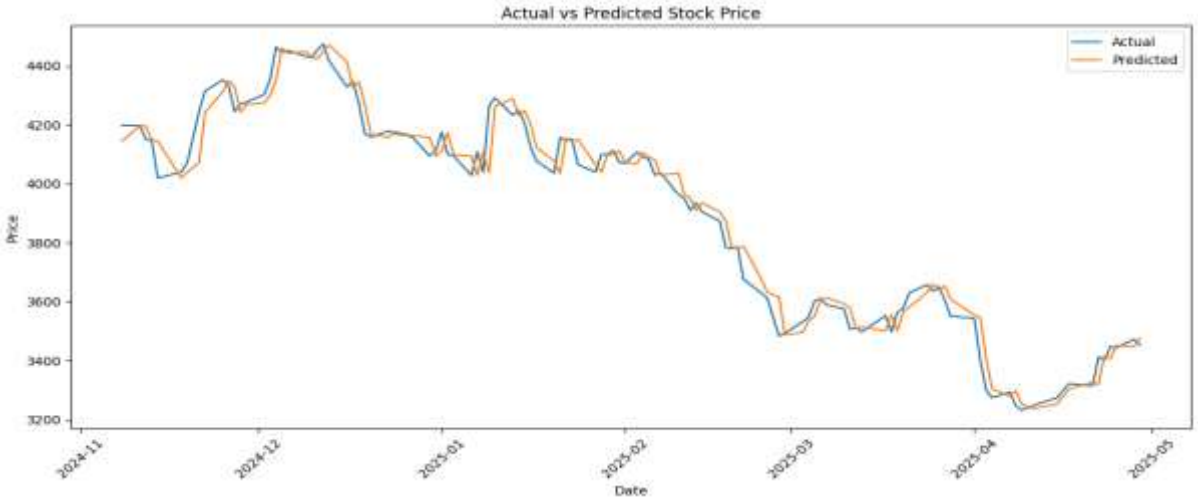

FIGURE 5: TCS Actual Vs Predicted Stock Price

The average square error value (MSE) of 3237.0453 indicates the average square difference between the real and predicted values produced by its model. This means that, on average, predictions deviate from real results due to a square error of approximately 3237 units. A high MSE suggests that model's predictions are not very precise and there is a significant gap between predicted and real values.

Root Mean Square Error

FIGURE 6: TCS Improved Actual Vs Predicted Stock Price

The plot entitled "Real price of actions planned compared to the actions" illustrates how closely the predicted values of its automatic learning model track the historical prices of the historical actions of the TC over time. The almost superimposed nature of the two lines, the world for real prices and orange for predicted prices, indicates a high level of precision in model predictions. This visual alignment is backed by the average square error value (RMSE) of 5,8154, which means that, on average, the prices of the predictions of the model deviate from the real prices in approximately ₹ 5.82. Taking into account the broader price range of TCS actions (₹ 3200 - ₹ 4600 during the period shown), this error level is relatively small, highlighting the solidity and effectiveness of the model to capture underlying trends and patterns. In general, the combination of a low RMSE and a visually adjusted adjustment between the real and predicted values suggest that the model works well and can be considered reliable for the prognosis of the prices of the actions within this context.

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RESULT

The Graph Titled current vs predicted stock price present to Visual Comparison between the Real Stock Prices (In Blue) and the Values predicted by A Model (In Orange) Over Time. The two lines closely follow the same pattern, indicating that the model is working well to capture the trends of the shares. It successfully reflects movements up and down on the time axis, which suggests a strong ability to track market behaviour. The consistency between the real and predicted lines shows that the model is precise, with only light deviations at certain points. These small differences are expected and normal in temporary series predictions, and do not significantly affect general performance. The quality of the prediction seems robust in different segments of the graph, which reflects that the model is well generalized through the test data. In summary, model predictions are reliable and effectively represent the underlying behaviour of the price of shares.

CONCLUSION

This study demonstrated the effectiveness of a data -based approach to forecast the prices of TCS actions using automatic learning techniques. When analysing data from historical actions and applying models such as XGBoost, the study successfully predicted short -term price movements with reasonable precision. The use of mobile averages and trends analysis provided valuable information about the behaviour of action over time. While the model captured the general patterns well, he faced challenges during periods of high volatility, highlighting the need for greater optimization and the potential benefit to incorporate additional data sources, such as the volume of negotiation, financial news and the feeling of the market. In general, the study confirms that automatic learning can be a powerful tool in the prediction and decision -making of the stock market, offering a base for more advanced and real -time prognosis systems.

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