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A Study on Stock Price Prediction Using LSTM and RNN

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Abstract:
Stock price prediction remains a critical task in financial markets, influencing investment decisions and portfolio management. This research paper explores the efficacy of Long Short-Term Memory (LSTM) and Recurrent Neural Networks (RNN) in forecasting stock prices. Leveraging deep learning techniques, we analyze real-world stock market data to evaluate the predictive capabilities of LSTM and RNN models. Through comprehensive experiments and performance evaluations, we demonstrate the effectiveness of these models in capturing temporal dependencies and making accurate predictions. Additionally, we discuss the impact of various factors on model performance and provide insights for future research directions.

Keywords: Stock price prediction, Deep learning, Long Short-Term Memory (LSTM), Recurrent Neural Networks (RNN), Machine learning, Data visualization, Real-world dataset, Investment decisions

1. INTRODUCTION:

BASIC INTRODUCTION OF STOCK MARKET:

The stock market serves as a bustling marketplace where investors buy and sell ownership shares in publicly traded companies. It's a complex ecosystem influenced by various factors such as economic indicators, company performance, geopolitical events, and investor sentiment. Understanding the dynamics of the stock market is crucial for investors aiming to navigate its fluctuations and potentially grow their wealth. [1]

Stock price prediction is a fascinating yet challenging aspect of financial analysis. It involves using various techniques, including fundamental analysis, technical analysis, and increasingly, machine learning algorithms, to forecast the future movements of stock prices. Fundamental analysis delves into a company's financial health, examining metrics like revenue, earnings, and growth potential to estimate its intrinsic value. Technical analysis, on the other hand, focuses on historical price and volume data, identifying patterns and trends to make predictions about future price movements. [1]

However, despite advancements in analytical tools and methodologies, predicting stock prices accurately remains elusive due to the inherent unpredictability of markets and the countless variables at play. Factors such as unexpected news events, market sentiment shifts, and irrational investor behavior can all influence stock prices in ways that are difficult to anticipate. [1]

While stock price prediction models can provide valuable insights and aid decision-making, they should be approached with caution, as no method can guarantee consistent success in the highly dynamic and uncertain world of stock trading. Investors should supplement predictive models with comprehensive research, risk management strategies, and a long-term investment perspective to make informed decisions in the ever-changing landscape of the stock market.[1]

2. LSTM:

LSTM stands for Long Short-Term Memory. It's a type of neural network architecture, a specialized form of recurrent neural network (RNN). LSTM networks are designed to process and make predictions based on sequential data, like stock prices over time or words in a sentence.

What makes LSTM special is its ability to remember information for long periods of time. Traditional neural networks struggle with this because they tend to forget older information as new data comes in. LSTM networks, on the other hand, have a mechanism called a "memory cell" that allows them to store and access information over long time intervals.

- **Understanding Patterns**: LSTM, which stands for Long Short-Term Memory, is like a smart tool that looks at patterns in historical stock price data. It's really good at spotting trends and figuring out how past prices relate to future ones.
- **Memory of the Past**: Imagine you're trying to predict tomorrow's weather. You'd want to know what the weather has been like recently, right? LSTM is similar – it remembers what happened in the past, even if it was a while ago. This memory helps it make better predictions about what might happen next in the stock market.
- **Learning from Data**: LSTM learns from a lot of historical stock price data. It looks at things like how prices have changed over time, how often they go up or down, and other factors that might affect stock prices.
- **Flexible Timing**: Stocks don't always change in price at the same rate or at regular intervals. LSTM is flexible and can handle this irregular timing. It doesn't mind if prices change quickly or slowly – it can still make sense of the data.
- **Training to Improve**: Just like practicing a sport makes you better, LSTM gets better at predicting stock prices the more it practices. It learns from its mistakes and adjusts its predictions to get more accurate over time.
- **Putting It All Together**: By using LSTM, we can build models that are really good at predicting future stock prices based on what happened in the past. This can help investors make smarter decisions about buying, selling, or holding onto stocks.

In simple terms, LSTM is like a smart friend who's great at remembering past events and using that knowledge to make predictions about the future – in this case, predicting stock prices.

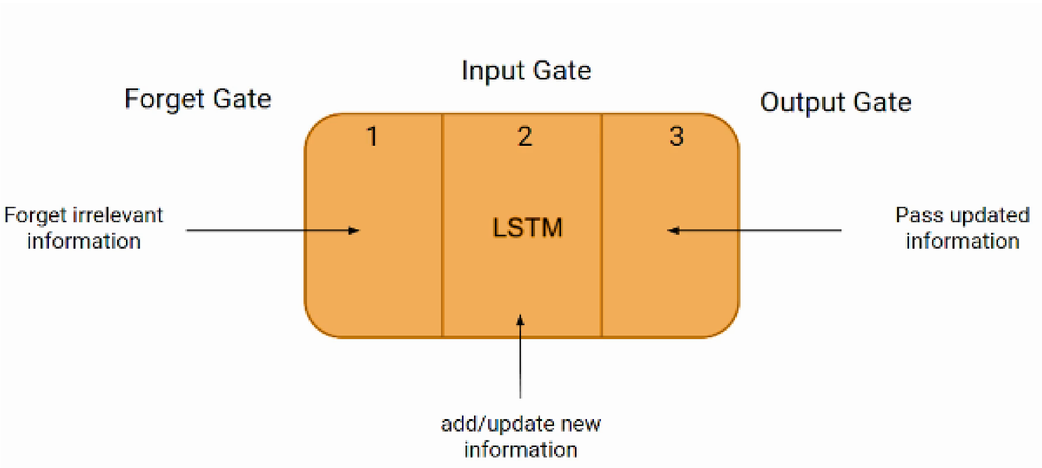

Figure-01

3. RNN:

A Recurrent Neural Network (RNN) is like a brain with memory for sequential data. Imagine processing a conversation where what was said earlier affects how you respond next. RNNs work similarly, remembering past information to understand and generate sequences, making them great for tasks like predicting stock prices, understanding language, and generating text.

- **Learning from Patterns**: Just like you might notice patterns in the story, like foreshadowing or recurring themes, an RNN looks for patterns in the stock market data. It learns from how stock prices have changed over time and tries to predict future changes based on those patterns.
- **Adapting to New Information**: If the story suddenly takes a surprising turn, you adjust your expectations for what might happen next. Similarly, an RNN updates its predictions as new stock market data comes in. It's constantly learning from the latest information to make its predictions as accurate as possible.
- **Considering Context**: When you read a sentence, you understand each word based on the words that came before it. Likewise, an RNN considers the context of past stock prices to make predictions about future prices. It understands that today's price depends on what happened yesterday, the day before, and so on.
- **Making Informed Guesses**: Just like you might make educated guesses about how a story will end, an RNN makes educated guesses about future stock prices. It's not always right, but the more it learns from past data, the better its predictions become over time.

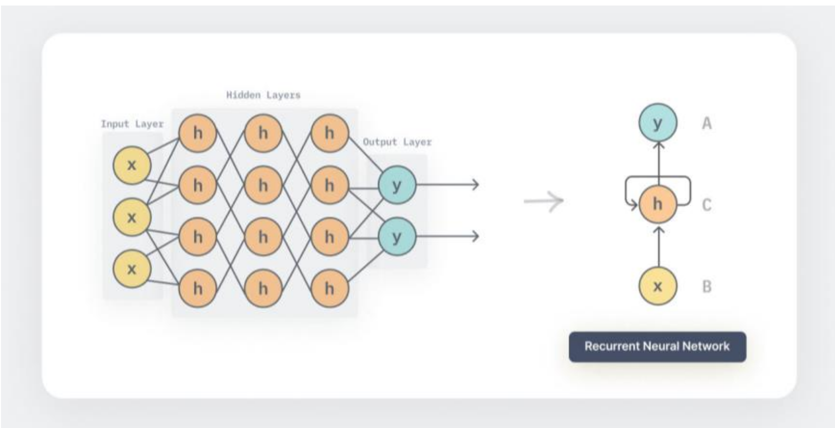

Figure-02

Project Description

This project is to uses a short term recurrent neural network to obtain stock price prediction. There are 4 LSTM hidden layers in the network, each layer adds Dropout and benefits of 0.2 in various e xperiments.Pre-processing will normalize the data using MinMaxScaler.

The training process is designed to determine the open data values of the last 60 days as learning parame tersfor LSTM until approximately the day after the market open.

The data used in this project is Google's 5 year business data from January 2012 to December 2016 opening price, closing price of stocks. It includes many data that can be downloaded from train data and test data.

A few graphs from different experiments are shown below to understand how the model works on a particular stock price effects. [2]

Experiments:

Experiment 1 (60 days, 10 epochs)

The first experiment was run for 10 epochs and learned from the last 60 days of Data to analyze the performance of the stock price and what predictions can we draw from the period of low prices? Below are screenshots of the actual regression and the regression prediction of the measured data. [2]

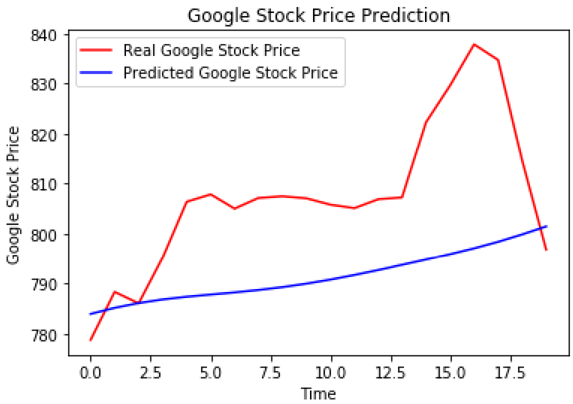

Figure-03

Experiment 2 (60 days, 25 epochs)

The first experiment ran for 25 epochs and ran on 60 days of data to examine how the model performed on the data and what predictions we could make from Epoch's low-cost needs. Below are screenshots of the actual regression and the regression prediction of the measured data. [2]

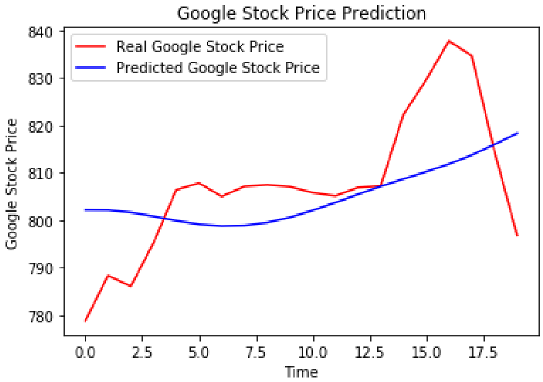

Figure-04

Experiment 3 (60 days, 35 epochs, Incremental Dropout)

The first experiment ran 35 epochs, learned over the last 60 days, and adjusted the dropout rate of each layer to 0.05, 0.10, 0.15, and 0.20 to set the standard. raised it. What will it do on the product, what predictions can we expect from low prices? [2]

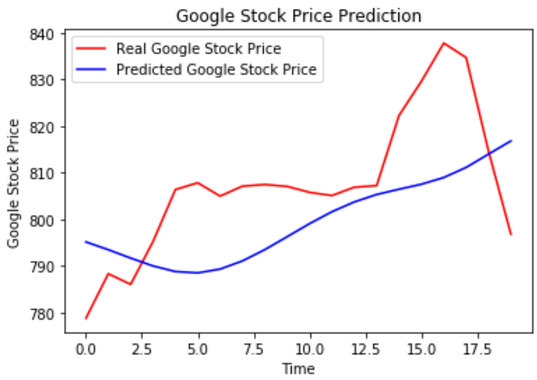

Figure-05

Experiment 4 (60 days, 50 epochs)

The first experiment ran for 50 epochs and examined the last 60 days of data to check the performance o f the data model and the results we could predict. can be achieved from the era of low prices. [2]

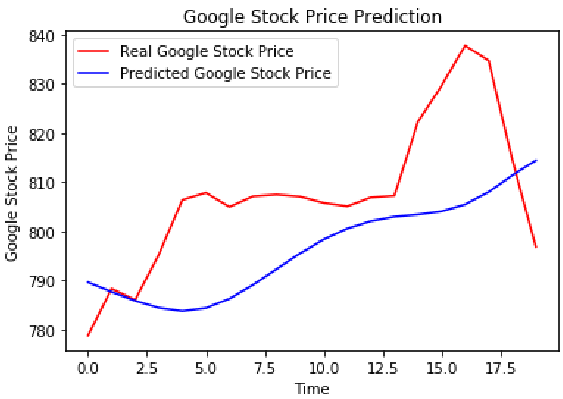

Figure-06

Experiment 5 (60 days, 100 epochs)

The first experiment ran for 100 epochs and ran on 60 days of data to study how the model works on the data and what kind of prediction we can make from the low-cost Epoch. . [2]

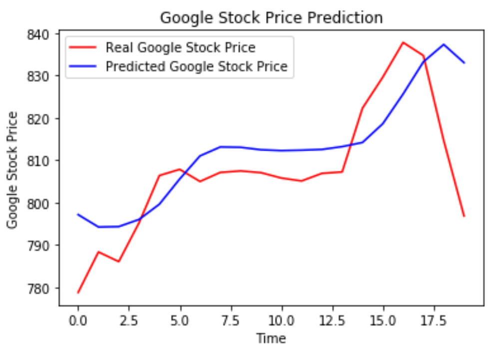

Figure-07

Experiment 6 (120 days, 100 periods)

The first experiment ran for 100 periods and examined the last 120 days of data to examine

how the model worked on the data and what kind of offers we could make at lower prices.
wanted. Estimating regression. [2]

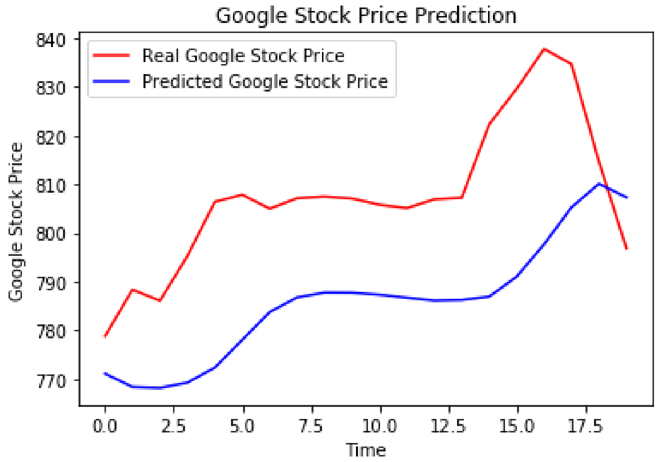

Figure-08

Analysis and Accuracy

After running 100 training epochs on the profile I got an overall loss of about 0.15% over 120 days, i.e. 0.0015 false positives calculated based on the mean squared error. Future resources: It is also possible to optimize lossbased hyperparameter tuning to better fit the model to the te st data. [2]

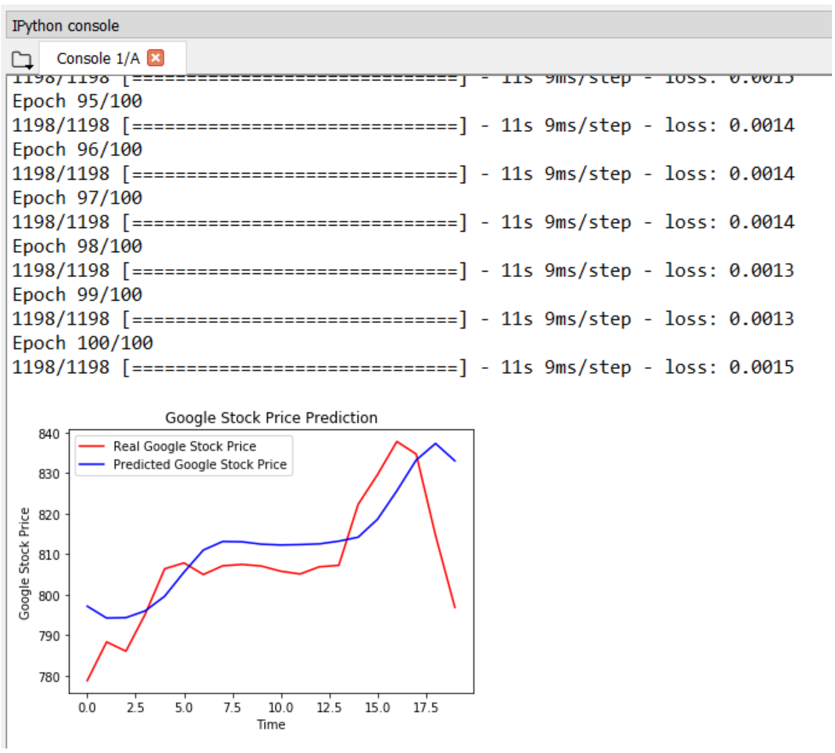

Figure-09

Conclusion:

In this research paper, we explored the application of long short-term memory (LSTM) and Recurrent

Neural Networks (RNN) within the domain of stock price prediction. We located promising results that underscore the capability of LSTM and RNN models for stock charge prediction tasks. These models verified the capacity to examine from historic stock information, pick out underlying styles, and make knowledgeable predictions approximately.

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