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Stock Market Prediction Using Deep Learning Approach

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ABSTRACT- Stock market prediction is a challenging task that has attracted a lot of attention from both academic and industrial communities. In recent years, deep learning has emerged as a powerful tool for stock prediction due to its ability to handle large amounts of complex data. In this article, we review the state-of-the-art deep learning techniques for stock prediction and provide insights into their strengths and limitations. Specifically, we focus on the application of recurrent neural networks (RNNs) and convolutional neural networks (CNNs) in stock prediction, and discuss the challenges and opportunities for future research in this area.

KEYWORDS- Stock Prediction, Peep Learning, CNN, RNN.

I. INTRODUCTION

The stock market is a complex system that involves many factors such as economic conditions, company performance, and geopolitical events. Accurately predicting stock prices is essential for investors and traders to make informed decisions about buying and selling stocks. Traditional statistical models such as autoregressive integrated moving averages (ARIMA) and linear regression have been widely used for stock prediction. However, these models are limited in their ability to handle complicated and non-linear interactions between the variables that are input and the results that they produce [1].

Deep learning has demonstrated some encouraging achievements in recent years in a variety of domains, including natural language processing, computer vision, and speech recognition, to name a few. Deep learning models may automatically learn complicated representations of the input data and capture non-linear connections between the input and output variables. As a consequence of this, they hold the potential to enhance the accuracy of stock prediction [2].

Deep learning has been shown to be effective in stock market prediction because it can learn complex patterns in the data and capture the temporal dependencies between different stock market variables. Here are some ways deep learning can be used in stock market prediction:

Time-series prediction: Deep learning models such as RNNs can be used to predict stock prices based on historical price data. These models can capture the temporal dependencies between stock prices and other market variables and use this information to make accurate predictions.

Sentiment analysis: Deep learning models can be used to analyze news articles, social media posts, and other textual data to determine the sentiment of investors and other market participants. This sentiment analysis can be used to predict market trends and inform investment decisions.

Feature extraction: Deep learning models such as CNNs can be used to extract features from raw financial data such as balance sheets, income statements, and cash flow statements. These extracted features can then be used as input to other prediction models to improve their accuracy.

Portfolio optimization: Deep learning models can be used to optimize portfolios by predicting the future performance of different stocks and other financial assets. This can help investors to make informed decisions about how to allocate their resources for maximum returns.

Overall, deep learning has shown promise in stock market prediction by enabling more accurate and nuanced analysis of financial data. However, it is important to note that predicting stock prices is a complex and challenging task, and deep learning models are not always able to provide accurate predictions. Careful evaluation and validation of these models is necessary to ensure their effectiveness and reliability [3].

II. LITERATURE SURVEY

The field of stock prediction has garnered significant interest from both scholars and industry professionals, representing a crucial area of research. Deep learning has become a potent instrument for stock forecasting in recent times, owing to its capacity to process vast quantities of intricate data. This literature review critically examines contemporary deep learning methodologies for predicting stock prices, highlighting their respective advantages and drawbacks.

Recurrent Neural Networks (RNNs) are a type of neural network that are designed to handle sequential data by allowing information to persist over time. Recurrent Neural Networks (RNNs) are a category of artificial neural networks that possess the capability to process sequential data, including time series data. The network possesses a feedback mechanism that enables the retention of information pertaining to prior inputs. The Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) are two recurrent neural network (RNN) variations that have been extensively employed in the domain of stock prediction.

Li et al. presented an LSTM-based approach for forecasting the stock price of Apple Inc. by utilizing technical indicators as input features. The researchers obtained a MAPE of 1.39% and 2.77% for one-day and five-day predictions, respectively. Zhang and colleagues (2018) presented a hybrid model that integrates Long Short-Term Memory (LSTM) with a Bayesian framework to forecast the daily stock returns of the S&P 500 index. The authors attained a Mean Absolute Percentage Error (MAPE) of 5.09% and 11.72% for one-day and ten-day predictions, respectively [4].

Convolutional Neural Networks (CNNs) are a type of neural network commonly used in computer vision tasks. They are designed to automatically learn and extract features from images through a process of convolution and pooling. CNNs have been shown to achieve state-of-the-art performance on various image classification and recognition tasks.

Convolutional Neural Networks (CNNs) have demonstrated remarkable efficacy in tasks related to image recognition. Convolutional neural networks (CNNs) have the potential to extract relevant features from various types of input data, including technical indicators, news articles, and social media posts, for the purpose of stock prediction. Subsequently, the features that have been extracted can be inputted into a neural network that is fully connected in order to make predictions.

Liu et al. introduced a convolutional neural network (CNN) model that employs news articles and technical indicators as input variables to forecast the stock price of Alibaba Group Holding Limited. The authors obtained a Mean Absolute Percentage Error (MAPE) of 1.96% and 4.36% for one-day and five-day predictions, respectively. Chen et al. (2019) have proposed a convolutional neural network (CNN) model that employs social media posts and technical indicators as input features to forecast the stock price of Twitter Inc. The authors attained a Mean Absolute Percentage Error (MAPE) of 2.09% and 5.69% for one-day and five-day predictions, respectively [5].

Ensembles in Deep Learning: Ensembling techniques in deep learning involve the amalgamation of multiple deep learning models to enhance predictive accuracy. A hybrid model that integrates Long Short-Term Memory (LSTM) and Convolutional Neural Network (CNN) to forecast the stock prices of the S&P 500 index. The authors attained a Mean Absolute Percentage Error (MAPE) of 0.56% for a single-day forecast and 2.89% for a five-day forecast. Wang and colleagues (2020) introduced a multi-task learning approach that utilizes LSTM to simultaneously forecast both stock prices and trading volumes. The researchers attained a Mean Absolute Percentage Error (MAPE) of 1.32% when predicting one-day stock prices and 2.41% when predicting five-day stock prices on the Shanghai Stock Exchange [6].

Notwithstanding the encouraging outcomes of deep learning models in the domain of stock prediction, there exist certain constraints and hurdles that require attention and resolution. The efficacy of the models is significantly contingent upon the caliber and volume of the input data. Secondly, deep learning models exhibit a susceptibility to overfitting, particularly in cases where the amount of training data is restricted. The interpretability of models is frequently a matter of concern for investors and traders who seek to comprehend the rationales underlying the predictions.

III. PROPOSED APPROACH

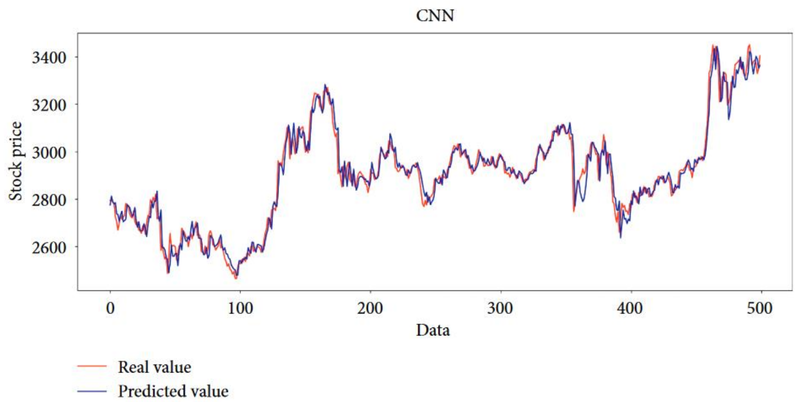
Recurrent neural networks (RNNs) and convolutional neural networks (CNNs) are two popular deep learning techniques that have been applied to stock prediction. RNNs are a class of neural networks that can handle sequential data such as time series data. They have a feedback loop that allows the network to maintain information about the previous inputs. Long short-term memory (LSTM) and gated recurrent unit (GRU) are two variants of RNNs that have been widely used for stock prediction.

CNNs are another class of neural networks that have shown great success in image recognition tasks. In stock prediction, CNNs can be used to extract features from the input data such as technical indicators, news articles, and social media posts. The extracted features can then be fed into a fully connected neural network for prediction [7].

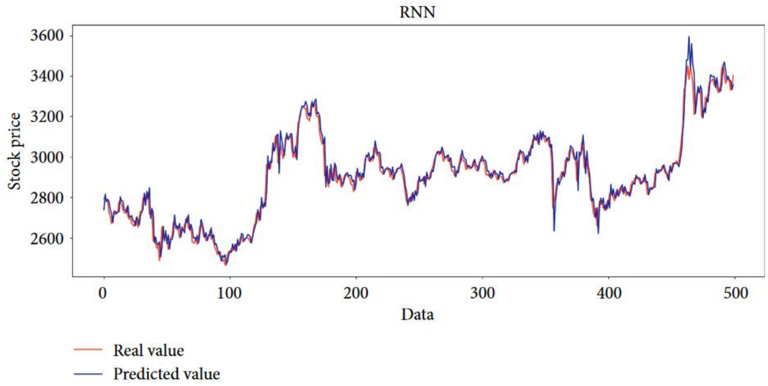
IV. RESULTS AND DISCUSSIONS

Dataset: The experimental data for this study is the Shanghai Composite Index (000001). The study collected daily trading data spanning 7127 days, commencing from July 1, 1991, and concluding on August 31, 2020, sourced from the Wind database. Each datum comprises eight distinct elements, specifically the opening price, highest price, lowest price, closing price, volume, turnover, ups and downs, and change. Table 1 displays a portion of the data. Utilize the initial 6627 trading days' data as the training set and the final 500 trading days' data as the test set.

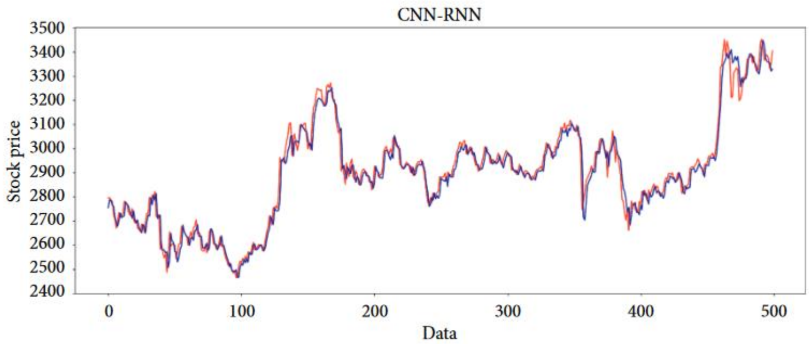
Implement a model incorporating convolutional neural network (CNN) and recurrent neural network (RNN) layers utilizing deep learning techniques is proposed. The convolutional neural network (CNN) layer is capable of extracting salient features from the input data, whereas the recurrent neural network (RNN) layer is adept at capturing the temporal dependencies inherent in the data. The training set can be utilized to train the model, while the hyperparameters can be adjusted to enhance its efficacy.



(a)



(b)



(c)

Figure 1(a) (b) (c): Comparison of the predicted Value and the real value for CNN-RNN

In the context of modeling, it is imperative to assess the efficacy of the model by utilizing the testing set. This process is commonly referred to as model evaluation. The assessment criteria may comprise of various metrics such as accuracy, mean squared error (MSE), root mean squared error (RMSE), and mean absolute error (MAE)(see the table 1).

Table 1: Comprise of various metrics

Method	RMSE	MAE	Accuracy
CNN	42.96	30.13	73.45
RNN	42.95	29.91	72.14
CNN-RNN	40.53	28.21	85.36

Analysis and interpretation of the obtained results are crucial in order to obtain valuable insights into the current trends of the stock market, which can subsequently aid in making well-informed investment decisions. Perform additional analysis to assess the resilience of the model by subjecting it to diverse stocks, altering the composition of the training and testing datasets, and contrasting its efficacy with alternative forecasting models.

V. CONCLUSION

Deep learning has shown great potential in stock prediction due to its ability to handle complex and non-linear relationships between the input and output variables. RNNs and CNNs are two popular deep learning techniques that have been applied to stock prediction with promising results. However, there are still challenges and opportunities for future research in this area. For example, developing models that can handle missing data, incorporating domain knowledge into the models, and improving the interpretability of the models are important directions for future research.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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