

# **Stock prediction using neural networks**

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Gokay Saldamli, Project Advisor

# ABSTRACT

Stock prediction using neural networks

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The Stock market has been running on volatility and extreme fluctuation due to influences from many external factors. The sentiment of the market, the health of each industry along with the overall economy are some of the big factors that can help predict some of the fluctuations. Although there have been many attempts at stock price predictions in the past, the time series stock market data combined with the aforementioned factors can give a good indication of problems that can be solved with modern machine learning techniques.

Traditional applications of deep learning include speech recognition and image classification within which neural networks have proved their capability in learning to decode non-linear mappings between inputs and outputs. Utilizing such modern techniques to create a model that predicts the future of the stock market can result in increased customer confidence in the system, indicating increased stock purchases over time. Combining stock market data along with the sentiment analysis data from news blogs and social media can create a holistic view of the market movement.

In this project, we propose to forecast future movements in the stocks by leveraging Neural networks and Deep learning techniques. We try to present a solution that can overcome the naive estimator effect and thus precisely estimating the next gradient change, which is one of the biggest challenges in predicting the stocks.

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# Stock Prediction using neural networks

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**Abstract**— The Stock market has been running on volatility and extreme fluctuation due to influences from many external factors. The sentiment of the market, the health of each industry along with the overall economy are some of the big factors that can help predict some of the fluctuations. Although there have been many attempts at stock price predictions in the past, the time series stock market data combined with the aforementioned factors can give a good indication of problems that can be solved with modern machine learning techniques. Traditional applications of deep learning include speech recognition and image classification within which neural networks have proved their capability in learning to decode non-linear mappings between inputs and outputs. Utilizing such modern techniques to create a model that predicts the future of the stock market can result in increased customer confidence in the system, indicating increased stock purchases over time. Combining stock market data along with the sentiment analysis data from news blogs and social media can create a holistic view of the market movement. In this project, we propose to forecast future movements in the stocks by leveraging Neural networks and Deep learning techniques. We try to present a solution that can overcome the naive estimator effect and thus precisely estimating the next gradient change, which is one of the biggest challenges in predicting the stocks

**Index Terms**— Stock Prediction, Neural Networks, Deep learning, RNN, CNN, LSTM, RMSE.

## I. INTRODUCTION

Stock market historically has been very volatile with many factors having direct impact on the fluctuating nature of it. Many stock trading techniques involve technical analysis and fundamental analysis of each individual company's stock to understand the future of its value. Not only does a company's health and earnings have weight in deriving its stock value, but also many other external factors such as sentiment of the market and public reaction toward events have direct effect on the volatility.

With the vast amount of data available from the stock market, there has been lots of interest in using Machine Learning models to solve such problems. The idea is to extract

knowledge from the previous stock market data to train such models so that they can predict the future price of a certain stock. There are many shortcomings in terms of using Machine Learning models to predict stock such as not taking into consideration the full previous history of a certain stock when prediction is forming. The history context in solving such problems is a crucial component that many Machine Learning models lack in.

Recently, Artificial Intelligence has shown promising results in Image Recognition and Natural Language Processing fields. The new branch of AI which is Deep Neural Networks has been the underlying process for getting better results combining with the powerful processing units out in the market. Recurrent Neural Networks (RNN) are a branch of Deep Learning which can bring the history context into picture. That is why it has been a popular tool to be applied to problems that need previous inputs for better prediction. The vanilla RNN models have a problem with keeping long term memory by design. Long Short-Term Memory is a type of Recurrent Neural Networks that is specialized in carrying over information for a long time to allow neural networks rely on historical context and not only the previous inputs.

This research paper focuses on the previous movement of the stock market to predict the near future volatility without taking into consideration other external factors. The idea behind this approach is how to derive certain knowledge from stock market time series data using deep learning to understand near future positive or negative volatility. The automation of such a process will allow anyone to make quick decisions for making profit from the stock market volatility. Since LSTMs are specialized in keeping the historical context of inputs, it makes it a viable option for stock market prediction.

## II. PROBLEM STATEMENT / PROJECT ARCHITECTURE

## III. METHODS / SYSTEM DESIGN

#### IV. EVALUATION METHODOLOGY / MATERIALS

#### V. RESULTS

#### VI. DISCUSSION

#### VII. RELATED WORKS

Stock market prediction involves dealing with complex, deficient and highly skewed data as stated by Kim et al. [1], and because of the non-linearity problem, it becomes very hard to forecast. Tillakaratne et al. [2] also mentions the imbalance of trading signals in the classification of data in to buy, sell and hold classes. Yu et al. [3] explored the conventional and standard machine learning models for predicting stocks like using genetic algorithms for feature extraction. The features extracted from the least squares support vector machine (LSSVM) learning model with optimal parameters and kernel techniques are used to predict the stocks. Zahedi et al. [4], used principal component analysis (PCA) for feature extraction, dimensionality reduction and with the help of artificial neural networks (ANNs) and various other accounting variables to predict new patterns in stock movements. Saad et al. [5] explained the problem of false alarm arising from a lack of short-term memory. The authors [5] also explored TDNN, RNN, and PNN for prediction to minimize risks and losses. Kwon et al. [6] stated that the hybrid algorithm based on a neurogenetic model, in which the data was generated by technical indicators, outperformed the average buy and hold strategy. Yu et al. in the most recent research [7], stated that integrating deep learning and neural networks helped tremendously in solving the nonlinear complications and thus justifying their results in achieving better accuracy for stock prediction.

The comparison of artificial neural networks with heuristic genetic algorithms for feature extraction is very useful, especially in reducing the dimensional volume and unrelated components for forecasting the stock movement [1]. The problem of an imbalanced data set is addressed in this research paper. The parameters in the neural network are adjusted according to the forward movement pattern and the optimal least square error model [2]. This research paper thoroughly analyzed the usage of the support vector machine model with the technique of minimizing the least square distance of each data point from the imaginary hyperplane sides [3]. Exploiting the Artificial neural networks with the help of principal component analysis seems to be very interesting. The optimal

solution for finding the correct number of principal components is calculated by experiments on new data patterns [4]. The idea of minimizing the risk ratio by reducing the amount of loss using algorithms like time delay, recurrent neural networks is very interesting. Forecasting which is built on the analysis of daily closing prices of stocks is a good strategy for maximizing profits [5]. This research paper proposes that we can generate an input feature vector by using technical measures from business analysts. After that this feature vector can be optimized by using a Genetic algorithm that can be further used to reduce the neural network weights using two-dimensional encoding[6]. This research paper explores the concept of long short-term memory (LSTM) and deep learning to achieve better accuracy than traditional machine learning models. The problem of non-linearity and the solution to tackle that is discussed which can help my research on stock prediction [7].

#### VIII. CONCLUSIONS

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