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RESEARCH ARTICLE

STOCK PRICE PREDICTION USING LSTM

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ABSTRACT

Stock market prediction is a challenging task, as stock prices are influenced by a variety of factors. However, deep learning has emerged as a promising tool for stock market prediction. Deep learning models can learn complex patterns from large amounts of data, which can be used to predict future stock prices. In this paper, we review the application of deep learning in stock market prediction. We discuss the different deep learning models that have been used for stock market prediction, and we evaluate their performance. We also discuss the challenges of using deep learning for stock market prediction, and we propose some directions for future research. Stock market prediction is a multidisciplinary problem that concerns economists, statisticians, and computer scientists. The proliferation of machine learning methodologies, especially deep learning techniques, has led to the adoption of these techniques in time-series forecasting, such as stock prices. A systematic literature review (SLR) of 12 papers was conducted to identify primary studies that deal with the prediction of stock markets in the European Union (EU) using deep learning techniques. The SLR indicates that there is not yet intense activity in this field, which thus appears open for further research.

INTRODUCTION

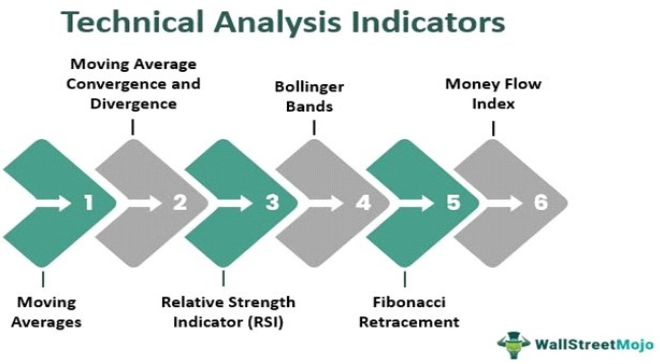
Stock Markets: Stock markets, often referred to as equity markets or financial markets, are vital components ofthe global economy where shares of publicly traded companies are bought and sold. They provide an essential platform for businesses to raise money and for investors to purchase stock in such businesses. Stock markets play a pivotal role in shaping the financial landscape, influencing economic growth, corporate decision-making, and individual wealth [Zaheer et al., 2023].

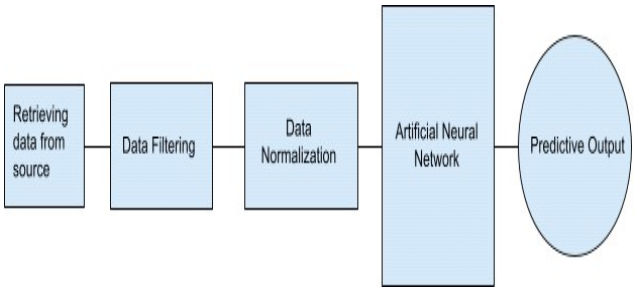
The existing techniques for stock market prediction are:

- **Technical Analysis**: Technical analysis involves the study of historical stock price charts, trading volumes, and patterns to predict future price movements. Technical analysts use tools such as moving averages, Relative Strength Index (RSI), and Bollinger Bands to identify trends and potential buy/sell signals.

Process Flow

- **Fundamental Analysis**: Fundamental analysis focuses on the financial health and performance of a company. Analysts examine factors like earnings reports, balance sheets, income statements, and economic indicators to assess a stock's intrinsic value and growth potential





Sentiment Analysis: Sentiment analysis involves analyzing news articles, social media posts, and other textual data to gauge market sentiment. Natural language processing (NLP) techniques are employed to extract sentiment and assess its impact on stock prices.

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III. PROPOSED METHOD

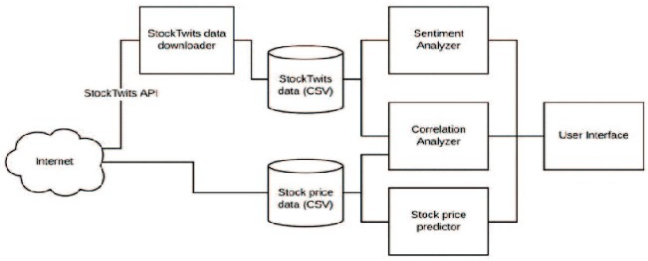
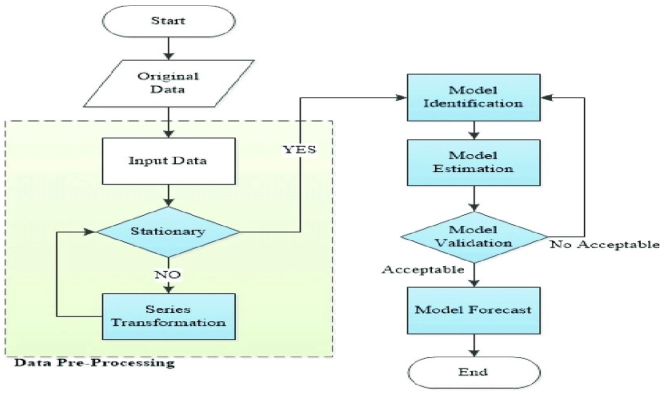


Figure 1. Framework overview

Time Series Analysis: Time series analysis methods, such as autoregressive integrated moving average (ARIMA) and GARCH models, focus on modeling the temporal dependencies in stock price data. These models aim to capture trends, seasonality, and volatility patterns. Predicting the stock market is crucial for investors to make informed decisions, manage risk, and plan for financial goals [Bukhari, 2020; Sharaf, 2021]. It aids in optimizing portfolios, timing investments, and boosting investor confidence. Additionally, stock market predictions serve as economic indicators and are essential for research and strategic planning by businesses and institutions, even though predicting market movements is inherently challenging and requires a cautious approach.



Deep learning: Due to the non-linear nature of the stock market, there is a vast amount of data. in order to predict, we require a model to examine the hidden patterns and the underlying forces. the deep learning algorithms can recognize and benefit from the interactions and patterns that exist in the data through the self-learning mechanism. Deep learning model, in contrast to other algorithms, can be a useful model for these kinds of data and can offer a strong predictive analysis of the interaction and hidden patterns in the data. The deep learning study is a subfield of machine learning algorithms inspired by the concerns and the structure and function of the brain, this is call artificial neural network. Most of the learning method uses neural network architecture, which is why you want to study deep learning model is commonly referred to as a deep neural network. Here, the term "deep" usually refers to the number of hidden layers of the neural network [Mehtab, 2021]. In the traditional neural network consists of only 2-3 hidden layers, while the deep neural networks with up to 150 hidden layers. These models are trained in the use of large data sets and neural network architecture and learn aboutthe features directly from the data, without the need for manual feature extraction. In deep learning method, requires a very large amount of data for the purpose of training models and graphics processing unit (GPU), and rapid processing of the data.

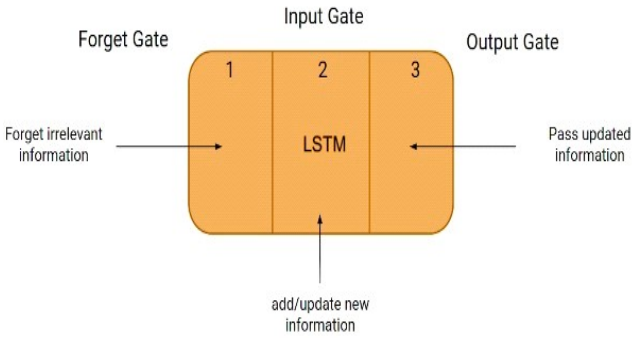
In general, a Neural Network (NN) consists of three layers:

- Input layer,
- Hidden layers,
- Output layer.

LSTM: Long Short-Term Memory (LSTM) represents a category within Recurrent Neural Networks (RNNs) known for its ability to capture and utilize historical data for future predictions. LSTMs incorporate a unique feature called the cell state, which serves as an additional memory reservoir [5], storing pertinent past information crucial for predictions. This cell state interacts with a modified structure referred to as the gate, and the process unfolds in several steps. Initially, there's the forget gate, responsible for determining whether to retain or discard specific existing information. Following this, the tanh layer comes into play, in conjunction with the input gate, to decide what new data should be added to the cell state. The addition and removal of information are determined by the preceding gate's decisions. Finally, an activation function is applied to the output data. In the LSTM architecture, the conventional hidden layers are substituted with LSTM cells. These LSTM cells encompass a range of gates that regulate the flow of input data [6-8]. Specifically, the LSTM cell comprises the input gate, cell state, forget gate, and output gate. Additionally, it incorporates sigmoid and tanh layers, as well as a point-wise multiplication operator.

To elaborate on the components of an LSTM cell:

- The input gate handles the intake of data.
- The cell state facilitates the addition or removal of information.
- The forget gate layer determines which portion of the information should be retained.
- The output gate yields the output produced by the LSTM.
- The sigmoid layer generates values within the range of zero to one.
- The tanh layer generates a new vector, which is subsequently added to the cell



Proposed work: The aim of my research is to forecast stock prices using a deep learning framework that aids in predicting future stock values. To accomplish this, I have compiled a dataset from diverse sources. The proposed approach is centered on predicting the closing stock prices for the following day among a list of companies [Roondiwala, 2017; Hu, 2021; Ding, 2020; Selvin et al., 2017]. This prediction method leverages Long Short-Term Memory (LSTM) technology. The dataset contains daily data for these listed companies.

The dataset encompasses details such as the opening price, closing price, high price, low price, and daily trading volume of stocks. In this research, I've specifically chosen to focus on two sectors: one in the IT industry and the other in the financial sector. Within these sectors, I've selected one company from each, and the data pertaining to these two companies has been extracted from historical records.

STEP 1: DATASET COLLECTION

STEP 2: DATA PREPROCESSING

STEP 3: FEATURE SELECTION

STEP 4: MODEL BUILDING

STEP 5: INITIALISING LSTM

STEP 6: OPTIMIZING

STEP 7: RESULTS

CONCLUSION

This article does a share analysis that may be expanded to include other shares in the future. If the model trains a larger number of data sets utilizing more powerful computers, more layers, more LSTM modules, the prediction may be more accurate. For equities traders, individual investors, and portfolio managers, stock price prediction is a topic of great interest. Due to its chaotic and nonlinear nature, however, accurate and reliable stock price prediction is a challenging endeavor. The projection may be impacted by a number of variables, including fundamental market data, macroeconomic data, technical indications, and others. of input variables that represent the many facets of the economy and wider marketplaces.

FUTURE WORK

Extend the breadth of data inputs: Consider incorporating external data sources such as news sentiment analysis, social media data, economic indicators, and macroeconomic factors to give a more comprehensive perspective of market dynamics and capture the effect of real-world events. Improve feature engineering: Investigate sophisticated strategies for extracting more meaningful information from raw financial data, such as wavelet transformations, technical indicators, and alternate representations of time series data. This might increase the model's performance. Use ensemble methods: mix predictions from numerous LSTM models or mix LSTM with other types of deep learning models to get more robust and accurate predictions. Make forecasts more interpretable: Develop techniques for explaining why the model produces particular predictions, which is critical for creating confidence with users and stakeholders.

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