

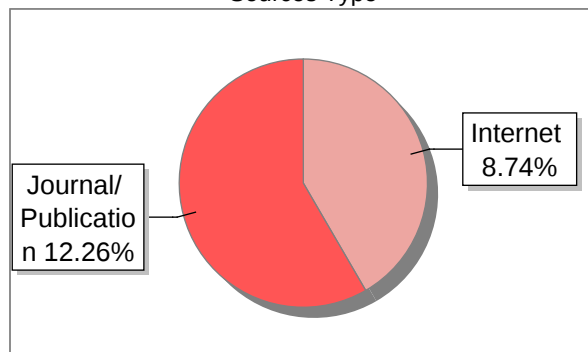
### Submission Information

|                          |                               |
|--------------------------|-------------------------------|
| Author Name              | Kristiaean                    |
| Title                    | Spoofing2022                  |
| Paper/Submission ID      | 4297905                       |
| Submitted by             | kristiawan@edu.unisbank.ac.id |
| Submission Date          | 2025-09-01 08:10:40           |
| Total Pages, Total Words | 24, 7395                      |
| Document type            | Article                       |

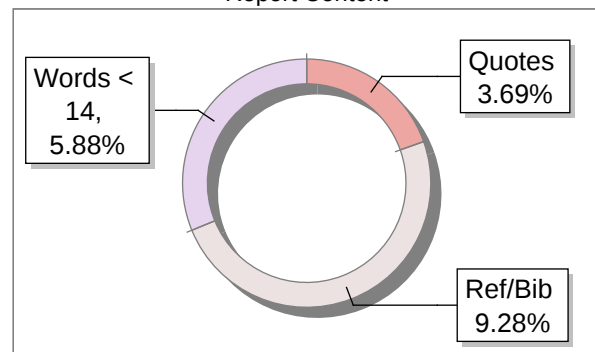
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## **PROCEEDINGS**

**Technology 4.0 for Smart Ecosystem: A New  
Way of Doing Digital Business**

## **ISEMANTIC 2022**

**7th International Seminar on Application for Technology of  
Information and Communication**

**September 17th – 18th, 2022**

**30**

**Universitas Dian Nuswantoro**

**Semarang, Indonesia**

**ISBN: 978-1-6654-8838-9**

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## Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business i

### Table Of Contents

|                                                                |         |
|----------------------------------------------------------------|---------|
| Greetings from Chair.....                                      | ii      |
| Welcome <sup>29</sup> Speech from IEEE Indonesia Section ..... | iv      |
| Welcome Speech from IEEE Power & Energy Society .....          | vi      |
| Welcome Speech from Vice Rector.....                           | vii     |
| Committee .....                                                | ix      |
| General Information .....                                      | xi      |
| Keynote Speaker 1 .....                                        | xii     |
| Keynote Speaker 2 .....                                        | xiii    |
| Keynote Speaker 3 .....                                        | xiv     |
| Keynote Speaker 4 .....                                        | xv      |
| Paper List .....                                               | xvi     |
| Proceedings .....                                              | 1 - 505 |

2022 International Seminar on Application for Technology of Information and Communication

Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business ii

Greetings from Chair

Dr. Eng. Farrikh Alzami, M.Kom

Chair of iSemantic 2022, Universitas Dian Nuswantoro

Bismillahirrohmanirrohim

Assalamu'alaikum wr. wb

Good morning all authors, participants and honorable guests.

The distinguished Rector of Universitas Dian Nuswantoro, Prof. Dr. Ir. Edi

Noersasongko, M.Kom;

The distinguished Representative of IEEE Indonesian Section, Dr. Ing. Wahyudi Hasbi  
as Chair, IEEE Indonesia Section;

The distinguished Representative of IEEE Power & Energy Society as financial  
sponsor of iSemantic 2022, Prof. Ir. Arif Nur Afandi, Ph.D as Chair, IEEE Power &  
Energy Society;

Dearest honorable guests and all representatives from universities and other  
institutions;

The distinguished Keynote Speakers and Dearest authors and participants for today's  
webinar conference.

I am pleased to welcome you to the webinar, on International Conference to discuss  
the scope of Application for Technology of Information and Communication.

I am highly honored to take this opportunity, on behalf of all committee and organizer,  
to welcome all of you today to this 7th International Seminar on Application for  
Technology of Information and Communication (iSemantic 2022)

The iSemantic 2022 international conference will face big challenges, because it is still  
in a pandemic period, and this does not create an obstacle for science to continue to  
grow. Another challenge is the quality of research. The standard of research in  
iSemantic 2022 is the best research. All thanks to supporting from IEEE Indonesia

Section and IEEE Power & Energy Society as financial sponsor and the hard work of the iSemantic 2022 committee to make this happen.

Last year, we have 76 papers accepted, out of 148 submitted papers, from 7 different countries including, United Arab Emirates, Taiwan, USA, Iraq, Ireland, Malaysia and Indonesia All the 76 papers presented last year have been successfully published in IEEE Xplore and indexed by SCOPUS.

2022 International Seminar on Application for Technology <sup>16</sup> or Information and Communication

Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business iii

And now with new topic “Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business”, there are 88 papers accepted, out of 150 submitted papers from 13 different countries including, India, Taiwan, Bangladesh, China, Uni Arab Emirates, Philippines, South Africa, Australia, United States of America, Iraq, Malaysia, Rwanda and Indonesia and they are ready to be presented by the authors in the conference today.

It is also my honor today to have four great persons who have agreed to be the Keynote Speakers for this webinar. The distinguished 4 persons are as follows:

1. Dr. Shay Bahramirad, the Vice President Engineering and Smart Grid ComEd (Oakbrook Terrace, IL)
2. Prof. Mohd. Faizal Bin Abdollah, from Associate Professor at Faculty of Information and Communication Technology University Teknikal Malaysia Melaka
3. Dr. Guruh Fajar Shiddik, M.CS, Vice Rector from Universitas Dian Nuswantoro Semarang
4. Celia Shahnaz Ph.D, IEEE WIE Committee Chair-Elect and Professor, Department of EEE, BUET, Bangladesh

<sup>31</sup> Therefore, I would like to thank all the organizers, supporters, and organizing committee members of iSemantic 2022 <sup>33</sup> who have made this conference happen. I believe that without their support and hard work, iSemantic 2022 in COVID-19 pandemic would not have come true.

I believe that by participating in this webinar, together, let us accelerate the exchange of ideas, scaling-up of good practices and make collaboration together.

We do hope that in this webinar iSemantic is also going to be a great success like the one last year, and we request for your support to make this event a memorable and successful one.

<sup>70</sup> Thank you for your participation and enjoy the series of webinar iSemantic event.  
Wassalamualaikum wr. wb

## 2022 International Seminar on Application for Technology or Information and Communication

### Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business iv

#### Welcome Speech from IEEE Indonesia Section

Ir. Linawati, M.Eng.Sc., Ph.D.  
Secretary, IEEE Indonesia Section

Dear Distinguished Guests, Colleagues, researchers, professionals, ladies, and gentlemen.

A prosperous and warm greeting.

First of all, let me thank to honorable rector of Universitas Dian Nuswantoro, Prof. Dr. Edi Noersasongko, M., and his representative; Chair of IEEE Power and Energy Society Prof. Afandi; Dr. Farih Al Zami as General Chair of this conference, thank you for inviting me to give the opening of this conference and the honorable; Dr. Saibah Ramirat, Dr. Guruh Fajar Shiddik, and Prof. Mohammad Faisal Bin and special for my close friend, Prof. Dr. Celia Shanasz, Ph.D. as speaker of this conference, as well as presenter and participants of the conference.

As well as a presenter and participants of this conference. On behalf of the chair of the IEEE Indonesia section, Bapak Dr. Wahyudi Hasbi, I'm pleased to welcome you to the iSemantic 2022.

We are glad that the situation is getting better because the pandemic now can be controlled. However, the conference is still held as a virtual conference because we're still facing unpredictable situations. This event activity tends to enrich knowledge, about the lattice issue, opinion, bright ideas of student, researcher and Academic. A new innovation in technology for future energy especially in the information and communication technology. That is the theme of this conference. iSemantic 2022 will encourage discussion and hope to inspire participants from a variety of things to start a collaboration within and across disciplines for the advancement of science. Session will also be important scientific progress and highlight the impact of Science and Technology. We hope you will have a productive and enjoyable time at this special conference. Honorable guests, keynote speaker, ladies and gentlemen, IEEE has over 400,000 members in more than 160 countries and more than 170,000 student members. It has the largest student members and a professional community, and let me explain about the IEEE Indonesia section briefly. As the section as one of the regular organization units of IEEE, IEEE Indonesia section was founded in 1988 and its development over the past 34 years. IEEE Indonesia section has contributed significantly in various activities that encourage the role of Science and Technology for Humanity in Indonesia, IEEE Indonesia together with volunteer members. All stakeholders have produced various activities by supporting more than 20,000 IEEE conference publications and more than 260 IEEE journals in Indonesia. IEEE

**Indonesia has also sponsored and supported more than 50 high quality conferences**

## 2022 International Seminar on Application for Technology <sup>5</sup> or Information and Communication

### Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business v

each year, including this conference, the result of the quality conference publication are published in the IEEE Xplore index by scopus, WOS and other major <sup>74</sup> databases, which has more than 5 million publications and more than 12 million download each month. As we all know, IEEE always maintains high quality publication as part of the intellectual culture. IEEE Indonesia also hold more than 40 professional technical, non-<sup>47</sup> Technical and administrative activities each year, for all members. Currently, we have more than two thousand nine hundred (2900) members and more than 50 senior members, consisting of professional industry Academia and government, IEEE Indonesia, supported the development of 26 technical society chapters, joint chapters and for this conference who is a major player and supporter from technical IEEE Power and Energy Society (IEEE PES), And IEEE Indonesia section has 33 University student branches and 9 IEEE student branch chapters, which have become a forum for Technical and social activities that provide the best experience for Indonesian student and graduate student members. In addition, we have a non-technical affinity group, consisting of young, professional and women in engineering, and one IEEE sights on e-health and telemedicine interest group. And of course, I would like to encourage all of you to become an IEEE member to get all the benefits, including broader networking between Academia, professional, and government members. Last year, IEEE Indonesia also initiated cooperation with the Direktorat Jenderal of higher education, in order to synchronize and support IEEE activities in the Indonesian Ministry of Education, and culture program, especially for the Kampus Merdeka, emancipated learning program. IEEE Indonesia is also exploring cooperation with the Indonesian industry in various activities. actively involved in providing input, the preparation of related government regulation <sup>68</sup> and other activities. Finally, congratulations to the conference <sup>68</sup> committee for making this event Success. We do hope you will join us to make the international seminar on application for technology of information and communication conference, a memorable event. Thank you, and have a great day.

2022 International Seminar on Application for Technology <sup>5</sup> or Information and Communication

Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business vi

Welcome Speech from IEEE Power & Energy Society

Prof. Ir. Arif Nur Afandi, Ph.D

Chair of PES Chapter

Good morning,

The honorable speaker, colleagues, professor, lectures, researcher, ladies and gentlemen.

<sup>21</sup> On behalf of the Power and Energy Society chapter of IEEE Indonesia. I would like to express my great gratitude and welcome you to iSemantic 2022 as a flagship event of this year. This conference series is used to lead conferences in engineering and informatics technology with its relative aspects.

As in veteran series, fresh chapter always commits to support enhancement and other skill up including this conference for iSemantic 2022. I hope that iSemantic 2022 would be able to achieve providing and effective forum for academicians which is just participate to advance knowledge research and technology for humanity. I also hope all participants stay on in the conference with attractive and excited about the future program reading knowledge research technology for humanity. More offer, I wish to collaborate more for the academicians participants around the world with all of the expertise related in engineering and informative. So, in iSemantic 2022, I believe this event will drive to the exchange of the idea between all participants around the world. More offer, referring to the iSemantic 2022 the first chapter reference for greet invitation for all member, for all joining this program to come, enjoy, and develop activity as the first establishment of the first chapter on between 2015. The most member of first chapter come from the academicians and industrial also professional. I am sure that our synergy will make a better list and endeavor technology <sup>36</sup> for sustainable development and finding knowledge. Finally, my deep gratitude to the iSemantic team for bringing out this event in 2022. Also, Dian Nuswantoro led the organization for this memorable event.

Thank You.

2022 International Seminar on Application for Technology of Information and Communication

Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business vii

Welcome Speech from Vice Rector

Dr. Pulung Nurtantio Andono, S.T., M.Kom  
Vice Rector IV, Universitas Dian Nuswantoro

Bismillaahirrohmaanirrohiim:

Assalaamu'alaikum Wr. Wb.

Very good morning, Everybody:

First of all and the utmost of all, we would like to submit our high gratitude to Allah SWT, God the Almighty, for all the blessings and amenities within our life, so that we can meet safe and sound today for this prestigious international seminar at our beloved campus of Universitas Dian Nuswantoro, Indonesia. As General Chair, with great honor, we welcome you all and we thank you for your great participation in this 2022 iSemantic (International Seminar on Application for Technology of Information and Communication), with the topic: Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business.

In the second occasion, we would like to mention with pride all the distinguished Key-note Speakers today:

1. Dr. Shay Bahramirad, Vice President Engineering and Smart Grid ComEd (Oakbrook Terrace, Illinois), US;
  2. Prof. Mohd. Faizal Bin Abdollah, Associate Professor at Faculty of Information and Communication Technology University Teknikal Malaysia Melaka;
  3. Dr. Guruh Fajar Shiddik, MCS, Vice Rector of Computer Science Universitas Dian Nuswantoro, Indonesia.
  4. Mrs. Celia Shahnaz, Ph.D, IEEE WIE Committee Chair-Elect and Professor at Department of EEE, BUET, Bangladesh
- We thank you very much for sharing your great experience concerning the update topic in the world today.

Dear all the Audience of Great Researchers,

We would also like to wish you all, your family, relatives, and colleagues: great health, happiness, and success during this Covid-19 Pandemic that has been long lasting until

69  
43 now. We pray together that this pandemic will end very soon.

Thank you for coming here today in our online Seminar about Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business. We believe together that doing business today is different from that in the past. Doing business today using “TANGAN

2022 International Seminar on Application for Technology <sup>5</sup> or Information and Communication

Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business viii

KOSONG” [or virtually empty hand or DIGITAL BUSINESS] is very possible and even it is growing excellent and far more successful than the traditional business practices. This is our common challenges ahead as well as challenges for our children of tomorrow.

Dear Ladies and Gentlemen,

Through this Seminar, we encourage all of you to stay and participate actively to share ideas and thoughts so that this conference can become a platform of world discussions about the Technology 4.0 for Smart Ecosystem, especially making the best efforts and finding the new ways for doing Digital Business. We also encourage all the scholars, academicians, scientists, and practitioners to take a significant part in this international conference.

To bring our speech to an end, we would like to send our great appreciation to all the conference managers, all the reviewers, all the authors and co-authors for all the contribution to the success of this 2022 iSemantic conference. We also thank our publishing partner: IEEE Indonesia Section, IEEE Universitas Dian Nuswantoro Branch, and IEEE Power&Energy Society for the collaboration and participation, conference process, and the sponsorship.

We also thank all the 2022 iSemantic <sup>21</sup> <sup>21</sup> committee members for their great efforts and hard work so that this international seminar is running very well and becomes successful today and tomorrow.

A short poem:

“EAST OR WEST, HOME IS BEST”

PLEASE BE NICE, iSemantic IS THE BEST.

<sup>56</sup> Thank you, thank you very much!

Wassalaamu’alaikum Wr. Wb.

## Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business ix

### Committee

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**Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business x**

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## 2022 International Seminar on Application for Technology <sup>5</sup> or Information and Communication

### Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business xi

#### General Information

iSemantic 2022 will be host by Universitas Dian Nuswantoro, Semarang, Indonesia. Due the WHO has characterized our situation as ‘Global Pandemic’, iSemantic 2022 Conference will be held with virtual conference as suggestion from IEEE.

<sup>59</sup> All sessions will take place by the best selection application to perform our events. For the seminar ceremony and keynote speaker presentation, we will use YouTube Live, Digital terrestrial television from TVKU (name of broadcaster brand) and the parallel session in virtual conference will be held using Zoom meeting application. The author will present live and orally or the moderator will play the presentation video from respected author. The Author will also attend in the room for Question and Answering Session.

Following guidance from IEEE which can be obtained at:

<https://ieeemce.org/introductionto-ieee-virtual-events/> in section: can anybody hear me; by submitting the video presentation at YouTube, the author agree and give the iSemantic 2021 to have rights to download publish it into YouTube in specified channel’s playlist so any viewers (attendees) can watch the video presentation at <sup>58</sup> times that are convenient for them. We are looking forward to meet you at ceremony and parallel session.

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2022 International Seminar on Application for Technology <sup>5</sup> or Information and Communication

Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business xii

Keynote Speaker 1

**Dr. Shay Bahramirad**  
Vice President Engineering and Smart Grid ComEd  
(Oakbrook Terrace, IL)

Shay Bahramirad is the Vice President of Climate and Resilience at Quanta Technology. She is responsible for assisting cities and utilities with climate change risk assessments for their assets, operations, and services and for developing mitigation strategies and investment strategies for adapting to climate change. Her work powers the planet by reducing carbon emissions, creating cleaner air for everyone, and making communities resilient. Dr. Bahramirad has held several positions in the Energy Sector, including Vice President of Engineering and Smart Grid at ComEd; the electric utility in IL. In these roles, she has overseen and/or executed “grid of the future” visions, technical roadmaps, analytical frameworks, and investment strategies. <sup>48</sup> <sup>57</sup> She has also been responsible for system reliability, DER integration, grid strategy and analytics, standards, emerging technologies, STEM programming, and reimagining the power grid to mitigate and adapt to climate change. She has also developed talent strategies, industry engagement plans, and advocacy programs to support business objectives. Dr. Bahramirad is an editorial board member of the Electricity Journal, an adjunct professor at the Illinois Institute of Technology, and the IEEE/PES Vice President of New Initiatives and Outreach, overseeing the organization’s engagement with policymakers globally and developing strategies for the next generation of frameworks including smart cities. She is the founder of PES WiP(Women in Power).

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### **2022 International Seminar on Application for Technology of Information and Communication**

**Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business xiii**

**Keynote Speaker 2**

**Prof. Mohd. Faizal Bin Abdollah**  
Associate Professor at **Faculty of Information and  
Communication Technology University Teknikal  
Malaysia Melaka**

**Associate Professor Mohd. Faizal Bin Abdollah:** received, master in Malaysia National University (UKM) and a Ph.D (Computer Network and Security) in University Technical Malaysia, Melaka Malaysia in the year 2004 and 2009 respectively. Currently, he is an Associate Professor in the Faculty of Information and Communication Technology University Teknikal Malaysia Melaka. He is also also serving as a reviewer of reputed top ranked SCI-indexed journals. He also authored a book of chapter and serve as consultant for network and forensics. Dr. Mohd. Faizal Bin Abdollah main research interest includes Computer Network and Security.

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**3**  
2022 International Seminar on Application for Technology of Information and Communication

**Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business xiv**

**Keynote Speaker 3**

**Dr. Guruh Fajar Shiddik, M.Cs**

**13**  
**Dean of Computer Science Universitas Dian Nuswantoro**

Associate Professor Dr. Guruh Fajar Shiddik received Master Degree in University Technical Malaysia, Melaka Malaysia and Ph.D (in Cloud Computing) in Universitas Gajah Mada, Yogyakarta, Indonesia. Currently he is the Dean of Computer Science Universitas Dian Nuswantoro. His research is mainly in Cloud Data Center, Computer Vision, and public health. His paper is published in top scopus journal, such as IEEE Access, **54**  
**Computer Methods and Programs in Biomedicine** Elsevier, International Review on Modelling and Simulation, and so on

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**3**  
2022 International Seminar on Application for Technology of Information and Communication

Technology 4.0 for Smart Ecosystem: A New Way of Doing Digital Business xv

Keynote Speaker 4

Celia Shahnaz

**18**  
IEEE WIE Committee Chair-Elect

**2**  
Celia Shahnaz, SMIEEE, Fellow IEB, received Ph.D. degree from Concordia University, Canada and is currently a Professor, Department of EEE, BUET, Bangladesh since 2015 (<http://www.celiashahnaz.com>). She has published more than 150 international journal/conference papers. She is a recipient of the Canadian Commonwealth Scholarship/Fellowship and Bangladesh Academy of Science Gold Medal for her contribution in Science and Technology. Recently, her papers have received best paper awards in Biomedical Engineering tracks at TENCON 2017 and at IEEE WIECON-ECE 2016, in Humanitarian Challenge track at R10 HTC 2017. She has around 20 years of experience (more than 18 years as an IEEE volunteer) of leading impactful Technical, Professional, Educational, Industrial, Women Empowerment and Humanitarian Technology and PES related Projects at national/international levels. **41**

### 3 Spoofing Detection of Fake Speech Using Deep Neural Network Algorithm

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15 Abstract - Spoofing is a challenging research topic in Speaker Recognition. Spoofing, among others, can use fake speech, especially in the form of voice identity falsification or fraud, which is a problem that must be resolved. Various classification methods in Data Mining have been used in research to detect spoofing. However, The low level of accuracy, especially in managing large data, is an obstacle to using this approach. 42 Deep Neural Network (DNN) is one of the methods in Deep Learning that is often used in research that processes extensive data. The DNN approach is proven to have good performance. This study uses the DNN method in detecting the authenticity of the speaker's voice. The results show that DNN is a method that has good performance in detecting fake speech spoofing with a model accuracy rate of 96.5%, 97.3% precision, 96.5% recall, and 96.7% F1 Measure. 61

Keywords - Detection, Fake Speech, Classification, DNN.

#### I. INTRODUCTION

Speaker Recognition is a research topic that continues to grow. Speaker Recognition is a process of recognizing the speaker through the sound produced [1]. 46 Various approaches have been tried to make the maximum level of performance in overcoming multiple problems in speaker recognition, including the Gaussian Mixture Model (GMM), Hidden Markov Model (HMM), Support Vector Machine (SVM), and various Deep Learning methods such as Deep Neural Network (DNN) to Convolutional Neural Network (CNN) in various researches that have been done. 22 35

Spoofing is one of the exciting research topics in Speaker Recognition. Spoofing is a speaker masquerading as a real speaker to gain access to data from that speaker [2]. Research on speaker detection with fake speech has been carried out using various methods, including using the Gaussian Mixture Model 60 63

(GMM), such as the research conducted by Paul[3] and Rakhmanenko[4] and the Support Vector Machine (SVM) method in the research of Bhangale, Kaur and Panice[4]. [5]–[7], The two classic machine learning methods are still often used to research on spoofing attack detection.

The method of detecting speakers with fake speech is research that involves various models in designing models and evaluating models, including the Machine Learning approach. According to Roihan, Machine Learning (ML) is a branch of artificial intelligence that functions to overcome various problems [8]. In its development, ML is very useful in overcoming difficulties, especially those related to prediction. ML consists of three categories, namely: Supervised Learning (SL), Unsupervised Learning (UL), and Reinforcement Learning (RL) [9]. Supervised Learning or referred to as guided learning is machine learning using a label containing the appropriate answer.

Unsupervised Learning is unsupervised learning which means that a model does not need to be supervised because the model will work independently to find the desired information. While Reinforcement Learning is one type of ML algorithm consisting of smart agents that can work independently in overcoming a specific problem. The various ML algorithms mentioned above, both SL, UL, and RL, have helped to overcome problems in research according to their research needs. However, along with the development of technology and the complexity of the amount of data (Big Data), traditional Machine Learning Methods have limitations in decreasing accuracy in processing larger amounts of data. Deep Learning (DL) approach is one solution in overcoming this problem. The DL method is known as the right approach in managing large amounts of data in research [10]. Various DL methods that are often used in various kinds of text, audio and video-based research include Deep Neural Network (DNN), Convolutional Neural Network (CNN), and Recurrent Neural Network (RNN).

This study uses the Deep Neural Network (DNN) method in detecting the authenticity of the speaker's voice. Several studies using DNN in detecting the authenticity of the speaker's voice have also been carried out by several researchers, including research conducted by Yu[9] which uses DNN, and Dynamic Acoustic Features and Borhani[10] which uses DNN to detect Spoofing attacks. Research using DNN is proven

can make a good contribution in increasing the accuracy of Spoofing detection to determine the authenticity of the speaker's voice. DNN has advantages in its ability to train large amounts of data and then build a model that is useful in detecting spoofing attacks, and speakers with fake speech sounds.

This paper consists of 4 parts of writing, namely part 1 is the introduction which contains a discussion about the introduction of spoofing speakers and the research that has been done. The second part is about the research method used, part 3 is the result and discussion

2022 International Seminar on Application for Technology of Information and Communication (iSemantic)

that discusses the research results and discussion, while the fourth part contains conclusions about the research that has been done.

## II. RESEARCH METHOD

In this research, three well-known Machine Learning methods are used in overcoming various problems in Data Mining, namely:

### 1. Naive Bayes (NB)

NB is one method that is known to be often used in various researches on data mining. NB is a method created by Thomas Bayes in predicting future opportunities based on past experience [13]. This method is often used in various classification problems, both text, images, and audio.

### 2. K-Nearest Neighbour(KNN)

KNN is one of the data mining methods that performs learning techniques with the closest data [14]. This algorithm is also often used in various predictive activities in data mining.

### 3. Logistic Regression(LR)

LR is a data mining method in studying the correlation between dependent, and independent variables related to one another [15], this method is also one of the robust methods used in cases in data mining.

As a solution to the limitations of the ML method in this study, this research also uses the Deep Learning (DL) approach which is a development method of the Machine Learning approach which is currently quite widely used by researchers in their work used in this research. DL is part of ML inspired by biological processes in the form of neural networks which have advantages over conventional ML approaches [16]. The architectural form of the Deep Learning network, according to Shenbagavalli [17], can be seen in Figure 1 as follows :

Figure. 1 Deep Learning Architecture

In Figure 1 it can be seen that the Deep Learning architecture consists of an input layer consisting of several neurons connected to a hidden layer on several neurons, as an output there is an output layer which is

the last layer in the DL architecture.

DNN or Deep Neural Network is a DL method used in the detection of spoofing fake speech speakers.

DNN is a method that has been proven to provide advantages in various studies including pattern recognition, control optimization and prediction [19]. If observed in Figure 2, the DNN architecture [20] is similar to Deep Learning where there is an input layer but has a deep hidden layer depth in addition to the output layer as the output of the processing results in the Deep Neural Network method, which will be used in this study. DNN architecture can be seen in Figure 2 as follows:

Figure. 2 DNN Architecture

In the above DNN architecture there is a hidden layer whose depth can be n layers. DNN is a robust method to be implemented in various problems in computer vision, including in the fields of image classification, speech recognition, video and object detection because it has advantages in layer architecture in a neural network that is arranged into several layers which allows the model to be more efficient in studying complex features and perform computations effectively on multiple concurrent operations.

This study uses an experimental method where the detection of spoofing sounds is carried out through research activities carried out using a set of computer equipment. The stages of this research begin with the following sequence of activities :

#### 1. Dataset

In this study, a spoofing speech dataset was used which consisted of 2 classes, namely REAL and FAKE which contained 10,000 data speakers labeled as real speakers (REAL) and fake speakers (FAKE).

#### 2. Preprocessing

This dataset is processed first by reducing sound noise or cleaning voice data that contains other background sounds.

#### 3. Feature Extraction (FE)

FE is a technique for extracting spoofing voice features using the Mel-Frequency Cepstral Coefficient (MFCC) method.

#### 4. Classification

The stages of detection of fake speech sounds will be classified using 4 methods, namely Naive Bayes, KNN, Logistic Regression and Deep Neural Network (DNN).

Naive Bayes is used because it is simple, fast and has high accuracy [22], KNN, Logistic Regression, and DNN also have advantages in classifying various kinds of problems in the classification process.

#### 4. Evaluation

The performance of the model generated in recognizing

speakers with fake speech can be measured using

2022 International Seminar on Application for Technology of Information and Communication (iSemantic)

several approaches, the Confusion Matrix Approach by displaying Accuracy, Precision, Recall, and F1 Score is the step that will be used in this study. CM is a method that is often used to calculate the level of accuracy, precision, recall, and error rate in a model [21]. In CM there are several terms, namely True Positive / TP, True Negative / TN, False Positive / (FP and False Negative / FN. The True Negative / TN value is the number of negative data that is correctly detected, while False Positive / FP is negative data but detected as positive data. The sampling technique used in managing the dataset is 10 Cross Validation. An explanation of the research method used in this study can be seen in Figure 3 as follows:

Figure.3 Research Stages

The research stages shown in Figure 3 show the process of recognizing fake speech by processing data through preprocessing activities then the structured data will be classified with four approaches where 3 approaches are

classical Machine Learning methods, namely Naive Bayes, KNN, and Logistic Regression, while **one Deep Learning method with DNN** will also be used in the classification process of this research. The DNN architecture used in this study can be seen in Figure 4.

Input layer    output layer

Figure.4 DNN of Spoofing Detection

### III. RESULTS AND DISCUSSION

This work uses the orange application to process spoofing speech data and uses a measuring instrument in measuring the performance of the speaker recognition model with fake speech using several approaches with evaluation results as below :

#### A. Accuracy Evaluation Result

Accuracy is one approach in measuring the level of prediction that is worth the correct answer compared to the whole data. Accuracy can be calculated by the formula below :

$$(1)$$

Where :

TP=True Positive FP=False Positive

TN=True Negative FN=False Negative

**in this study, the accuracy of the fake speaker spoofing detection results can be seen in table 1 as follows :**

Table 1. Comparison Result of Fake Speaker

Detection Accuracy

Methods Accuracy (%)

Naive Bayes(NB) 87.5

KNN 89.1

Logistic Regression(LR) 87.5

DNN 96.5

Table 1 shows that the DNN method is the method that contributes the highest accuracy in recognizing speakers with fake speech compared to other

methods such as NB, KNN and LR. DNN provides high accuracy results with the arrangement of the architectural forms of the model involving 100 neurons in the hidden layer using the Relu activation function and the Adam Optimizer that compose the DNN network.

#### **B. Precision Evaluation Results**

Precision is the level of prediction that produces a positive correct when compared to all results that are predicted to be positive. Precision can be calculated using the following equation formula :

$$\text{Precision} = \frac{\text{TP}}{\text{TP} + \text{FP}} \quad (2)$$

In this study, the precision achieved can be seen in table 2 which compares the results using 4 different data mining methods

**Table 2. Fake Speaker Detection Precision Result**

**Methods Precision (%)**

**Naive Bayes(NB) 76.5**

**KNN 94.2**

**Logistic Regression(LR) 76.5**

**DNN 97.3**

Table 2 shows that the DNN method is still superior in terms of precision when compared to 3 other Machine

#### **Hidden Layer**

**Spoofing speech dataset**

**Preprocessing & Feature Extraction**

**Classification**

**Evaluation**

**Accuracy**

**Recall**

**Precision**

**F1 Score**

**Naive Bayes KNN**

**Logistic**

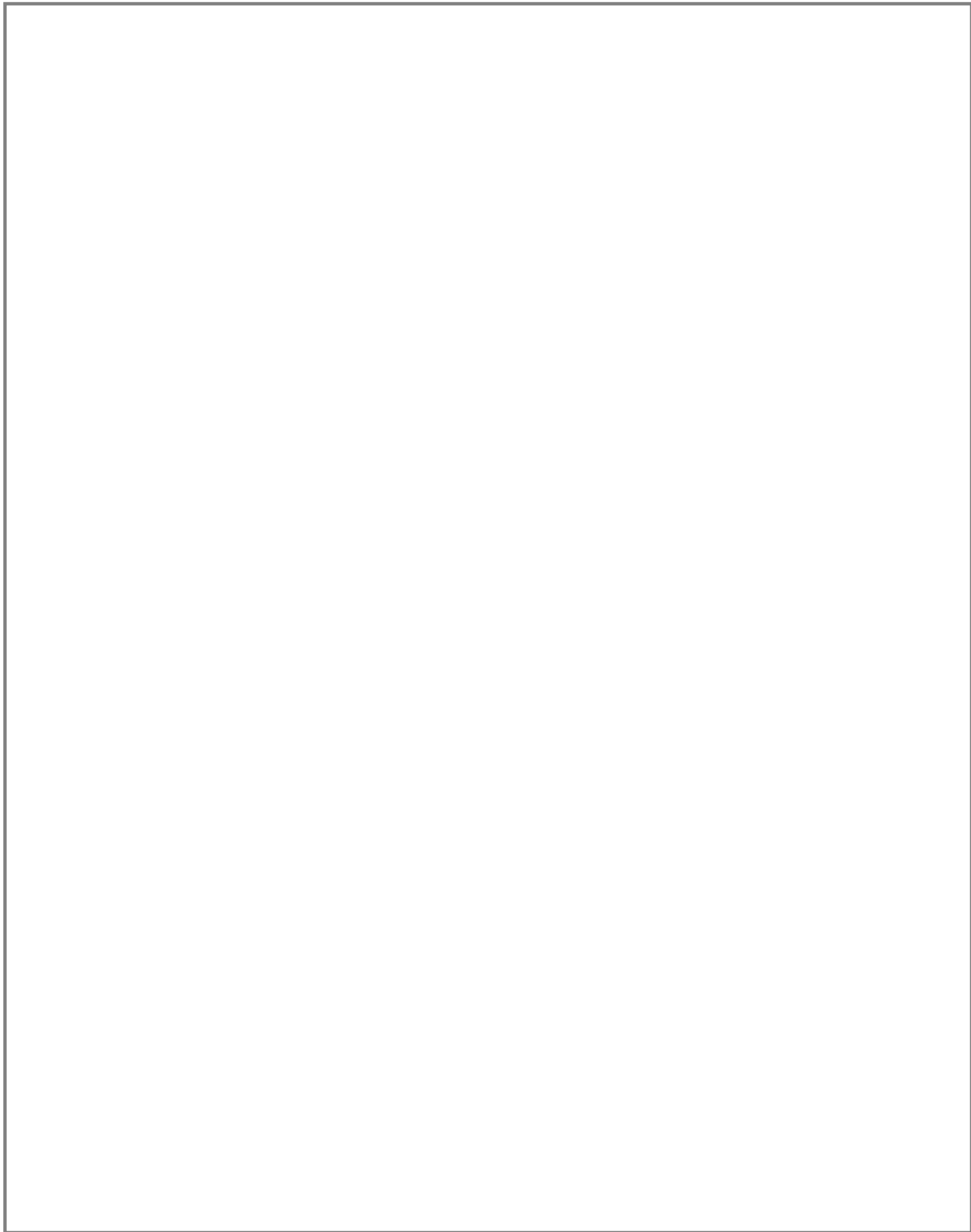
**Regression**

**Deep Neural**

**Network**

**REAL**

**FAKE**



Learning methods such as Naive Bayes, KNN, and Logistic Regression.

#### C. Recall Evaluation Result

Comparison of the results of the model's performance also uses Recall which is the level of comparison with the correct prediction rate when compared to the overall true positive and false negative. Recall calculation can be calculated using the equation with the formula :

(3)

The results of the comparison of Recall measurements between various methods in machine learning, and deep learning, namely NB, KNN, LR, and DNN can be seen in table 3 as follows:

Table 3. Fake Speaker Detection Recall Comparison  
Methods Recall (%)

Naive Bayes(NB) 87.5

KNN 89.1

Logistic Regression(LR) 87.5

DNN 96.5

In the evaluation of the model using Recall, it can be seen that DNN still provides the highest accuracy results compared to other methods. This proves that the DNN method has superior performance.

#### D. F1 Evaluation Result

The performance of the speaker recognition model with fake speech was also measured using the F1 scale which compared the mean of precision and recall that had been weighted previously. The results of the F1 calculation can use the formula :

$$F1 = 2 * (Recall * Precision) / (Recall + Precision) \quad (4)$$

In this work, F1 measure achieved by using several methods can be seen in table 4 as follows:

Table 4. Fake Speaker Detection F1 Comparison  
Methods F1 Measure (%)

Naive Bayes(NB) 81.6

KNN 90.4

Logistic Regression(LR) 81.6  
DNN 96.7

If we look at the results of the F1 measure in table 4, it can be seen that DNN still dominates the performance level compared to the other three classification methods. The performance of measuring the level of accuracy, precision, recall, and F1 as a whole can be seen in the figure 5 below:

Figure.5 Fake speech detection methods performance comparison

Figure 5 shows that the Deep Neural Network (DNN) method has the best performance when measured in terms of accuracy, precision, recall, and F1 measure in detecting speaker spoofing with fake speech.

#### IV. CONCLUSION

This research has succeeded in implementing the Deep Neural Network (DNN) model in detecting fake speech voice by achieving a level of accuracy, precision, recall and F1 size that far exceeds the performance of classical

Machine Learning algorithms such as Naive Bayes (NB), K-Nearest Neighbor (K-Nearest Neighbor). NN), and Logistic Regression (LR). DNN is proven to provide high performance in managing fake speech voice data with an accuracy rate of 96.5%, precision of 97.3%, recall of 96.5% and F1 measure of 96.7%. The larger the data processed by the DNN method, this approach provides a greater level of accuracy so that the DNN method is a formidable method to be used in speech recognition.

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