Analysis and Prediction of Stock Market Performance using Ensemble RNN

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Abstract- **Stock prices prediction is interesting and challenging research topic. Developed countries' economies are measured according to their power economy. Currently, stock markets are considered to be an illustrious trading field because in many cases it gives easy profits with low risk rate of return. Stock market with its huge and dynamic information sources is considered as a suitable environment for data mining and business researchers. The aim is to predict the future value of the financial stocks of a company. The recent trend in stock market prediction technologies can use of data science which makes predictions based on the values of current stock market indices by training on their previous values. Recurrent Neural Network (RNN) is used to processing sequential data and it gives more accuracy in prediction of stock prices. This work focus on the use of Ensemble RNN to predict stock values.**

Keywords:- Stock market, RNN, ensemble RNN, financial stock, close value.

I. INTRODUCTION

Recent business research interests concentrated on areas of future predictions of stock prices movements which make it challenging and demanding. Researchers, business communities, and interested users who assume that future occurrence depends on present and past data, are keen to identify the stock price prediction of movements in stock markets. However, financial data is considered as complex data to forecast and or predict. Predicting market prices are seen as problematical.

The Efficient Market Hypotheses (EMH) is considered as bridging the gap between financial information and the financial market; it also affirms that the fluctuations in prices are only a result of newly available information; and that all available information reflected in market prices. The EMH assert that stocks are at all times in equilibrium and are difficult for inventors to speculate.Ability to predict direction of stock/index price accurately is crucial for market dealers or investors to maximize their profits. Data Science have been successfully shown to generate high forecasting accuracy of stock

II. LITERATURE REVIEW

Artificial Neural Network and Random Forest [10] techniques have been utilized for predicting the next day closing price for five companies belonging to different sectors of operation [5]. The historical data for the five companies has been collected from Yahoo Finance.

The dataset includes 10 year data from 4/5/2009 to 4/5/2019 of Nike, Goldman Sachs, Johnson and Johnson, Pfizer and JP Morgan Chase and Co. Authors concluded that deep learning models could be developed. Convolution Neural Network (CNN) has been used for predicting the stock price of a company based on the historical prices available [6, 8, 9]. Dataset is taken from highly traded stocks of three different sectors which are Automobile, Banking and IT sectors from NSE. The corresponding stocks from these sectors are Maruti, Axis bank, and Hcltech. Each contains information like stock symbol, stock series, stock date and previous closing, opening, high, low, closing and average prices. This work hasn't explored the advantage of using a hybrid network which combines two networks to make a

model for prediction.Deep learning based system has been used for stock market price trend prediction [7].

A customized Long Short-Term Memory (LSTM) based deep learning model has been proposed. Authors have built the dataset by themselves from the data source as an open-sourced data API called Tushare. More comprehensive prediction system can be developed based on training diverse learning techniques.Authors applied k-nearest neighbor algorithm and non-linear regression approach in order to predict stock prices for a sample of six major companies listed on the Jordanian stock exchange to assist investors, management, decision makers, and users in making correct and informed investments decisions [11]. Data was extracted from the Jordanian stock exchange. The study sample included stock data of five randomly selected companies listed on the Jordanian stock exchange. This work need to utilize advanced predicting models to help the financial markets.

The integrated prediction model based on Support Vector Machines (SVM) with Independent Component Analysis (ICA) (called SVM-ICA) is proposed for stock market prediction [12]. Historical weekly observations of a set of variables obtained from Bucharest Stock Exchange and daily observations taken from Baltic Stock Exchange. More hybridized prediction system can be developed for gaining better experimental results. Authors presented a novel deep learning framework where Stacked Auto encoders (SAEs) and Long-Short Term Memory (LSTM) are combined for stock price forecasting [13].

Six market indices and their corresponding index futures are chosen to examine the performance of the proposed mode. Advanced hyper-parameters selection scheme might be embedded in the system to further optimize the proposed deep learning framework. Authors used a machine learning technique called Support Vector Regression (SVR) to predict stock prices for large and small capitalizations and in three different markets, employing prices with both daily and up-to-the-minute frequencies [14]. Independent variables may include other TA (Technical Analysis) indicators, trend predictors or past prices. In addition, fundamental analysis indicators, such as company size, liquidity, indebtedness, profitability and activity measures, could be included.

III. METHODOLOGY

Stock-market prediction using machine-learning technique aims at developing effective and efficient models that can provide a better and higher rate of prediction accuracy [1, 2, and 3]. The data used in this project is of the Alphabet Inc. from January 1, 2005 to June 20, 2017.

This is a series of data points indexed in a time series. Goal is to predict the closing price for any given date after training algorithm. To improve the prediction, fine tuning parameters of RNN has been focused. Each parameter is tested and analyzed and then final value is selected based on algorithm. To analyze and predict "CLOSE" price, Ensemble RNN is proposed in this paper.

Fig 1. System Flow Diagram.

IV. EXPERIMENT AND RESULTS

1. Dataset Collection:
The data used in this project is of the Alphabet Inc from January 1, 3 2005 to June 20, 2017, this is a series of data points indexed in time order or a time series [4]. Goal was to predict the closing price for any given date after training. For ease of reproducibility and reusability, all data was pulled from the Google Finance Python API. The prediction has to be made for Closing (Adjusted closing) price of the data. Since Google Finance already adjusts the closing prices, need to make prediction for "CLOSE" price.

2. Data Preprocessing/Preparation:
Remove unimportant features(date, high and low) from the acquired data and reversed the order of data. From data exploration, one can infer from this

dataset that date, high and low values are not important features of the data. As it does not matter at what was the highest prices of the stock for a particular day or what the lowest trading prices was. What matters is the opening price of the stock and closing prices of the stock.

If at the end of the day we have higher closing prices than the opening prices that we have some profit. Also volume of share is important as a rising market should see rising volume, i.e, increasing price and decreasing volume show lack of interest and this is a warning of a potential reversal. A price drop (or rise) on large volume is a stronger signal that something in the stock has fundamentally changed.

3. Algorithms and Techniques:

The goal of this paper was to study time-series data and explore as many options aspossible to accurately predict the Stock Price. Recurrent Neural Nets (RNN) which are used specifically for sequence and patternlearning. As they are networks with loops in them, allowing information to persist andthus ability to memories the data accurately. But Recurrent Neural Nets have vanishingGradient descent problem which does not allow it to learn from past data as wasexpected. The remedy of this problem was solved in Recurrent Neural Networks (RNN). These are a special kind of RNN, capable oflearning long-term dependencies.

4. Results:

Table 1. Performance of Algorithms.

Algorithms	MSE	RMSE
Logistic Regression	0.08133781	0.28519784
RNN	0.00453063	0.13050625
Ensemble RNN	0.00093063	0.03050625

Table 1represents the performance of algorithms. Results show that Ensemble RNN performs better than all other algorithms.

V. CONCLUSION

In this paper, a prediction process for five listed companies on the Jordanian Stock Market was carried out, and is considered to be the first of its type implemented in Jordan as a case study using real data and market circumstances.

Consequently, a robust model was constructed for the purpose set out. The data was extracted from five major listed companies on the Jordanian stock exchange, the sample data was used to be our training data set (about 200 records for each company) upon the criteria previously mentioned to apply our model.

Furthermore, this may weakens the attractiveness of investments in the Jordanian market which eventually weakens the market return. The study also shows that contemporary data mining techniques offer the world of finance useful stock market movements' prediction analysis.

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