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FINANCIAL DATA PREDICTION USING TASK AWARE BACK PROPAGATION

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ABSTRACT:

This paper address the issue wherein the attempt will be made to train computer to beat experienced traders for financial assert trading. This is tackled by injecting a deep neural network (NN) to deal with financial signal representation and trading by using two trends like, the learning concepts of deep learning (DL) and back propagation .The deep learning (DL) is utilized for sensing the dynamic varying market condition for informative feature learning, after that the back propagation module which helps to reduce error and interact with deep representations and provide decisions to acquire the ultimate rewards in an unknown environment within task-aware back propagation through time method.

Keywords: Deep learning (DL), financial signal processing, neural network (NN).

[1] INTRODUCTION

Predicting trades is one of the most challenging tasks due to many uncertainties involved and many variables affect the particular values of stock during the day such that economic condition, political events, investors sentiment towards a company, gold values, exchange rate, disaster, international crude oil price etc. Because of those reasons stock market is more susceptible to quick changes which cause random fluctuation in stock price. However, the stock market has always followed a haphazard pattern and its prediction is always quite a difficult task.

Basically, two types of analyses which are preferred by investors for investing in to stock market. Fundamental analysis is first analysis, where investors look at value of stocks, political climate, the performance of the various industries and economic conditional values which would helps to decide where invest as well as whether to invest or not in stock market. Technical analysis is next analysis which is an assessment of stocks using various statistical generated by market activity, such as past prices and volumes. The technical analyst uses stock charts which helps in identification of various patterns and helps in suggesting stock behavior in future. As stock market affects by various factors the so that to avoid that effective preprocessing of information is done from stock prices and well suited algorithms are applied to predict the stock market condition which provide efficient way to analyze stock market [2].

This paper is focusing on financial data prediction using deep learning. Deep Neural Network (DNN) is currently foundation of various applications related to an artificial neural network which are speech and image recognition, robotics, various games like chess and self-driving car, in medical section to detect cancer and in the analysis of financial signal etc [1]. The deep neural network has an efficient processing power which help to improve efficiency and throughput without compromising performance of model. The superior accuracy comes with high computational costs means that to get more accuracy DNN require more computation power like graphics processing units (GPUs) which helps to accelerate DNN computation. DNN is nothing but an multilayer network which involves many hidden layers with there weights and there are trained by various algorithms.

There are many prediction models used for financial analysis. The pre-prediction model predicts market as positive or negative with the help of different attributes. These factors

include price fluctuation of fuel, commodity, foreign exchange, interest rate, general public sentiment, related NEWS and Simple Moving Average (SMA) and Auto-Regressive Integrated Moving Average (ARIMA) predicted values with help of historical data of the market. The techniques used for prediction include techniques Single Layer Perceptron (SLP), Multi-layer Perceptron (MLP) Deep Belief Network (DBN) and Radial Basis Function (RBF) and also includes techniques like Support Vector Machine (SVM), Naïve Bayes and Decision Tree [3].

The remaining part of this paper is organized by following manner. Section (2) background .Section (3) contains literature survey . Section (4 A) gives idea about system architecture. Section (4B) relevant mathematical foundation .Section (4 C) algorithm and analysis .Section (5) conclusion of this paper.

[2]BACKGROUND

Artificial intelligence and deep neural network DNNs deep neural networks, also called as deep learning, which is part of the large field artificial intelligence (AI), with ability to achieve goals like humans do in there regular life to deal with various problem, according the field of study that provides ability to computers to learn outwardly unequivocally trained. Which provide an single programming flow and then, outside the notion of programming, that program will be trained or learn how to do some intelligent activity and then it will be able to do it.

There is many advantages of an machine learning with help multiple methods. Instead of the arduous and hit-or-miss approach of creating a perspicuous , consulted program to solve each individual problem , in the single machine learning algorithm simply needs to learn, via different processes also called as training, which helps to handle each new obstacle. There are different methods which helps to train the module with new weights .Mostly there are common approaches called as supervised learning, where all the training samples are labeled. Unsupervised learning is next approach here all the training weights are not usually labeled used in structured data or in clustering. Semi-supervised learning is combination of both two approaches such as labeled .Next reinforcement learning is also used to train a DNN to be a policy network such that given an input, it can output a decision on what action to take next and receive the corresponding reward; the process of training this network is to make decisions that maximize the received rewards (i.e. reward function), and the training process must balance exploration (trying new actions) and exploitation (using actions that are known to give high rewards) and there are many methods like CNN,RNN etc [1].

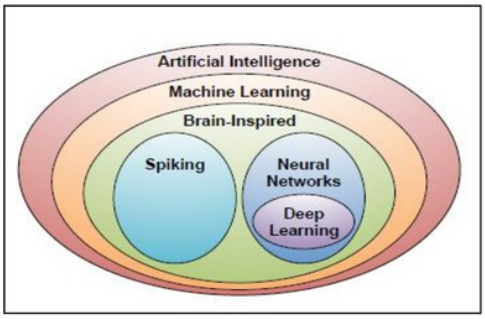

Figure: 1. Deep learning in context with artificial intelligence [1].

[3] LITERATURE SURVEY

Y. Deng, F. Bao, Y. Kong [4] proposed, deep learning with reinforcement learning prediction of stock market. As there are two modules first is DL which helps to senses the aggressive market conditions which helps to select different features. Then next module is nothing but RL module is well-adjusted with deep learning module which makes trading decisions for the extreme rewards in an anonymous circumstances or varying condition. In this paper, training module involves neural network (NN) that provides fusion of both the deep and recurrent neural network. Here task-aware back propagation algorithm utilized to handle gradient vanishing issue in deep learning. The strength of the neural network is justified on both the stock and various commodity features of markets under an ample testing circumstance.

Chia-Hsuan Yeh and Chun-Yi Yang [5] investigated how detectable with regards of mimetic strategic learning within a dedicated website which affects the asset price inimically. Here two peculiarities are embellished, leading algorithm is genetic programming, in which traders are peculiarities by delimited rationality and their adaptive learning behavior is illustrated. Second, the traders are pertaining to inharmonious based on their positions in dedicated website. Mimetic learning responds when it interact with in local traders which are directly bound with each other when they are approaching their trading policy entrust to the analogous performance of their own and their neighbor's. Accordingly they are going to analyze the effect of network topologies, i.e., a regular lattice, volatility, and trading volume.

Wu, L. Zheng and D. Olson proposed, a sentimental analysis is pre-owned to predict the stock market. As Internet provision the contingency for investors to post online assessment that they are contribution with other investors. Sentiment analysis of online assessment posts can expedite both investor's investment decision making and stock companies' risk approach. This paper introduces novel sentiment conviction which conducts conditional sensitive sentiment analysis of online assessment of posts in stock markets. This technique accommodate sentiment analysis into machine learning avenue based on support vector machine and generalized autoregressive heteroskedasticity modeling, which provides solid interconnection between stock price volatility and stock sentimental po[6].

Li-Xin Wang introduces price emphatically model with big buyers and sellers. The basic idea is to estimate parameter which is based on the firmness of the big buyers and the big sellers and make buy/sell decisions accordingly. Here nominated two trading strategies: (i) Follow-the-Big-Buyer which acquires when big buyer begins to show up and there is no sign of big sellers, holds the stock as long as the big buyer is still there holding it, and it sells the stock once the big buyer disappears from list and second is (ii) Ride-the-Mood which buys when the big buyer durability begins to outpace the big seller durability, and sells the stock once the contradictory occurred. This method contributes more profit contrast to old approaches with adequat[7].

Lean Yu, Huanhuan Chen, Shouyang Wang , introduces least squares support vector machine (LSSVM) learning integrates with the merge kernel which helps to scrutinize stock market condition. In the contemplated learning a genetic algorithm (GA) and evolutionary algorithms (EAs), is used to select input features for LSSVM learning, i.e., an evolution of input features. After that another parameters optimization of LSSVM is done with help of GA. After that expanding LSSVM learning with convenient feature subgroup, flawless specification, and a merge kernel is used to forecast stock market evolution direction which concerns with historical data series. Obtained experimental results show that the proposed evolving LSSVM can contribute forecasting models which is simple to interpret using predictive features and are more compell[12] than other parameter methods. After going through these findings it clearly indicates that the proposed evolving LSSVM learning paradigm can be used for exploration of stock market tendency [8].

Adam Ghandar, Zbigniew Michalewicz, elaborates an robust computational intelligence system for learning trading methods. Even in dynamic market conditions, the fuzzy logic rule base is used to deliberate the trading rules and with help of artificial evolutionary process, the system review to form rules that can achieve well for prediction aspiration. In both financial industry and academia a encyclopedic analysis of the outcome of implemented the system for portfolio development using portfolio evaluation tools extensively useful [9].

William Leigh, Cheryl J. Frohlich introduce, an efficient market hypothesis (EMH) is an important quality of financial economics. The EMH asserts provides all available information of security prices fully reflect and fair values that of the stock market prices securities. Because of this investors cannot consistently "beat the market" due to stocks reside in perpetual equilibrium, which makes research efforts pointless. Technical analysts help for partially predict future stock price by analyzing past stock prices, can undeviating achieve a trading return that surpasses the stock market average return. This All this information is tested using knowledge engineering experimentation with one price history pattern the "bull flag stock chart" which used by technical analysts to provide information those are helpful for predicting the future of stock market price values [10].

[4] METHODOLOGY

[A]SYSTEM ARCHITECTURE

Figure no. 2 shows the architectural flow of proposed system. First, we load data from the dataset which is readily available on various website but considering bank related data. Then applying parsing and tokenization the data set after that we train module by feed forward and back propagation then detect the threshold value and predict the condition of the stock market. Using graph, it is easy to show predicted values. More than three layers (including input and output) qualify as "deep" learning, in that more than single hidden layer are present. So that in deep learning involves more than one hidden layer between input and output. In deep-neural networks, each layer of nodes trains based on a various features of the previous layer's output; here old weights are replaced by new weights with accurate values. The furthermore foremost into the neural network, the more complex the features add nodes which help in reorganization since they are doing an aggregation and recombination of features from the previous layer.

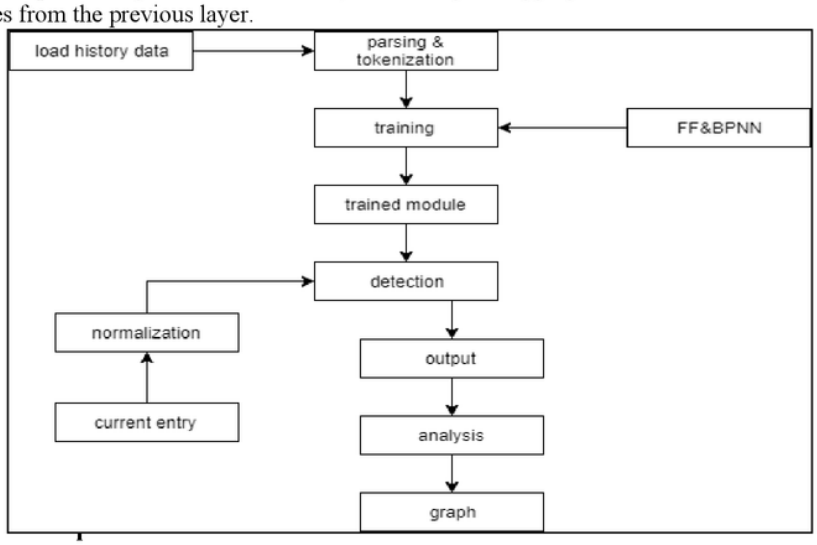

Figure no.2: Architectural flow

[B] RELEVENT MATHEMATICAL FOUNDATION:

Consider S be the system which includes following attributes,
$S= \{U, I, Id_{, Io}, s, f, F\}$
U be set of users where $U= \{U_1, U_2 \ldots U_n\}$
I be input neurons $I= \{I_1, I_2 \ldots I_n\}$
I_d set of hidden neurons $I_d = \{I_{d1}, I_{d2} \ldots I_{dn}\}$
I_o output neurons.
s is success condition.
F is failure condition.

For detection and training module we use following equations sets.
F be the set of function
$F= \{F_1, F_2 \ldots F_n\}$
F_1 =loading data
F_2 =parse and tokenization
F_3 =getting random weight
F_4 =calculating delta

$$W=\sum W_i * X_i \quad \ldots. (1)$$

Where Wi=weight of node or axons
Xi=input values of incoming neuron

$$F(x) = 1/ (1 + e^{-x}) \quad \ldots.(2)$$

$$\Delta=(T-O)*((1-O)*O) \quad \ldots.(3)$$

Where T=target
O=output

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$$W^{+}_{AB} = W_{AB} + (Error_B \times Output_A) \quad \ldots. (4)$$

Where W^{+}_{AB} = new weight
W_{AB} = old weight

[C]ALGORITHM AND ANALYSIS

Input:	From data set (bank related data)
Output:	Prediction of financial market
Procedure:	
	1.Define total layers L, input neuron N and hidden neuron N'
	2. Prepare network by connecting axons to each neuron accordingly.
	3. Assign random weights Wi for each neuron.
	4 .Calculating values for next neuron by using equation (1)
	5 .Repeat up to last layer and apply limitor function shown in equation(2)
	6. Then calculating error with the help of equation (3)
	7. Calculating new weight of each node by equation(4)
	8. Apply same procedure to all nodes.

For this research work we are considering bank related dataset. Consider we have used 200 rows for training module and 100 rows for testing. After that we get confusion matrix. Confusion matrix used to check performance of classification of model. Consider out of 100, 60 are bank corrupt and 40 are non corrupt. By using those values we can find out various positive and negative rates. Also we can find out accuracy by formula,

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN} \quad \text{...(5)}$$

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Where TP=true positive
TN=true negative
FP=false positive
FN=false negative

[5] CONCLUSION

In this research work deep neural network ensemble is used to predict bank related data. Deep-neural networks are helpful to get accurate output with less error. The relative errors of predicted indices and actual indices, as well as the accuracy of trend predictions, are calculated to measure the performance of predictions. As stock market has always followed a disorganized pattern and its prediction is always quite a difficult task. A large number of different techniques and algorithms are available for prediction of trade of stock market but here we focused on the deep neural network. The deep neural network provides an efficient processing to improve efficiency and throughput without compromising performance of model. As the name indicates deep learning it uses multiple hidden layers, so it improves accuracy. For training purpose feed forward and back propagation used which helps to minimize error rate.

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Authors brief Introduction

Asmita J. More, received BE degree in ENTC, from SITS narhe pune. Now pursuing ME Degree in Department of Information Technology from Pune Institute of computer technology, Pune. Area of interest includes machine learning, artificial intelligence.

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