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Volume 2714

2nd International Conference on Advanced Information Scientific Development (ICAISD) 2021

Innovating Scientific Learning for Deep Communication

Jakarta, Indonesia • 5–6 August 2021

Editors • Agus Junaidi, Haryani, Taufik Baidawi, Sarifah Agustiani, Dwi Puji Hastuti, Sopiyan Dalis and Yoseph Tajul Arifin

AIP Publishing

AIP Conference Proceedings

Volume 2714

ISBN: 978-0-7354-4520-8

ISSN: 0094-243X

pubs.aip.org/aip/acp

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Volume 2714

Conference collection

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Sopiyan Dalis
Yoseph Tajul Arifin
Bina Sarana Informatika University, Central Jakarta, Indonesia

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AIP Publishing

Melville, New York, 2023
AIP Conference Proceedings

Volume 2714

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Editors

Agus Junaidi

Haryani
Bina Sarana Informatika University
Information Technology
Kramat Raya Street No. 98, Kwitang
Central Jakarta, 10450
Indonesia

Email: agus.asj@bsi.ac.id
haryani.hyi@bsi.ac.id

Taufik Baidawi
Bina Sarana Informatika University
Information System
Kramat Raya Street No. 98, Kwitang
Central Jakarta, 10450
Indonesia

Email: taufik.tfb@bsi.ac.id

Sarifah Agustiani
Bina Sarana Informatika University
Computer Technology
Kramat Raya Street No. 98, Kwitang
Central Jakarta, 10450
Indonesia

Email: sarifah.sgu@bsi.ac.id

Dwi Puji Hastuti
Bina Sarana Informatika University
English
Kramat Raya Street No. 98, Kwitang
Central Jakarta, 10450
Indonesia

Email: dwi.dsu@bsi.ac.id

Sopiyan Dalis
Bina Sarana Informatika University
Information System
Kramat Raya Street No. 98, Kwitang
Central Jakarta, 10450
Indonesia

Email: sopiyan.spd@bsi.ac.id

Yoseph Tajul Arifin
Bina Sarana Informatika University
Electrical Engineering
Kramat Raya Street No. 98, Kwitang
Central Jakarta, 10450
Indonesia

Email: Yoseph.ypa@bsi.ac.id

ISBN 978-0-7354-4520-8
ISSN 0094-243X
Printed in the United States of America

AIP Conference Proceedings, **Volume 2714**
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ARTIFICIAL INTELLIGENCE

Preface: 2nd International Conference on Advanced Information Scientific Development (ICAISD) 2021

The 2nd International Conference on Advanced Information Scientific Development (ICAISD) 2021 was organized by Universitas Bina Sarana Informatika.

It was held in BSI Convention Center, Bekasi, West Java, Indonesia, event held by the Institute of Research and Community Service (LPPM) of Universitas Bina Sarana Informatika on August 5-6, 2021. ICAISD 2021 is an International Conference for sharing knowledge and research in Computer and Information Science and providing a platform for researchers and practitioners from both academia as well as industry to meet and share the cutting-edge development of Computer and Information Science research. The theme that we raised in this international conference is: "**Innovating Scientific Learning for Deep Communication**".

The background of the theme selection is related to the rapid development of science and technology in the 21st Century that has contributed to change or renew various fields of life, including Applied Science and Artificial Intelligence. This issue is published in line with the Second International Conference on Advanced Information Scientific Development (ICAISD) 2021. The articles cover a broad spectrum of topics in Computer Science, Computer Engineering and Computer Systems, Software Engineering, Mobile Multimedia and Information Technology, Information Systems and Information Management. The committee received 162 papers via easychair.org as well, with details of 126 papers received. Of the 126 papers, 64 papers in Applied Science, and 62 papers in Artificial Intelligence. These articles provide an overview of critical research issues reflecting on past achievements and future challenges. Those papers were selected from 126 abstracts, and we send these papers to IOP Publisher (Journal of Physics Conference Series) to be published there as an Open Access Proceeding Scopus. This statistic shows the high competition to get published on this proceeding. This issue and seminar become special as more delegates come and join from various country as well as universities. We host 42 delegates both from abroad and local. From abroad the delegation comes from Malaysia, Bangladesh, Turkey, Germany, Japan, Taiwan and Philippines.

The 2nd ICAISD was held together with APTIKOM, APTIKOM DKI Jakarta, University of North Sumatra, University of Nusa Mandiri, BRI Institute, STMIK Pelita Nusantara and AMIK-STIKOM Tunas Bangsa. This is also the second year of our partnership with APTIKOM Indonesia, Poznan University of Technology Poland, Delft Technical University the Netherlands, and Jyothi Engineering College-Jyothi Hills India.

This form of activity takes the form of scientific seminars or international conferences that are held virtually or webinars consisting of plenary lectures and oral presentations. The target participants are practitioners in the field of Information Technology and Management from academics (lecturers, researchers, and students) as well as practitioners and industry as a mean of socializing progress and development in the field of Information Technology and Management to increase their understanding and use for stakeholders on national and international scale. In addition, through this conference, the participants can develop research networks and

2nd International Conference on Advanced Information Scientific Development (ICAISD) 2021
AIP Conf. Proc. 2714, 010001-1–010001-2; https://doi.org/10.1063/12.0014624
Published by AIP Publishing. 978-0-7354-4520-8/$30.00

collaboration with research partners in the field of information technology and management in Indonesia and researchers from abroad.

In connection with this theme, we present four speakers as the main speakers, namely Prof. Ir. Zainal Arifin Hasibuan, MLS, Ph.D (General Chair of APTIKOM Indonesia), Prof. Dr. Gerhard Willem Weber (Poznan University of Technology, Poland), Prof. Dr. Dorien De Tombe (Delft Technical University, the Netherlands), Prof. Dr. Sunny Joseph Kalayathankal (Jyothi Engineering College-Jyothi Hills India, and Prof. Dr. Herman Mawengkang (Universitas Sumatera Utara).

We also thank all reviewers and editors, for their commitment, effort and dedication in carrying out the task of reviewing all abstracts and full papers. Without their help and dedication, this process would not have been possible in such a short time. I really appreciate all the committee members (Advisors, Program Committee Chairs, Executive Chair, Chair of Committee, and Organizing Committee Chair) for their joint efforts and invaluable contributions to the success of the conference.

Wassalamu'alaikum Warrahmatullah Wabarrakatuh.

Jakarta, August 5, 2021
Best Regards,
Conference Chair of ICAISD-2021

ICAISD 2021

Taufik Baidawi, M.Kom

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2ND INTERNATIONAL CONFERENCE ON ADVANCED INFORMATION SCIENTIFICT DEVELOPMENT (ICAISD-2021)
AUGUST 5-6, 2021

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AIP Conf. Proc. 2714, 010002-1–010002-2; https://doi.org/10.1063/12.0019321
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KEYNOTE SPEAKER

Profile Prof. Zainal A. Hasibuan, Ph. D

The Conference speaker was born in Pekanbaru 24 December 1959, he earned his PHD in information storage and Retrieval system at Indiana University. His research interest in Information Retrieval, E-Business, E-Learning, E-government. Information System has have been published at various conferences both international and national, he is also a reviewer of multiple journals, and until now he serves as the chairman of the Association of Computer Science (APTIKOM)

Profile Prof. Dr. Herman Mawengkang

The Conference speaker was a professor of mathematics. He earned his doctoral degree at the University of New South Wales, School of Mechanical and Industrial Engineering in 1989. His research in mathematics has been widely published nationally and internationally if it is a reviewer from various journals and a speaker at multiple conferences, he is also a lecturer doctoral Mathematics science program at the University of North Sumatera.

Profile Prof.Dr. Sunny Joseph Kalayathankal, Ph.D

Prof, Dr. Sunny Joseph Kalayathankal received the MSc. degree from Kerala University , Kerala, India in 1986, BEd from Calicut University, Kerala in 1987, MPhil Kerala University in 1993 and Ph.D (Mathematics) degree in 2010 from Kerala University, MCA from Indira Gandhi National Open University, New Delhi, India in 2002, M.Tech IT from Karnataka State Open University in 2013 and Ph.D. in Computer Science under Bharathiar University, Coimbatore, India in 2018. He is currently working as a Principal (Professor & Dean of Research) Jyothi Engineering College Affiliated to APJ Abdul Kalam Technological University, Thrissur, Kerala India and has 34 years and 8 months of teaching and 16 years of research experience. He has published more than 84 papers in the areas of Fuzzy modelling and decision making, Graph theory and Applied Mathematics. He has served as Keynote and invited speaker in various National and International conferences. He is the reviewer of Iranian Journal of Fuzzy System, International Journal of Fuzzy system and Journal of Mathematical Modeling and Computer Simulation.

Profile Prof. Dr. rer. Nat Gerhard Wilhelm Weber

The conference speaker was a man born in Westphalia Germany on October 20, 1960, he was a professor of the faculty of management and technology Poznan University of Technology, Poland, he researched in the areas of Financial Mathematics, mathematical programming, Mathematical and Computational Statistics, dynamical systems, discrete tomography, neuroscience, special aspects of discrete mathematics, he is an expert in the field of mathematics and masters several programming languages such as Basic, Fortran and Pascal, he has also published many titles in the field of mathematics as well as being a reviewer in several international journals, he is also active as a speaker at various international conferences.

2nd International Conference on Advanced Information Scientific Development (ICAISD) 2021
AIP Conf. Proc. 2714, 010003-1–010003-2; https://doi.org/10.1063/12.0019322
Published by AIP Publishing. 978-0-7354-4520-8/$30.00

Profile Prof. Dr Dorien DeTombe

Prof. Dr Dorien DeTombe is the founder and chair of the field Methodology for Societal Complexity. She developed the Compram Methodology for political decision making on complex societal issues like sustainable development, terrorism, credit crisis, climate change and water affairs. The Compram Methodology is advised by the OECD to handle Global Safety. She studied social science and computer science. Her doctorate is in Methodology for Societal Complexity. She spends her main career at Utrecht University and Delft University of Technology in The Netherlands, and is since 2015 connected with Sichuan University, Chengdu, P.R. China. She is a facilitator of many workshops on complexity. She published many books, more than 150 articles. She gives lectures and workshops as Visiting Professor and Conferences all over the world. She organizes yearly conferences and is editor of many journals. She is in the board of many research groups and established a world-wide research network on International Society on Methodology of Societal Complexity.

RESEARCH ARTICLE | MAY 09 2023

Deep learning for Tesla's stock prices prediction

Hendri Mahmud Nawawi ✉; Muhammad Iqbal; Yudhistira Yudhistira; ... et. al

AIP Conference Proceedings 2714, 030004 (2023)
https://doi.org/10.1063/5.0128535

Deep Learning for Tesla's Stock Prices Prediction

Hendri Mahmud Nawawi,[1, a)] Muhammad Iqbal,[2, b)] Yudhistira Yudhistira,[2, c)] Imam Nawawi,[3, d)] Slamet Widodo,[3, e)] and Nuraeni Herlinawati[2, f)]

[1)]*Technical Information, Nusa Mandiri University, Jakarta, Indonesia*
[2)]*Computer Technology, Bina Sarana Informatika University, Jakarta, Indonesia*
[3)]*Information Systems, Bina Sarana Informatika University, Jakarta, Indonesia*

[a)]*Corresponding author: hendri.hiw@nusamandiri.ac.id*
[b)]*iqbal.mdq@bsi.ac.id*
[c)]*yudhistira.yht@bsi.ac.id*
[d)]*imam.imw@bsi.ac.id*
[e)]*slamet.smd@bsi.ac.id*
[f)]*nuraeni.nhw@bsi.ac.id*

Abstract. Modeling stock price predictions is a challenging and not easy task because it is influenced by internal and external factors. Recently, investors are paying attention to invest in Tesla electric cars. Tesla's advantage by issuing new shares with a lower effective cost of capital is a competitive advantage and significant to attract investors' attention. However, in terms of investment, the possibility of getting a lot of profits and allowing investors to lose all their savings is commonplace and commonplace. In this paper, the concentration of writing is to predict Tesla's stock price in the future based on the data of the last 5 years. The MLP and LSTM models are used as models for testing the tesla dataset sourced from investing.com and the yahoofinance dataset is tested to see a graph of Tesla's future price predictions. The MLP model with Adam optimization, Loss: MSE is the best model for investing.com dataset with the smallest MAE value of 4.41644 and the MLP model with Adam optimization, Loss: MAE is the best model for the yahoofinance dataset with an MAE value of 6.20797.

INTRODUCTION

Predicting stock prices is a challenging and difficult task because the prediction of stock prices has an element of uncertainty [1], [2], [3]. Stock prices are influenced by internal and external factors that cause fluctuations every day and even every second [4]. Every day the stock market price is always changing and very difficult to predict by sellers and buyers [5]. From the stock market, a person can get a lot of profit and even lose all his savings [6]. Forecasting or prediction covers several fields including business and industry, economics, environmental science, and finance [7].

In this paper, the focus of research on Tesla stock price predictions is obtained from data sources on the internet, namely investing.com and yahoofinance. This study uses a time series by taking the Tesla stock price dataset from 2015 to March 2021. Time series data can be defined as a sequence of chronological observations for the selected variable [7]. The selected variable is the stock price when it is open, low, high, and close. From the point of view of the sentiment of traditional cars, manufacturers are considered stuck in the last century. Tesla can issue new shares at a lower effective capital cost thereby giving Tesla a significant competitive advantage, especially given the large capital requirements for the manufacture of electric cars [8]. This paper concentrates on forecasting future Tesla stock prices based on the historical Tesla dataset from 2015 to 2021.

Research [9] Evaluates the effectiveness of using technical indicators, such as the Moving Sample Average closing price, closing price momentum, etc. In the Turkish stock market to capture the relationship between technical indicators and the stock market during the study period, a hybrid artificial neural network (ANN) model was used which includes the ability to take advantage of harmony search (HS) and genetic algorithm (GA), which are the most widely used. In this study, it is argued that technical indicators are the most relevant indicators. In order to obtain higher accuracy in value prediction, new variable prices have been formulated using existing variables. Neural networks are used to predict the closing price of the next day's shares, and comparative RF analysis is also applied. Based on the comparative analysis of the value of RMSE, MAPE, and MBE, it is clear that ANN provides better stock price forecasts than RF [1].

The deep learning model is used to model future Tesla stock price predictions. This study uses a deep learning machine model to test the dataset sourced from investing.com and yahoofinance. The evaluation and validation for the results of this model consist of Mean Absolute Error (MAE), Root Mean Squared Error (RMSE) and Mean Squared Error (MSE). The smallest MAE, RMSE, and MSE values are the best models for modeling future Tesla stock price predictions based on the variables of the opening price, lowest price, highest price, and closing price.

2nd International Conference on Advanced Information Scientific Development (ICAISD) 2021
AIP Conf. Proc. 2714, 030004-1–030004-7; https://doi.org/10.1063/5.0128535
Published by AIP Publishing. 978-0-7354-4520-8/$30.00

THE PROPOSED MODEL

This research dataset is secondary data obtained from investing.com and historical yahoofinance from recorded open, low, high, and close prices to predict the model using our proposed model, namely Multilayer Perceptron / Artificial Neural Network and Long Short-Term Memory Network (LSTM). To evaluate the performance of the model proposed in this study, validation is used MAE, MSE, and RMSE. The MLP model is proposed because it is able to generalize the data [10] and the LSTM model is used to reduce prediction errors for time series datasets in the case of forecasting by making accurate predictions of a variable. The best prediction is based on the prediction error rate, the smaller the error rate, the more accurate the prediction method [11].

Artificial Neural Network (ANN)

Artificial Neural Network is inspired by the function of biological neural networks [10], [3]. ANN is designed to identify the underlying trend of data and to generalize it [10]. The NN model using technical analysis variables has been applied to predict the Shanghai stock market, in this study the proposed method focuses on stock price prediction for companies listed on the NSE (National Stock Exchange) sliding window approach adopted for overlapping data obtained a model for prediction purposes. who can use minute sage data as input. Such modeling has applications in algorithmic trading where high-frequency trading occurs [7]. Deep learning in neural networks depends on the problem and how the neurons are connected, such behavior may require a long causal chain of computational stages, where each stage alters (often in a non-linear way) the activation of the network aggregate. Deep Learning is all about giving credits accurately at many such stages [12].

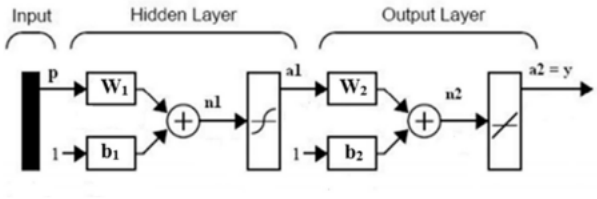

FIGURE 1. Neural Network Architecture [9]

Long Short-Term Memory (LSTM)

Long Short-Term Memory Network or LSTM network is a type of recurrent neural network used in deep learning because very large architectures can be trained successfully [13]. The LSTM is sensitive to the scale of the input data, especially when the sigmoid (default) or tanh activation function is used [9]. LSTM combines short-term memory with long-term memory via gate control [14]. LSTM Model Architecture in Figure 2.

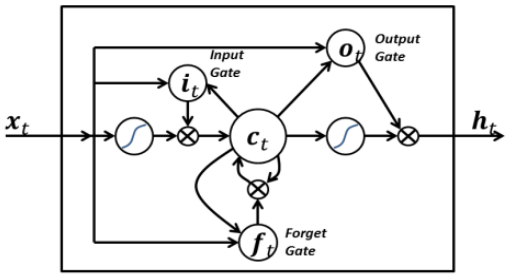

FIGURE 2. LSTM Model Architecture [13]

METHOD AND RESULT

The technique used for the model in this study is regression to predict the results based on the input given. This study takes a secondary dataset obtained from investing.com and yahoofinance. This dataset is divided into two parts, namely training data and testing data, then training data and testing data are tested with predetermined models, namely Artificial Neural Network (ANN) and Long Short-Term Memory Network (LSTM). Broadly speaking, this research method is explained in Figure 3.

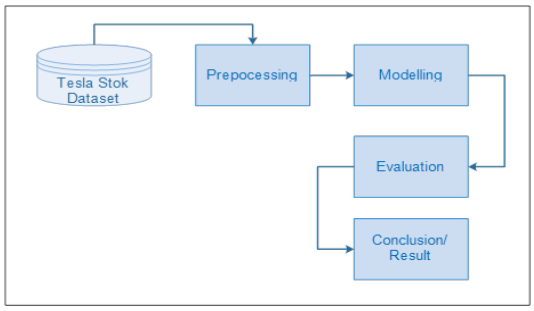

FIGURE 3. Framework

Dataset

The number of datasets from research taken from sources investing.com 1777 and yahoofinance 1816 variable data used for modeling are

- **Open**: The opening price of the stock, this attribute describes and displays the numbers at the opening price, namely the price for the first time the transaction was made on that day.
- **High**: The highest share price, is the price range of the daily movement of the stock where the investor has the courage or rationality to buy or sell, if information is obtained that the stock price will soar, this is an opportunity for investors to make a purchase.
- **Low**: The lowest share price, is the opposite of high if it is received news that the stock will go down, the investor will sell the stock.
- **Close**: The closing price reflects all available information for all market participants (especially institutional market participants with more accurate information) at the end of the stock transaction and the close variable will be used as the Y variable (Prediction) in this study to study the behavior of the Tesla stock market.

TABLE I. Research Dataset

Date	Open	High	Low	Close
02/01/2014	30.02	29.96	30.5	29.31
03/01/2014	29.91	30	30.44	29.72
06/01/2014	29.4	30	30.08	29.05
07/01/2014	29.87	29.52	30.08	29.05
...	...	...	...	...
20/01/2021	850.45	858.74	859.5	837.28
21/01/2021	844.99	855	855.72	841.42

Source: Investing.com

The dataset from each source is divided into training data and complete testing data is shown in table 1.

TABLE II. Data Training and Testing

Source	Total Data	Training	Testing
investing.com	1777	1421	356
yahoofinance	1816	1452	364

This study uses time-series data from the historical stock price of Tesla, the training data used to train testing data is taken from the last 20% of the price, this aims to see the price trend so that it is not random.

Preprocessing

At the preprocessing stage, the variables taken are open, low, high, and close and daily data on the date column variable are used as a benchmark for determining training data and testing data. Training data and testing data are divided into 80-20% to test the models used, namely ANN and LSTM.

Modelling

At this stage, the Multi-Layer Perceptron and LSTM algorithm models are used to test training data and testing data so that the final result is to produce a model from the two tested datasets.

The formula for the MLP model is formulated as

$$St = f(UxXt + WxSt - 1) \tag{1}$$

$$Ot = g(VxSt) \tag{2}$$

Where St is the network memory at time t;
U, W, and V are the weight sharing matri ces in each layer;
Xt and Ot represent input and output at time t;
F (.) And g (.) Represent nonlinear functions.

In the LSTM model the input gate is formulated:

$$it = \sigma(Wix(ht - 1, xi) \tag{3}$$

$$ft = \sigma(Wfx(ht - 1, xi) + bf \tag{4}$$

Where Wi and Wf are weight matrices;
ht - 1 is the output from the previous cell;
xt is input, and
bi and bf are bias vectors

Evaluation

To test the model proposed in this study, general validation is used which is usually used in the regression dataset model to assess the smallest error value. The validation used includes MAE, MSE, and RMSE.

$$MAE = \frac{\sum actual - prediction}{n} \tag{5}$$

$$MSE = \frac{\sum (actual - prediction)^2}{n} \tag{6}$$

$$RMSE = \sqrt{\frac{\sum actual - prediction^2}{n}} \tag{7}$$

Where 'actual' refers to the original closing price, 'prediction' refers to the estimated closing price and 'n' refers to the size of the total number of datasets.

Result

In testing the dataset several optimizations are used, namely Adam optimization and RMSprop optimization to test the proposed model. Evaluation of the desired research results is to find the smallest error from the MAE value and MSE value.

In this study, the parameters used with adam optimization are derivatives of the SGD method, a combination of RMSprop and momentum, and RMSprop optimization is a gradient-based optimization technique used in training neural networks [15]. The results of the optimization with both are in table 3.

TABLE III. Model Evaluation with Adam and RMSprop Optimization

Source	Model	Optimation	MAE	MSE	RMSE
Investing.com	MLP	Adam, Loss MAE	4.55677	58.7798	7.66680
		Adam, Loss MSE	4.41644	57.9040	7.60947
		RMSProp, Loss MAE	6.72914	119.7559	10.94330
		RMSProp, Loss MSE	7.71910	124.7455	11.1689
	LSTM	Adam, Loss MAE	5.51722	81.28398	9.01576
		Adam, Loss MSE	8.425007	201.97892	14.2119
		RMSProp, Loss MAE	7.82761	161.8619	12.7224
		RMSProp, Loss MSE	4.88365	64.7356	8.0458
Yahoofinance	MLP	Adam, Loss MAE	6.20797	98.5519	9.92733
		Adam, Loss MSE	6.82502	131.8554	11.4828
		RMSProp, Loss MAE	9.76632	207.5074	14.4051
		RMSProp, Loss MSE	7.89033	169.0175	13.0006
	LSTM	Adam, Loss MAE	7.24312	132.9047	11.5284
		Adam, Loss MSE	8.32073	182.8076	13.5206
		RMSProp, Loss MAE	6.43921	104.4532	14.4051
		RMSProp, Loss MSE	11.38947	323.2057	17.9779

In investing.com's Multilayer Perceptron model dataset with Adam's optimization, Loss MSE is the best evaluation value for forecasting stock prices with a minimum MAE value of 4.41644, MSE value, MAE value 57.9040 and RMSE value 7.60947.

Tesla stock price forecasting predictive model with MLP model, Adam optimation, Loss MSE is Figure 4.

FIGURE 4. MLP Predictive Model (Opt : Adam, Loss MSE)

From Figure 4 in the case of Tesla's stock price model obtained from investing.com, it predicts that the learning pattern obtained is an upward trend based on the actual value of the prediction.

Table 3 of the yahoofinance dataset shows that the best model is the Multilayer Perceptron with Adam optimization, Loss: MAE is different from the investing.com dataset, with an MAE value of 6.20797, MSE 98.5519 and RMSE 9.92733. Next, look at the trend for optimization with the model and its optimization. The result is figure 5.

FIGURE 5. MLP Predictive Model (Opt : Adam, Loss MAE)

In Figure 5, from the Yahoofinance dataset, Tesla's price trend is predicted to experience a downward trend, unlike the previous dataset, which is predicted to experience an uptrend.

It should be noted that the MLP model is the best model of the model proposed in this study so that the pattern of the dataset can be known and Adam optimization, Loss MSE is the best optimization for investing.com dataset and Adam optimization, Loss MAE is the best optimization to see Tesla stock price trend from dataset sourced from yahoofinance.

CONCLUSION

This research is about the prediction of Tesla stock price using the deep learning neural network model and LSTM from the investing.com dataset and yahoofinance. The best model for the prediction of Tesla stock price on the dataset sourced from investing.com is the MLP model with Optimization (Adam, Loss: MSE) where the MAE value for this model is 4.41644, MSE 57.9040, and RMSE 7.60947 is the smallest compared to the LSTM model. In the yahoofinance dataset, the best model for modeling Tesla stock price predictions is the MLP model with optimization (Adam, Loss: MAE), the smallest values of MAE, MSE, and RMSE, respectively, are 6.20797, 98.5519, and 9.92733.

ACKNOWLEDGMENTS

We would like to thank LPPM Bina Sarana Informatika University for organizing the 2nd edition of ICAISD.

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