

# Exploring Stock Price Trend Prediction through Multi-Step Stacked LSTM: A Comprehensive Survey

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*Abstract: Machine Learning (ML) and Deep Learning (DL) techniques have found successful applications in forecasting stock price trends. Despite the advocacy by finance practitioners and academics for combining Fundamental Analysis (FA) and Technical Analysis (TA), ML research has predominantly focused on utilizing TA-based indicators. The primary aim of ML researchers has been to predict the next day's price for market indices or individual stocks.*

*This study seeks to explore the impact on ML-based stock price forecasting by incorporating various inputs and considering the prevailing states of the stock market. A novel framework is proposed herein for effectively predicting stock price trends. This framework facilitates the identification of the best-performing model with pertinent inputs, while also accommodating the sensitivity of a stock's price to different market conditions. The proposed framework forecasts the next day's price movement, framing it as a buy-sell decision, achieving an accuracy rate of approximately 73%.*

*Furthermore, the framework introduces a DL-based approach termed "Multi-step Stacked - Long Short Term Memory" (MS-LSTM) for forecasting future stock trends and prices.*

*Keywords: Prediction, Machine learning, Multi-step Stacked, LSTM, Deep Learning*

## I. INTRODUCTION

The Efficient Market Hypothesis (EMH) posits that in efficient markets, predicting stock prices is unattainable. However, if this were entirely true, the financial investment sector would cease to exist. Many finance experts subscribe to EMH, which asserts that the market comprises rational investors who have already factored all available information into current stock prices, rendering future price predictions impossible.

A robust stock market is crucial for a country's economic well-being, serving two vital functions. Firstly, it enables firms to raise capital from the public, facilitating expansion and operational funding. Secondly, it offers individuals the opportunity to share in company profits. The stock market's inherent nature is complex, nonlinear, volatile, and susceptible to external influences, posing challenges for prediction. With the proliferation of stock trading platforms, investors are increasingly focused on devising systematic strategies to forecast market movements and stock prices, with the aim of capitalizing on profitable buying and selling positions.

Stock price forecasting is typically categorized into Fundamental Analysis (FA), Technical Analysis (TA), and Time Series Forecasting. FA operates on the principle that as a company grows, so does its stock value, making it a

long-term investment tool. The components of FA include various financial metrics and market data.

Related research has traditionally approached the stock price forecasting problem from two perspectives: Statistical Techniques and ML Techniques. Statistical methods assume a linear relationship between stock prices and their drivers, while ML techniques, better equipped to handle non-linear and noisy financial time-series data, have emerged as more effective predictors. Despite ML's widespread acceptance in studying stock market behavior, there's still no universally agreed-upon set of indicators and methodologies for consistently forecasting stock prices.

De Souza et al. explored the profitability of TA in stock markets, investigating whether fundamental analysis and technical analysis complement each other. They developed an automated trading system using technical analysis techniques, showing promising returns, particularly in portfolios from Russia and India. Their approach utilized various moving averages, such as Simple Moving Averages (SMA) and Exponential Moving Averages (EMA), over different time periods.

Another approach proposed by authors involved deep LSTM Neural Networks (NN) with embedded layers and LSTM-NN networks with automatic encoders to forecast stock prices, offering an alternative to traditional NN architectures.

Algorithms can sometimes mispredict the stock market, with LSTM-NN with embedded layers showing superior accuracy compared to other methods. The maximum accuracy achieved with this approach is 57.2%.

In a study [23], a novel technical analysis method is proposed to enhance decision support quality and investor profitability by forecasting stock market trends. The method employs trend-based classification, indicator selection, and trading signal forecasting.

Xiong et al. [26] utilized economic variables and LSTM to predict the volatility of the S&P index, incorporating Google trend data. Yu [26] employed deep NN and LSTM to forecast trading data for Amazon stock, achieving a maximum prediction accuracy of 54%. It was noted that the performance of the deep NN model surpassed that of LSTM.

Authors [27] employed an improved CNN and SVM hybrid model to forecast stock indices and exchange rates in American, European, and Hong Kong markets, achieving the highest accuracy among the models studied.

Furthermore, in another study [29], RNNs were used to forecast the prices of three stocks. By incorporating economic variables as input alongside historical data, the

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forecasted prices were found to align better with actual prices.

This paper introduces a DL-based framework designed for forecasting future prices and trends in the stock market. The architecture of this framework, along with the DL network, is detailed below.

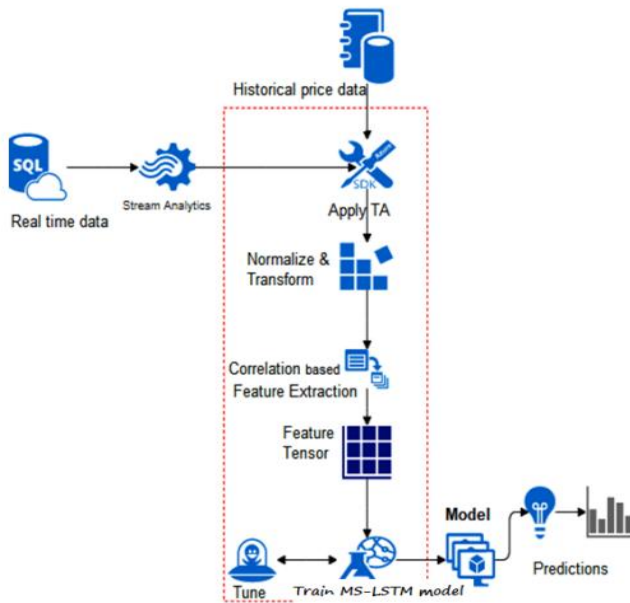


Figure 3.1: Proposed Multi-step Stacked LSTM framework for stock price trend prediction.

This study delved into the effectiveness of applying Fundamental Analysis (FA) and Technical Analysis (TA) to stock prices. We examined whether stock traders could achieve greater profits compared to recent research, such as that by Pang X. et al. (2018), which focused on deep learning models and other methodologies. Our work showcased the concept of developing adaptive TA strategies based on historical price and volume data.

## II. CONCLUSION:

Through our analysis, we determined the appropriate Short-Term Indicators (STIs), which were then supplied as tensors to the model. Ultimately, our model offers an efficient approach to assist investors in making informed investment decisions and maximizing profits. The Enhanced Deep Learning Approach (EDLA) provides decision indicators (BUY (1) or SELL (0)) to investors, along with trend-based analyses to guide decisions on holding stocks for the long or short term.

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