Interest Rate Analyzer Using Deep Learning Model

T Hemanthkumar and M Kavitha

May 9, 2023

INTEREST RATE ANALYZER USING DEEP LEARNING MODEL

1.Mr.Hemanthkumar T,
M.Sc.Computer Science,
KG College of Arts and Science,
Coimbatore,Tamil Nadu.
E-mail:hemanth.sai.hk849@gmail.com

2.Ms. M. Kavitha,
Assistant Professor M.Sc., M.Phil. (Ph.D.),
Dept.of Software Systems and Computer Science(PG)
KG College of Arts and Science,
Coimbatore, Tamil Nadu.
E-mail: m.kavitha@kgcas.com

ABSTRACT

In macroeconomics, decision-making is highly sensitive and significantly influences the financial and business world, where the interest rate is a crucial factor. In addition, the interest rate is used by the governments to manage the monetary policy. There is a need to design an efficient algorithm for interest rate prediction. The analysis of the social media sentiment impact on financial decision-making is also an open research area. In this study, user deploy a deep learning model for the accurate forecasting of the interest rate for India, the UK, Turkey, China, Hong Kong, and Mexico. For this purpose, daily data of the interest rate and exchange rate covering the period from Jan 2010 to Oct 2021 is used for all the mentioned countries. It also incorporate the input of the Twitter sentiments of six mega- events, namely the Indian election 2021, the US election 2012, the Mexican election 2012, Gaza under attack 2014, the Hong Kong protest 2014, the Refugee Welcome 2015, and Brexit 2016. The results will provide evidence that the error of the deep learning model significantly decreases when event sentiment is incorporated. The Gaza under attack 2014, the Hong Kong protest 2014, the Refugee Welcome 2015, and Brexit 2016. The results will provide evidence that the error of the deep learning model significantly decreases when event sentiment is incorporated.

Keywords: Machine Learning, Deep Learning, Logistic Regression, SVM, LSTMs.

I. INTRODUCTION

Machine learning is a method of data analysis that automates analytical model building. It is a branch of artificial intelligence based on the idea that systems can learn from data, identify patterns and make decisions with minimal human intervention and their types are various as follows Supervised-Learning,Unsupervised-Learning,Semi-Supervised Learning,Reinforcement Learning.

The system also supports Deep Learning is a subset of Machine Learning. It is based on learning by example, just like humans do, using Artificial Neural Networks. These Artificial Neural Networks are created to mimic the neurons in the human brain so that Deep Learning algorithms can learn much more efficiently. Deep Learning is so popular now because of its wide range of applications in modern technology. From self-driving cars to image, speech recognition, and natural language processing.

The suggested system uses a DL model based on Long Short Term Memory is a type of Deep Learning architecture commonly used for Prediction on Stocks,Weather forecasting, Language modelling and recognition tasks. It is a variety of Recurrent Neural Networks[RNN] that are capable of learning long-term dependencies,especially in sequence prediction problems.

II.LITERATURE SURVEY

"Predicting Stock Prices and Exchange Rates Using Multilayer Perceptrons: An Empirical Investigation" by Y. L. Chen and C. C. Tsai (2011) - Investigated the use of multilayer perceptron neural networks for predicting stock prices and exchange rates. They find that the neural networks outperform traditional time series models in terms of accuracy and robustness.

"Predicting Stock Prices with Financial News Using Sentiment Analysis and Recurrent Neural Networks" by S. Li, X. Wu, and X. Zhang (2018) - Proposed a sentiment-based approach to predict stock prices using recurrent neural networks. They use financial news articles as input data and show that the sentiment extracted from these articles can improve the accuracy of the prediction.

"A Survey of Machine Learning Techniques for Stock Market Prediction" by G. G. Bontempi and S. A. Ben Taieb (2018) - The paper provided a comprehensive survey of machine learning techniques for stock market prediction, including neural networks, support vector machines, and decision trees. They evaluate the performance of these techniques on a variety of datasets and highlight the challenges and limitations of each approach.

"Interest Rate Forecasting with Machine Learning Methods" by M. H. Shabani, M. Nikoo, and A. Tahmasebi (2019) - Investigated the use of machine learning methods for interest rate forecasting. They compare the performance of various models, including neural networks, support vector regression, and random forests, and show that the machine learning models outperform traditional time series models.

"Predicting Stock Prices Using Technical Analysis and Machine Learning Algorithms" by S. Poonia and P. Saxena (2020) - Proposed a hybrid approach to predict stock prices using technical analysis and machine learning algorithms. They use technical indicators such as

moving averages and relative strength index as input features and show that the hybrid approach outperforms traditional time series models.

In a number of studies that focus on the mining of public opinions and emotions, which is normally referred to as social media, where twitter is considered as one of the widely used social platforms. In addition, these opinions, in the form of sentiments, have numerous applications in market services and investment settings. Social media plays a vital role in the return prediction of Chief Executive Officer (CEO) through inside trading. In the literature, there are studies that focus on stock prediction using social media sentiment of mega-events and exchange rate prediction in a similar context. In terms of model comparison, there has been a formal comparison of single-factor models. The study was conducted on the data of the US and rejected the commonly used square root diffusion model. The system uses machine learning algorithms like linear regression and SVM.

System predicts interest rate using ANN and improving the network using some novel heuristic algorithms such as Moth Flame Optimization algorithm (MFO), Chimp Optimization Algorithm (CHOA), Time-varying Correlation Particle Swarm Optimization algorithm (TVAC-PSO), etc. we used 17 variables such as oil price, gold coin price, house price, etc. as input variables.

In the existing literature, the deep learning model has not been used before to model the interest rate. Moreover, the twitter sentiment on mega-events of a dynamic nature has never been incorporated to predict the interest rate, which is a highly volatile and sensitive macroeconomic variable. Hence interest rate is predicted only using certain variables, not included macro-economic variables. Hence prediction accuracy is less.

Moreover, this technique is only suitable when there is a lack of information about the data generating process Prediction is done based on NSE , BSE values only using ANN. Prediction is not done for analysis of the social media sentiment which has great impact on financial decision making.

III. METHODOLGY

DATASET COLLECTION

In order to predict the interest rate, we follow a set of approaches that includes a state-of-the art econometric technique of linear regression, support vector regression, and deep learning. In the first step, the system predict the interest rate for different countries: the UK as a developed economy, and Turkey, India, Hong Kong, and Mexico as emerging economies. The system considered six mega-events of a dynamic nature for the sentiment analysis. The dataset of the events was taken from twitter, which will contains almost 9 million tweets.

SENTIMENT ANALYSIS FROM TWITTER

The twitter sentiment of the relevant events is used to predict the interest rate in the second step. Twitter dataset of different events and calculate the sentiment for global and local

events. In order to calculate the sentiment from the textual data, we used the Alex Davies word list. In this approach, the list consists of almost five thousand words categorized into positive, negative, and neutral sets. Tweets are tokenized, and the word list is prepared in order to remove whitespace, emotions, punctuations, and URL.

Tweets are classified as positive, negative, and neutral categories by using an efficient and accurate dictionary. Module replaced the word list by adding our own list of 4000 words to improve the results because this list considers the relationship of each word and multi-word expressions. At first, the daily textual data of positive, negative, and neutral tweets were represented in percentages, after which the net daily sentiment was calculated. This module will process the textual dataset of twitter of multiple events for the sentiment analysis.

INTEREST RATE FORECASTING

This module incorporate this social media sentiment to predict the interest rate of the UK, Turkey, India, Hong Kong, and Mexico by using multiple techniques, i.e., Linear Regression, Support Vector Regression, and Deep learning (DL).

Linear models are simple in nature, and therefore the time series data is predicted using these simple models. Deep learning is used to achieve more efficient results. There are hidden layers in neural networks, and in each layer the net network learns new feature space through the linear transformation of the given inputs. The continual non-linear function is applied, leading the process to the output layer. Neural networks are defined as the process to get the output by flowing the information through hidden layers. In our study, we apply the DL model, which contains a large number of hidden layers and neurons which are interconnected and operate in a parallel way. Moreover, this approach is also common for solving regression problems. The performance of the DL model improves when the frequency of the data increases. In this project, system uses a DL model based on the Long Short-Term Memory Networks with the standard-setting.

LSTMs Prediction
1. Libraries-To Load necessary dependencies,
2. Loading the data on Datasets,
3. Data Preprocessing,
4. Scaling the Data,
5. Transforming the data,
6. Training LSTM,
7. Teacher Forcing.

FEATURES:

Macro-economic variables are considered, hence prediction accuracy is high.Moreover, this technique is suitable even when there is a lack of information about the data generating process. To know large number of hidden results. To achieve more efficient results.Finding Prediction on stocks in different companies like Reliance Industries,Tata Chemical Industries,Adani Steels etc..

ARCHITECTURE DIAGRAM:
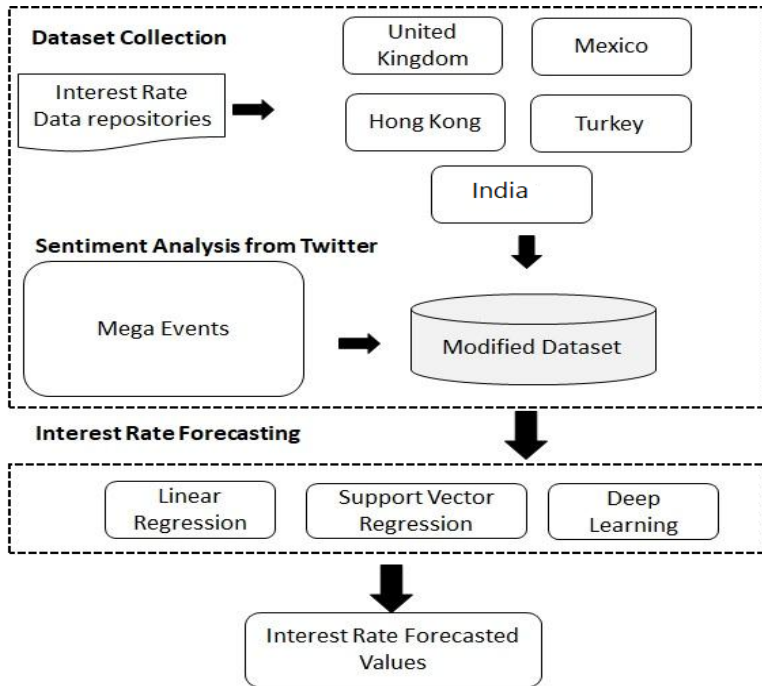
[Figure-1]

TRAINED MODEL:
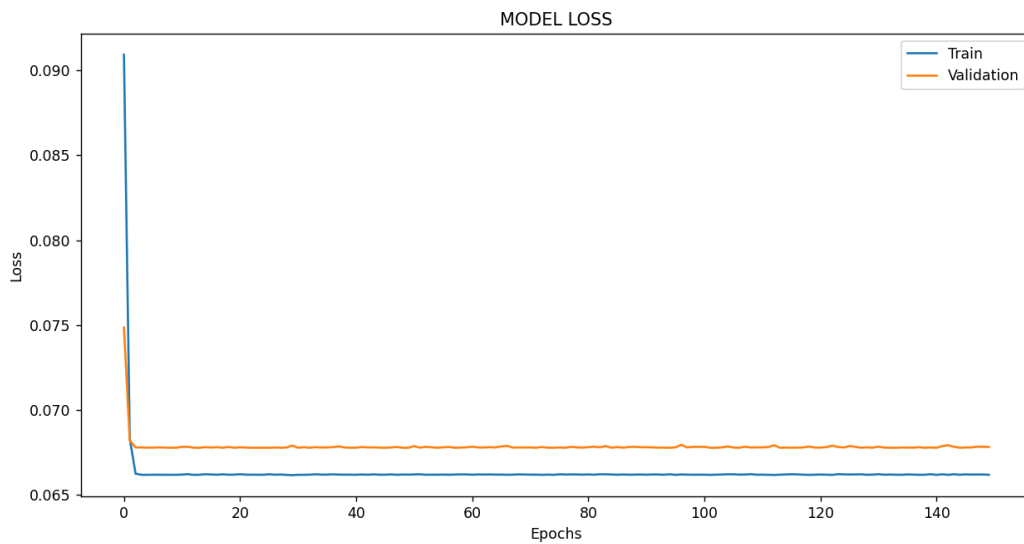
[Figure-2]

[Figure-3]

IV. RESULTS AND DISCUSSION

In [Figure-1] the suggested system carefully considers the development and deployment of Architectural Model. In [Figure-2] gives an overview of accuracy rates of the trained classifiers[Training and validation loss with teacher forcing]. All the calculations are done using Packages. In [Figure-3] the system indicates the LSTM Prediction by default it has shown the live market rate stock prediction of Reliance Industries.[Bombay Stock Exchange]

Sentiment Analyzer Results

The above sections discussed the method followed to train the classifier used for sentiment analysis of tweets. The classifier with features as macro economic variables are considered,hence prediction accuracy is high. Tweets trained on those algorithms with a split percentage of 90 for training the model and remaining for testing the model showed an accuracy of 70.2%. Though the results are very close to model trained with tweets because of its promising accuracy for large datasets. Provided this information, the results may obtained from the sentiment classification can be observed as very good figures while predicting the sentiments in short texts, tweets, less than 140 characters in length.

Teacher Forcing

The teacher forcing is a method for training RNN that use the output from a previous time step as an input.When RNN trained,it can generate a sequence by using the previous output as current input as shown in a Market Watch on LSTM Prediction [Figure-3] and also the same process can be used for training [Figure-2] Training and validation loss with teacher forcing.

V. CONCLUSION

In this paper, have shown that a strong correlation exists between rise/fall in Interest Rate of a different countries to the public opinions or emotions about that company expressed on twitter through tweets. The main contribution of our work is the development of a sentiment analyzer that can judge the type of sentiment present in the tweet. The tweets are classified into three categories: positive, negative and neutral. At the beginning, we claimed that positive emotions or sentiment of public in twitter about a company would reflect in its Interest Rate. Our speculation is well supported by the results achieved and seems to have a promising future in research.

REFERENCES

[1] Qian, Bo, Rasheed, Khaled, Stock market prediction with multiple classifiers, Applied Intelligence 26 (February (1)) (2007) 2533, http://dx.doi.org/10.1007/s10489-006-0001- 7.

[2] E.F. Fama, The behavior of stock-market prices, The Journal of Business 38 (1) (1965) 34105, http://dx.doi.org/10.2307/2350752

[3] J. Leskovec, L. Adamic and B. Huberman. The dynamics of viral marketing. In Proceedings of the 7th ACM Conference on Electronic Commerce. 2006

[4] B. Jansen, M. Zhang, K. Sobel, and A. Chowdury. Twitter power: Tweets as electronic word of mouth. Journal of the American Society for Information Science and Technology. 2009.

[5] A. Pak and P. Paroubek, Twitter as a corpus for sentiment analysis and opinion mining, in Proceedings of the Seventh International Conference on Language Resources and Evaluation, 2010, pp. 13201326

[6] Asur, S., Huberman, B.A.: Predicting the Future with Social Media. In: Proceedings of the ACM International Conference on Web Intelligence, pp. 492-499 (2010)

[7] Ruiz, E. J., Hristidis, V., Castillo, C., Gionis, A., Jaimes, A.: Correlating financial time se-ries with micro-blogging activity. In: Proceedings of the fifth ACM international confer-ence on Web search and data mining, pp. 513-522 (2012)

[8] Bordino, I., Battiston, S., Caldarelli, G., Cristelli, M., Ukkonen, A., Weber, I.: Web search queries can predict stock market volumes. PLoS ONE 7(7), e40014 (2011)

[9] Gilbert, E., Karahalios, K.: Widespread Worry and the Stock Market. In: Proceedings of the Fourth International AAAI Conference on Weblogs and Social Media, pp.58-65 (2010)

[10] Bollen, J., Mao, H., Zeng, X.: Twitter mood predicts the stock market. Journal of Compu-tational Science, 2(1), 1-8 (2011)

[11] Aramaki, Eiji, Sachiko Maskawa, and Mizuki Morita. "Twitter catches the flu: detecting influenza epidemics using Twitter." Proceedings of the conference on empirical methods in natural language processing.
    Association for Computational Linguistics, 2011. [12] R. Chen and M. Lazer, Sentiment Analysis of Twitter Feeds for the Prediction of Stock Market Movement, Cs 229, pp. 15, 2011.

[13] L. Zhang, Sentiment Analysis on Twitter with Stock Price and Significant Keyword Correlation, pp. 130, 2013. [14] Dickinson, Brian, and Wei Hu. "Sentiment analysis of investor opinions on twitter." Social Networking 4.03 (2015): 62.

[15] Bing, Li, Keith CC Chan, and Carol Ou. "Public sentiment analysis in Twitter data for prediction of a company's stock price movements." eBusiness Engineering (ICEBE), 2014 IEEE 11th International Conference on. IEEE, 2014.

[16] Agarwal, Apoorv, et al. "Sentiment analysis of twitter data." Proceedings of the workshop on languages in social media. Association for Computational Linguistics, 2011.Mittal, Anshul, and Arpit Goel. "Stock prediction using twitter sentiment analysis.