

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



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Table of Contents

Preface: 2nd International Conference on Advanced Information Scientific Development (ICAISD) 2021	0100
Committees: 2nd International Conference on Advanced Information Scientific Development (ICAISD) 2021	010002
Keynote Speaker: 2nd International Conference on Advanced Information Scientific Development (ICAISD) 2021	010003
 APPLIED SCIENCE 	
The review analysis of zoom meeting and Google meeting user by using the KNN algorithm Muhammad Rezki, Kartika Handayani, Badariatul Lailiah, Rabiatus Sa'adah, and Octa Pratama Putra	020001
Critical analysis of digitalization implementation for covid 19 vaccination registration Raden Roro Roosita Cindrakasih, Riastri Novianita, Pramelani, Abdul Aziz, and Priyono	020002
The evaluation of information security awareness level in Indonesian E-government service user: A knowledge attitude behaviour approach Ade Surya Budiman, Fahrizal, Mari Rahmawati, Desmulyati, and Ahmad Al Kaafi	020003
Implementation of the modified nearest neighbor (M-KNN) algorithm for book classification Fricles A. Sianturi, Petti I. Sijabat, Amran Sitohang, Arjon Samuel Sitio, Yuda Perwira, Baringin Sianipar, Jonson Manurung, and Dedi Candro Parulian Sinaga	020004
Instagram user sentiment analysis of E-commerce promo using Naïve Bayes classifier algorithm method Yunita, Jenie Sundari, Ahmad Setiadi, Rahmat Hidayat, and Imron	020005
Comparison of data mining algorithm in predicting TLKM stock price Reza Maulana, Wahyu Nugraha, Nurmalasari, Latifah, and Panny Agustia Rahayuningsih	020006
Factors affecting the use of Zoom app in online lectures during Covid-19 pandemic Sukri Syafrudin, Kartika Handayani, Ranu Agastya Nugraha, Siti Lestari, and Lindung Parningotan Manik	020007
Classification of brain tumor types using Convolutional Neural Network (CNN) Karlana Indriani, Diah Puspitasari, Wina Widiati, Eko Yulianto, Asta Pratiwi, and Kresna Ramanda	020008
Sentiment analysis on Indonesian stock investment application (IPOT) reviews using naive bayes algorithm and genetic algorithm as feature selection method D. A. Muthia, D. A. Putri, R. Sari, and R. Y. Hayuningtyas	020009
Classification of potato leaf diseases based on texture, shape and color features using the random forest algorithm Adilah M. Tika, Hendra Supendar, Miwan Kurniawan Hidayat, Ahmad Setiadi, and Sri Muryani	020010

Twitter in analysis of policy sentiments of the omnibus law work creative design Windu Gata, Surohman Surohman, and Hendri Mahmud Nawawi	0200
The comparison of Zoom meeting and Google Meet acceptance toward the online learning using TAM method Hanggoro Aji Al Kautsar, Asep Sayfulloh, Kartika Handayani, Abdul Latif, and Muhammad Rifqi Firdaus	020012
The role of transformational leadership as a mediating variable in delone and mclean information system model (Case study: Online learning usage Universities in Indonesia) Siti Nurhasanah Nugraha, Rangga Pebrianto, Dwi Yuni Utami, Narti, and Ridan Nurfalah	020013
Particle swarm optimization for feature selection in sentiment analysis on the application of digital payments OVO using the algorithm of Naive Bayes Ratih Yulia Hyuningtyas, Retno Sari, and Wina Yusnaeni	020014
The algorithm comparison of support vector machine and Naive Bayes in sentiment analyzing the Tiktok application Sopian Aji, Jenie Sundari, Yunita, Imron, and Octa Pratama	020015
Sentiment analysis of computer-based national examination policy with data mining approach Iqbal Dzulficar Iskandar, Agung Baitul Hikmah, Deddy Supriadi, Taufik Wibisono, and Yani Sri Mulyani	020016
Health protocol campaign tweet classification during the Covid-19 pandemic Frieyadie, Fachri Amsury, Irwansyah Saputra, Ita Suryani, Asriyani Sagiyanto, Liliyana, and Instanti Elyana	0200
Comparison of Logistic Regression, K-Nearest Neighbour, and decision tree (C4.5) on parameter optimization to increase prediction of breast cancer Harsih Rianto, Omar Pahlevi, Rudianto, Amrin, and Paramita Kusumawardhani	020018
Analysis of human factors and technology on mobile-based academic information systems Amin Nur Rais, Warjiyono, Sugiono, Rousyati, and Richky Faizal Amir	020019
Recognition of cat ras of face and body using convolutional neural networks Akhmad Wahyu Aji, Esmeralda Contessa Djamal, and Ridwan Ilyas	020020
Combination of K-Means method with Davies Bouldin index and decision tree method with parameter optimization for best performance Elly Muningsih, Chandra Kesuma, Sunanto, Suripah, and Aprih Widayanto	020021
Determining student satisfaction levels in online learning during the Covid-19 pandemic using the K-Medoids algorithm Ririn Restu Aria, Susi Susilowati, Susliansyah, Isnurrini Hidayat Susilowati, and Iin Soraya	020022
The implementation of the Simple Additive Weighting (SAW) method to determining the superior commodity of Tasikmalaya city Yani Sri Mulyani, Ai Ilah Warnilah, Ahmad Madkur, Hiqma Nur Agustina, Andini Linarsih, Herlan Sutisna, Fahmi, and Gusti Ayu Rai Made Suarniti	020023

Evaluation of the application of the integration model of D&M and UTAUT in the online learning system for routing and switching essentials subject	Nuzul Imam Fadlilah, Corie Mei Hellyana, Denny Pribadi, Deddy Supriyadi, and Ai Ilah Warnilah	020024
The digital transformation of retail industry in Yogyakarta Indonesia and it's effectiveness in consumer perspective during pandemic Covid 19	Chriswardana Bayu Dewa, Lina Ayu Safitri, Diah Pradiatiningtyas, Sri Kiswati, and Wisnu Hadi	020025
Wind speed prediction using independent component analysis and convolutional neural networks	Meli Melawati, Esmeralda C. Djamal, and Ridwan Ilyas	020026
Classifier types of personal document imagery using convolutional neural network	Hinggil Pawestri, Esmeralda C. Djamal, and Ridwan Ilyas	020027
Comparison of saw and topsis methods for determining online learning management system in the pandemic time	Sunarti, Dewi Ayu Nur Wulandari, Omar Pahlevi, Frans Edward Schadu, and Indah Purwandani	020028
Decision support systems to choose the type of tourist object that are opened after covid 19 pandemic using TOPSIS method	Enok Tuti Alawiah, Tati Mardevi, Sefrika, Dwi Andini Putri, and Siti Nurwahyuni	020029
Research methodology for computer science	Mahyuddin K. M. Nasution, Marischa Elveny, and Rahmad Syah	020030
Mining Twitter data on Covid-19 for sentiment analysis using SVM algorithm	Dwi Andini Putri, Dinar Ajeng Kristiyanti, Elly Indrayuni, Acmad Nurhadi, and Dinda Ayu Muthia	020031
Decision support system for determining the choice of majors in vocational high schools using profile matching method	Eni Irfiani, Fintri Indriyani, Frans Edward Schadu, and Syaiful Anwar	020032
Twitter sentiment analysis using support vector machine and deep learning model in e-learning implementation during the Covid-19 outbreak	Dinar Ajeng Kristiyanti, Dwi Andini Putri, Elly Indrayuni, Acmad Nurhadi, and Akhmad Hairul Umam	020033
Subjective norm and religiosity in public acceptance towards digital money usage with TAM model	Anita Primastiwi, Taufan Adi Kurniawan, and Devy Putri Milanda	020034
Classification of Alzheimer's disease using convolutional neural network based on brain MRI image	Siti Khotimatul Wildah, Sarifah Agustiani, Ali Mustopa, Hamdun Sulaiman, and Ami Rahmawati	020035
Sentiment analysis review flip app users on Google play using Naïve Bayes algorithm and support vector machine with smote technique	Hermanto, Taufik Asra, Antonius Yadi Kuntoro, Riza Fahlapi, Lasman Effendi, and Ferry Syukmana	020036
Comparison of pyrus fruit classification using K-Nearest Neighbor (KNN) and Adaptive Neuro Fuzzy Inference System (ANFIS) algorithms	Riyan Latifahul Hasanah, Indarti, Dewi Laraswati, Marlina, and Agus Priadi	020037

Sentiment analysis of Google Meet and zoom application user reviews on online learning in the Covid-19 period using algorithms support vector machine and Naive Bayes based on particle sarm optimization	Astrid Noviriandini, Hermanto, Arif Hidayat, Novita Indriyani, and Irwin Ananta Vidada	0200
Application of applied cognitive work analysis method as knowledge design management system model	Eri Bayu Pratama, Windi Irmayani, Yoki Firmansyah, Ragil Wijianto, and Ina Maryani	0200
Particle swarm optimization comparison on decision tree and Naive Bayes for pandemic graduation classification	Embun Fajar Wati, Anggi Puspita Sari, Enok Tuti Alawiah, Martua Hami Siregar, and Biktra Rudianto	020040
Analysis of consumer satisfaction levels with online shopping intentions using validity and reliability	Irmawati Carolina, Adi Supriyatna, Suharjanti, Rachman Komarudin, Ghofar Taufiq, and Ida Zuniarti	020041
Two factor authentication in E-voting system using time based one time password	Angga Fantiya Hermawan, Faiza Renaldi, and Fajri Rakhmat Umbara	0200
Determination of elderly card recipients in west Jakarta by modeling C4.5 algorithm using Python	Normah, Ita Yulianti, Bakhtiar Rifai, Siti Nurajizah, and Ainun Zumarniansyah	020043
Implementing public participation geographical information system to determine subsidized market operation of primary commodities in Indonesia using analytical hierarchy process	Muhamad Gema Almauludi, Faiza Renaldi, and Wina Witanti	020044
Implementing geographical information system in selecting a proper health facilities based on analytical hierarchy process	Reanto Ansori H., Faiza Renaldi, and Wina Witanti	020045
Implementing secure rest API on the integration of electronic medical records between a local hospital and nearby private clinics	Hary Suryanto, Faiza Renaldi, and Irma Santikarama	020046
Entrepreneurial capacity measurement for entrepreneurs	Yasinta Indrianti, Violleta Florencia, and Elisabeth Tirta Santoso	020047
A model to optimize palm oil biomass supply chain by considering production traceability information	Heru Pranoto, Muhammad Zarlis, Syahril Efendi, and Herman Mawengkang	020048
Logistics distribution supply chain optimization model with VRP in the context of E-commerce	M. Khahfi Zuhanda, Herman Mawengkang, Saib Suwilo, Mardiningsih, and Opim Salim Sitompul	020049
Optimization for support chain planning of crude oil industry	Lilis, Opim Salim Sitompul, Sutarman, Saib Suwilo, and Herman Mawengkang	020050

Improving KNN and random forest accuracy by enhancing WBCs images using shock filtering equation	Gregorius Vito and P. H. Gunawan	020051
Pedestrian flow simulation using macroscopic model in Jalan Lampulo Banda Aceh	Dara Hanifah and P. H. Gunawan	020052
The use of resampling techniques to overcome imbalance of data on the classification algorithm	Riska Aryanti, Yoseph Tajul Arifin, Sayyid Khairunas, Titik Misriati, Sopiyan Dalis, Taufik Baidawi, Rizky Ade Safitri, and Siti Marlina	020053
Multi-objective optimization model supply chain network design by considering supply uncertainty	Puteri Fajar Addini, Saib Suwilo, and Herman Mawengkang	020054
Monte Carlo's simulation method from the law of large numbers on Chebyshev's inequality	Rifky Pradana Daulay, Open Darnius, and Elvina Herawati	0200
Heat transfer in non-Newtonian fluid	Sarah Violita Sirait, Tulus, and Mardiningsih	0200
Flow optimization in network systems with graph theory	Bimo Chantio Sitio, Herman Mawengkang, and Tulus	0200
Water distribution network optimization	Sutarman and Herman Mawengkang	020058
Data envelopment analysis to determine the size of productive scale with real and integer value data	Depi Purnama Sari Ritonga, Sutarman, and Syahril Efendi	020059
The 7E's instructional model and its longitudinal impact on the mathematics achievement of tertiary students	Milagros R. Baldemor	020060

ARTIFICIAL INTELLIGENCE

Von Mises stress analysis of CoCrMo-on-CoCrMo hip prosthesis based on body mass index: 2D FEM estimation	Muhammad Imam Ammarullah, Ilham Yustar Afif, Mohamad Izzur Maula, Mohammad Tauviqirrahman, Athanasius Priharyoto Bayuseno, Jamari, Tri Indah Winarni, Hasan Basri, Ardiyansyah Syahrom, and Amir Putra Md Saad	030001
Analysis of the quantum perceptron algorithm for classification of bank marketing data	Solikhun, Syahril Efendi, Muhammad Zarlis, and Poltak Sihombing	030002
Determining chronological aspects of a direct and indirect cause of dominance factors on a self confidence using applied method of Structure Equation Model; Path Analysis	Siti Mudrika Zein and Hendra Setiawan	030003

Deep learning for Tesla's stock prices prediction Hendri Mahmud Nawawi, Muhammad Iqbal, Yudhistira Yudhistira, Imam Nawawi, Slamet Widodo, and Nuraeni Herlinawati	030004
Comparison of machine learning algorithm for prediction learning achievement on e-learning students Elin Panca Saputra, Indriyanti, Supriatiningsih, Taufik Rahman, and Ahmad Hafidzul Kahfi	030005
Palm recognition using local binary pattern histogram and cascade method Witriana E. Pangesti, Qudsiah N. Azizah, Eva A. Pratama, Adhi D. Suriyanto, and Andreyestha	0300
Eye pupil image segmentation conducted with intensity adjustment method and active contour method Nissa Almira Mayangky, Dwiza Riana, Sri Hadiani, Siti Nurdiani, Ridan Nurfalah, and Achmad Rifai	030007
KNN and C4.5 algorithms for predicting whirlwind disasters Ayuni Asistyasari, Sukmono Bayu Adhi, Bibit Sudarsono, Roosita Cindrakasih, and Indah Puspitorini	030008
Comparison of C4.5 and Naïve Bayes algorithm to determine recommendations of patients receiving the Covid-19 vaccine at Cimanggis Jaya clinic Trevino Aristarkus Pakasi, Lilyani Asri Utami, Artika Surniandari, Hilda Rachmi, and Dini Nurlela	0300
PSO optimization for analysis of online marketplace products on the SVM method Sucitra Sahara, Annida Purnamawati, Sulaeman Hadi Sukmana, Mely Mailasari, Erma Delima Sikumbang, and Nurlaela Eva Puji Lestari	0300
Faster method for negation of sum of products Yavuz Can	030011
Improving the accuracy of k-nearest neighbor (k-NN) using Synthetic Minority Oversampling Technique (SMOTE) and Gain Ratio (GR) for imbalanced class data Adli A. Nababan, Sutarman, Muhammad Zarlis, and Erna B. Nababan	030012
Two-wheeled motor selection recommendations using weighted product method Susi Susilowati, Susliansyah, Ririn Restu Aria, Ratnawaty Marginingsih, and Wiwik Widiyanti	030013
Numerical study of underwater topography with measurement data Satoshi Iwakami, Masahiko Tamega, Masahide Sanada, Michiaki Mohri, Yoshitaka Iwakami, Naoki Okamoto, Ryousuke Asou, Shuji Jimbo, and Masaji Watanabe	030014
Internet of things based siren for earthquake mitigation Verry Riyanto, Indah Ariyati, Ridwansyah, and Susy Rosyida	030015
Segmentation of rice leaves image for disease classification with K-means and GLCM Recha Abriana Anggraini, Fanny Fatma Wati, Eva Argarini Pratama, Yustina Meisella Kristania, and Haerul Fatah	030016

Over-sampling strategies with data cleaning for handling imbalanced problems for diabetes prediction	Wahyu Nugraha, Reza Maulana, Latifah, Panny Agustia Rahayuningsih, and Nurmalasari	030017
K nearest neighbor algorithm based on particle swarm optimization for optimization classification rice leaf disease	Rizal Amegia Saputra, Sri Wasiyanti, Dede Firmansyah Saefudin, Siti Masripah, and Lila Dini Utami	030018
Classification of tomato leaf disease and combination extraction features using K-NN algorithm	Baginda Oloan Lubis, Dony Oscar, Firstianty Wahyuhening Fibriany, Budi Santoso, Jefi, and Arief Rusman	0300
Comparison of machine learning algorithm and feature selection particle swarm optimization on software effort estimation	Wahyutama Fitri Hidayat, Ahmad Setiadi, Hendra Supendar, and Miwan Kurniawan Hidayat	0300
Optimization the Naive Bayes algorithm using particle swarm optimization feature selection and bagging techniques for detection of Alzheimer's disease	Rizal Amegia Saputra, Diah Puspitasari, Mochamad Wahyudi, Lis Saumi Ramdhani, and Kresna Ramanda	03002
Improving machine learning performance using exponential smoothing for liver disease estimation	Indah Suryani, Hani Harafani, Ispandi, Duwi Cahya Putri Buani, and Fernando B. Siahaan	030022
Multiple-objective as decisions in computing	Mahyuddin K. M. Nasution, Marischa Elveny, and Rahmad Syah	030023
A robust optimization approach for measuring efficiency in stochastic DEA	Hengki Tamando Sihotang, Syahril Efendi, Muhammad Zarlis, and Herman Mawengkang	030024
Deep learning for Twitter sentiment analysis about the pros and cons of Covid-19 vaccines in Indonesia	Dinar Ajeng Kristiyanti, Ahmad Al Kaafi, Esty Purwaningsih, Ela Nurelasari, and Baiatun Nisa	030025
Design innovation model for digital ecosystem: Development forum based on service oriented against internet addiction	Muharman Lubis, Hamdan Dzikrurrobi, and Dini Oktarina Handayani	030026
Application of K-mean clustering algorithm in grouping data prospective new students	Dedi Saputra, Haryani, Agus Junaidi, Taufik Baidawi, and Artika Surniandari	030027
Framework for tackling stochastic DEA based on data-driven approach	Hengki Tamando Sihotang, Syahril Efendi, Muhammad Zarlis, and Herman Mawengkang	030028
Classification of lemon fruit ripe using convolutional network	Brianly Hedi Rawung, Esmeralda Contessa Djamal, and Rezki Yuniarti	0300
Financial optimization using stochastic programming model	Ella Silvana Ginting, Devy Mathelinea, and Herman Mawengkang	030030

Model Naive Bayes classifiers for detection apple diseases	
Sumanto, Adi Supriyatna, Irmawati Carolina, Ahmad Yani, Ruhul Amin, and Eka Dyah Setyaningsih	030031
Indoor temporal spatial analysis on the movement of nurses in hospitals based on local Wi-Fi networks	
Mia Mediyanti, Faiza Renaldi, and Asep Id Hadiana	030032
Python gmail dictionary attack using wordlist	
Septian Rheno Widiyanto, Muhammad Sony Maulana, Eri Bayu Pratama, Yoki Firmansyah, and Nurmalasari	030033
Smart queueing for outpatient in a private hospital using location-based service	
Sayyidah Sarah Sukmanisa, Faiza Renaldi, and Irma Santikarama	030034
Clothing type classification using convolutional neural networks	
Raden Gilvia Adinda Putri, Esmeralda C. Djamal, and Sinta Sundari	030035
Microservices technology in citizen-centric E-government	
Rival Muhamad Saepuloh, Faiza Renaldi, and Fajri Rakhmat Umbara	030036
Recommendations for cardiac disease prevention packages based on medical records with collaborative filtering recommendations using factorization matrix	
Christine Chlyw Nova, Faiza Renaldi, and Fajri Rakhmat Umbara	030037
A constrained based approach for solving the multi-period single sourcing problem	
Adi Suarman Situmorang, Herman Mawengkang, Tulus, and Opim Salim Sitompul	030038
On solving robust optimization using decomposition approach	
Hendra Cipta, Saib Suwilo, Sutarman, and Herman Mawengkang	030039
A binary programming model for logistics problems with multi-suppliers and relaxed time Windows	
Muliawan Firdaus, Herman Mawengkang, Tulus, and Sawaluddin	030040
A framework of nonparametric regression to predict natural gas demand	
Rani F. Sinaga, Sutarman, Tulus, Open Darnius, and Herman Mawengkang	030041
A mixed-integer model for aircraft fleet assignment and manpower planning problems under uncertainty	
Rianita Simamora, Herman Mawengkang, Saib Suwilo, and Muhammad Zarlis	030042
A dynamic model of rumor spreading with time delay	
Yanty Maria Rosmauli Marbun, Herman Mawengkang, Tulus, and Sawaluddin	0300
A sustainable forest planning model with water allocation optimization for power plant	
Juli Antasari Sinaga, Tulus, Herman Mawengkang, and Mahyuddin K. M. Nasution	030044

Multi-Criteria decision making model for CSR program planning in the direction of a sustainable CPO industry	
Tua Halomoan Harahap, Herman Mawengkang, Saib Suwilo, and Sutarman	030045
Designing a dynamic model of waste management to get a sustainable living condition	
Husain, Herman Mawengkang, Devy Mathelinea, Nurul Fitriani, and Avery Boy Detinty	030046
Developing teacher wellbeing Android application based on face recognition	
Sasmoko, Yasinta Indrianti, Abu Yazid Abu Bakar, and Jurike Moniaga	030047
A new frequency domain and dynamic time warping based feature: WFOD feature	
Ekin Can Erkus and Vilda Purutcuoglu	030048
Stationarity test for medicine time series data	
Devy Mathelinea, R. Chandrashekar, and Herman Mawengkang	030049
Arrhythmia classification using feature selection based on particle swarm optimization	
Diah Puspitasari, Abdul Syukur, A. Zainul Fanani, and Zainal A. Hasibuan	030050
Mathematics model for location routing problems with intermediate transfer stations on waste	
Miko Purnomo, Sawaluddin, and Parapat Gultom	030051
Mixed integer nonlinear programming model for sustainable production planning and scheduling based on energy consumption	
Tohonan Kristina N. Butar-Butar, Herman Mawengkang, and Syahriol Sitorus	030052
Development of heuristic method for scenario formation of stochastic program problems	
Mimmy Sari Syah Putri, Herman Mawengkang, Saib Suwilo, and Tulus	030053
Data-Driven optimization approach to health care management planning	
M. Irfan Fahmi, M. Zarlis, Syahril Efendi, and Tulus	030054
The Mars method approach in the analysis of earthquake hazard predictions in Sumbawa	
Dadang Priyanto, Muhammad Zarlis, and Syahril Efendi	030055

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

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



Taufik Baidawi, M.Kom



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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.

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.

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Deep learning for Tesla's stock prices prediction

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Deep Learning for Tesla's Stock Prices Prediction

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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.

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].

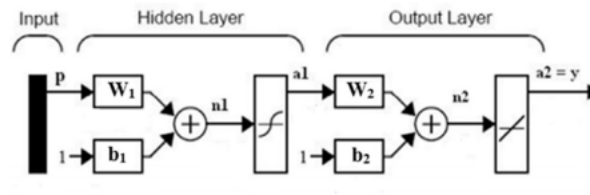


FIGURE 1. Neural Network Architecture [9]

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.

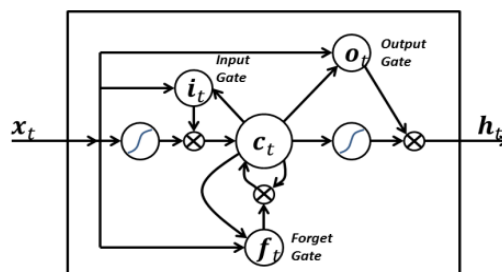


FIGURE 2. LSTM Model Architecture [13]

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.

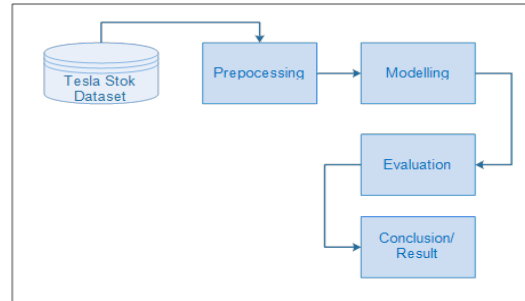


FIGURE 3. Framework

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

$$St = f(UxXt + WxSt - 1) \quad (1)$$

$$Ot = g(VxSt) \quad (2)$$

Where St is the network memory at time t ;

U , W , and V are the weight sharing matrices 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:

$$it = \sigma(Wix(ht - 1, xi) \quad (3)$$

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

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.

$$MAE = \frac{\sum actual - prediction}{n} \quad (5)$$

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

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

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	Optimaton	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 optimization, Loss MSE is Figure 4.

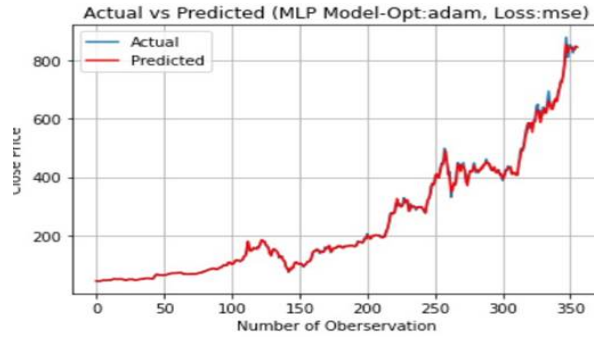


FIGURE 4. MLP Predictive Model (Opt : Adam, Loss MSE)

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.

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