

Optimization of Artificial Intelligence in Telecommunication

Nurhayati Sembiring, Maghfira Ashila Nasution, Andri Gunawan and Bayu Febrilliandika

Department of Industrial Engineering
Universitas Sumatera Utara
Medan, Indonesia

nurhayatipandia68@usu.ac.id, maghfiraashila74@gmail.com, andrigunawan0403@gmail.com

Muhammad Fadly Tanjung

Faculty of Computer Science
Universitas Indonesia
Depok, Indonesia
muhammad.fadly02@ui.ac.id

Abstract

One of the keys for companies to be able to compete is the fulfillment of customer satisfaction. Telecommunications is one of the industrial sectors that is currently growing very rapidly. Competition between companies is also getting fiercer. Therefore, each company strives to innovate to create technology that is more efficient, inexpensive, and easy to use. One of the newest technologies used massively in the telecommunications sector is artificial intelligence. Several characteristics of problems in the telecommunications sector can be overcome by implementing AI. Problems that require immediate handling, problems that require precise analysis of large amounts of data, and customer service problems that require 24 hours are characteristic of problems that are generally solved by implementing AI in the telecommunications sector.

Keywords

Artificial intelligence, Optimization, and Telecommunication.

1. Introduction

The telecommunications industry is currently growing very rapidly so that it provides a very significant economic contribution to every country. The use of information technology is increasing, thereby increasing competition between telecommunication companies. The business environment in the telecommunications industry is getting more competitive from day to day (Nekmahmud and Rahman 2018). One of the key factors in winning the competition in the market is increasing customer satisfaction. Companies that are not able to meet consumer desires will lose market share because consumers will switch to companies that offer higher quality products (Adekia 2016). Telecommunications companies must provide services and products that are oriented to customer desires. Various items of customer desire for the products and services of the telecommunications industry must be identified by the company. Several items considered in selecting the telecommunications operator by customer consist of service innovation, customer service, competitiveness, and service consistency (Rahman 2014). Technological updates must be carried out by the telecommunications industry in order to improve the quality of service to consumers. Technology can increase the productivity of a business. One of the technologies that are highly developed in the industrial world is artificial intelligence. AI systems are used to meet consumer demands for technology that is faster, cheaper, and easier to use. Implementing AI also requires a fairly high investment of human resources and finances. The implementation of AI also cannot be done on all problems in the telecommunications industry. Therefore, analysis is needed to see the implementation of AI in the telecommunications industry to date. In addition, it is necessary to analyze the characteristics of the problems that are solved by implementing AI so that it can be a reference for problems

that are likely to occur in the future in the telecommunications industry so that the implementation of AI is done appropriately (Khrais 2020).

1.1 Objectives

This study is conducted to analyze the implementation of artificial intelligent in telecommunication industry. The analyze is conducted for two side. The first side is the country where the researches of AI in telecommunication mostly come from. The second side is the kind of problem that commonly fixed by the implementation of AI in telecommunication. Hence, it can be categorized what is the characteristic of problem regarding the costumer demand in the future that AI has the probability to be implemented.

2. Literature Review

2.1 Artificial Intelligence

Artificial intelligence uses are usually consist of two classifies, Machine Learning (ML) and Expert Systems (ES). ES make use of a science build frequently reflecting realities and if-then regulations but deficiency the capability to study self-sufficiently of outer data (Qi, Wu, Li, & Shu 2007). New facts concluded by a conclusion engine then prevails the regulation to the leaded facts. Unique uses enter methods, ES normally promote human decision-making in matters with lowly difference. Creating analysis of them as a category more hard than a highly great amount of ES uses as well as decision trees leading client care talks with client (Macleish 1988). Several professionals debate, yet, that ES are not right AI as they deficiency the capability to study self-sufficiently of outer data (Russell & Norvig 2009).

2.3. Telecommunication Industry

The telecommunications sector has undergone significant reforms since the 1980s. Developed countries began to develop information technology to overcome various problems faced by humans. Developing countries are also starting to realize the importance of improving information technology for a country's economic growth. In this modern era, the need for information technology is also growing. Currently, technology is needed that is efficient, inexpensive, and easy to use. Various technologies are still being developed to improve the quality of information technology so that it can continue to meet human needs. The list of studies from various countries resulting from previous studies that has been analyzed can be seen on table 1.

Table 1. Results of the research for the artificial intelligence in telecommunications

Paper By	Method	Result	Research Sites
ICT Discoveries	The research was conducted by analyzing previous research about designing of AI.	AI gives over before risking human prestiges. It takes in huge potency of itself to fix the exists of plentiful also to make sure human rights to all.	Netherland
Elsevier	A review of the application artificial intelligence for telecommunications	Likely to recognize the AI uses, have the largest impact today, and those that are carried out in the future.	Switzerland
Elsevier	Big data of artificial intelligence	Acquainted that promotes the supplementary make use of Artificial Intelligence and Big Data with a main focus on municipal ability to prop and feasibility.	Australia
ICT Discoveries	Using inclusion to identify artificial intelligence in communication services	Practiced model is provided to clarify its forecasting and explain ability which is combine direct into the fabric of the design.	China
Sage Publishing	The collaboration of human-machine communication and artificial intelligence based on the previous research	Because AI technologies upgrade think communicative characters once allied with humans, both the nature of such interplays and their greater purposes for community will need more capitulated treaty from communication savants.	USA

Table 1. Results of the research for the artificial intelligence in telecommunications (continued)

Paper By	Method	Result	Research Sites
ICT Discoveries	The convergence of machine learning and communications	Yet, before source-thick designs as well as inside neural networks able be prevailed on a great balance in telecommunication uses.	Germany
ICT Discoveries	The method use is a wireless communication convolved with artificial intelligence	A lot of labor is compulsory to be live and intelligent networks, inside learning, and conceptual algorithms are one of the many sectors to be proceeded on.	Denmark
ICT Discoveries	Using Bayesian method for basic online studying collaborate with cognitive radio system of spectrum ownership forecasting	The simulation outcomes have checked the efficacy of the BOL design in forecasting PU channel circumstances existence.	China
Springer	With machine learning in smart home environment as a basic of video-selection encryption safety system	Only the video tip connected to lower the overhead and computational complication, the secrecy denomination can be encrypted, and machine learning technology selectively encrypted the video.	China
Springer	The method use is a potency oversee algorithm for D2D telecommunication underlying cellular networks	Yet, both the suggested Q-learning algorithms make it better the disordered strength oversee th algorithm in names of the tract throughput and gratification comparison.	China
ICT Discoveries	Review of new technology practices in telecommunication operators	Telecommunication operators will make larger application of the conventional benefits.	China
Springer	The research was about maritime telecommunication system	The proposed scheme can safely sent one more data in one transmittal process.	China
Scientific Research Publishing	Cloud computing to artificial intelligence	The research is a simple subscription to the science of great effort works like telecommunications and how there is a potent by not only technological but also management renewals as well as the merger of cloud computing to artificial intelligence.	United Emirates Arab
Springer	Catching in D2D enabled telecommunication	Numeral outcomes indicate lest the suggested schemas can not only fix the cache beat rate importantly but also cut the pleonastic demand comparison and the usual general postpone of UEs.	China
Springer	SA multi-classifier oncoming for fuzzy KNN, WIFI indoor localization basics	The suggested oncoming fixes the average functioning errors and their standard deviations by 21% and 26% respectively contrasted to the conventional KNN algorithm.	China
Springer	Survey on artificial intelligence for appearing robotic telecommunication	Making use AI for telecommunication between humans and with robots thru the internet, heads to a recent time called IoRT, a pledging technology that creates smart objects conveys another robot and a human.	New York
Springer	An efficient line requirement technique for fix QoS for mobile telecommunication deployment	The outcomes have notified that with the lines requirement technique, the Pcd and Pcb has been largely fixed.	New York

Table 1. Results of the research for the artificial intelligence in telecommunications (continued)

Paper By	Method	Result	Research Sites
ICT Discoveries	The convergence of machine learning and communications	Yet, before source-thick designs as well as inside neural networks able be prevailed on a great balance in telecommunication uses.	Germany
ICT Discoveries	The method use is a wireless communication convolved with artificial intelligence	A lot of labor is compulsory to be live and intelligent networks, inside learning, and conceptual algorithms are one of the many sectors to be proceeded on.	Denmark
ICT Discoveries	Using Bayesian method for basic online studying collaborate with cognitive radio system of spectrum ownership forecasting	The simulation outcomes have checked the efficacy of the BOL design in forecasting PU channel circumstances existence.	China
Springer	With machine learning in smart home environment as a basic of video-selection encryption safety system	Only the video tip connected to lower the overhead and computational complication, the secrecy denomination can be encrypted, and machine learning technology selectively encrypted the video.	China
Springer	The method use is a potency oversee algorithm for D2D telecommunication underlying cellular networks	Yet, both the suggested Q-learning algorithms make it better the disordered strength oversee th algorithm in names of the tract throughput and gratification comparison.	China
ICT Discoveries	Review of new technology practices in telecommunication operators	Telecommunication operators will make larger application of the conventional benefits.	China
Springer	The research was about maritime telecommunication system	The proposed scheme can safely sent one more data in one transmittal process.	China
Scientific Research Publishing	Cloud computing to artificial intelligence	The research is a simple subscription to the science of great effort works like telecommunications and how there is a potent by not only technological but also management renewals as well as the merger of cloud computing to artificial intelligence.	United Emirates Arab
Springer	Catching in D2D enabled telecommunication	Numeral outcomes indicate lest the suggested schemas can not only fix the cache beat rate importantly but also cut the pleonastic demand comparison and the usual general postpone of UEs.	China
Springer	SA multi-classifier oncoming for fuzzy KNN, WIFI indoor localization basics	The suggested oncoming fixes the average functioning errors and their standard deviations by 21% and 26% respectively contrasted to the conventional KNN algorithm.	China
Springer	Survey on artificial intelligence for appearing robotic telecommunication	Making use AI for telecommunication between humans and with robots thru the internet, heads to a recent time called IoRT, a pledging technology that creates smart objects conveys another robot and a human.	New York
Springer	An efficient line requirement technique for fix QoS for mobile telecommunication deployment	The outcomes have notified that with the lines requirement technique, the Pcd and Pcb has been largely fixed.	New York

Table 1. Results of the research for the artificial intelligence in telecommunications (continued)

Paper By	Method	Result	Research Sites
Institute Telecom	Analysis of telecommunication management technologies	This study has also presided that conventional schemas are no more streamlined management schemas in consequence of continuous growing in the complication on technological and one hand progresses in system and treatment on other side.	France

3. Methods

The research was conducted by analyzing various previous research results. Research related to the topic of blind intelligence in telecommunications was collected and analyzed. Several stages are carried out to draw conclusions based on the research objectives. The phases of working on this study are as follows:

- Stage 1
 The first stage in this research is to determine the research topic. The topic is determined by analyzing the problem to be investigated. After the problem is identified, the purpose of the research is determined. The first stage of this research determines the topic to be studied.
- Stage 2
 The next stage is to collect literature related to the research topic. This is done to collect various facts related to the research objectives. Articles submitted must be published within the last four years to ensure that the facts collected are up to date
- Stage 3
 The next stage is the selection of the literature that has been collected. The selection is related to the quality of the journal and the suitability of the journal content to the research topic. The selected journals are the journals with the best quality and the most appropriate topics for this research
- Stage 4
 The next step is to analysis of each article. The analysis was carried out related to the background, research objectives, research methods, and the results obtained. The problems in the research were analyzed so that it can be seen the types of problems that are generally solved by implementing AI.
- Stage 5
 The last phase of this study method is to evaluate and debrief the outcomes of the analysis implemented in the fourth stage. Evaluation is implemented to specify the benefits and losses of the artificial intelligence in telecommunication activities. Evaluation and debriefing is held to get an purpose view of the selected articles that have been analyzed

4. Results and Discussion

Since past by means a almost hard article selection phase, it was set up that eighteen articles from various publishers and various countries were published in the last four years. The diagram describing articles got from various countries in the world is shown by Figure 1.

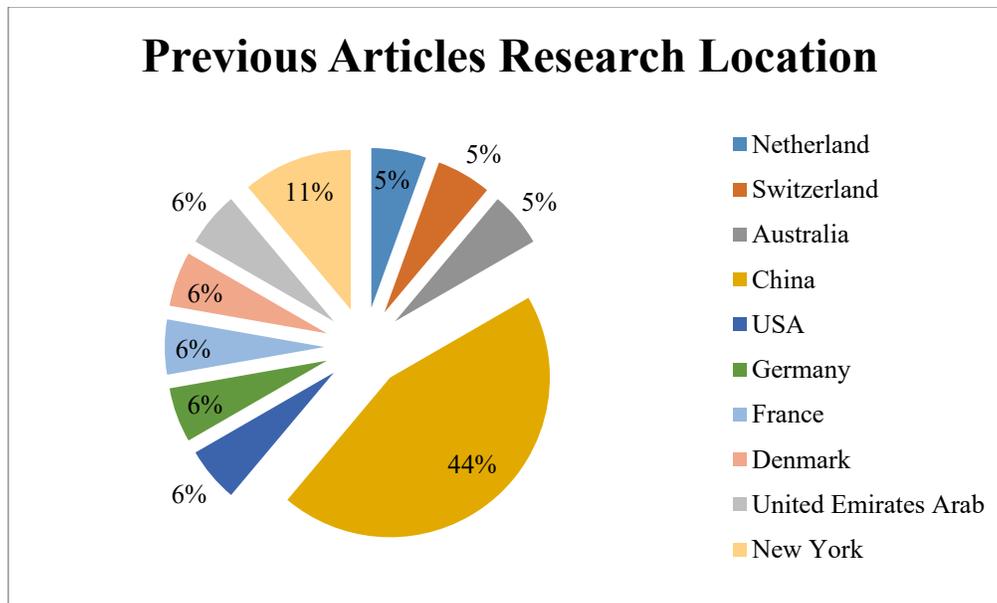


Figure 1. Previous article locations

According to the data above, it can be viewed that study on artificial intelligence in telecommunication activities is still controlled by Asian countries. China was the largest articles contributor in this study with a percentage of 44% of the eighteen articles that were selected. Eight papers obtained from China discuss artificial intelligence in telecommunication activities to get the best pattern based on factors that affect artificial intelligence activities that being used in telecommunication area such as the function of neural network, robotics, and WIFI. These factors include characteristic the problem, network layer, complexity of the model, and software-intensive systems.

The background of the use of AI in the telecommunications industry is very diverse. The first problem is a problem that must be solved quickly. If the problem is not resolved quickly, service to consumers will be disrupted. An example is automated self-repair technology. AI is used to directly fix errors that occur on the network. The repair algorithm forms a loop so that AI is used as a supervisor in case of damage and is also able to repair the damage. Conventional repairs are carried out using human power so that it takes longer and requires more energy. Therefore, many sectors related to service to consumers are carried out automatically to reduce repair time if an error occurs.

In telecommunications products, AI is also used to handle complex analytical tasks with big data. For example, AI is also used to protect computer systems. AI has very fast big data analysis capabilities. Unnatural data spikes can be detected by AI through the analysis of the Big data. If this happens, AI can carry out the security process because it is indicated as a cyber attack or virus. The ability to analyze big data quickly and precisely is very useful because human abilities are still very slow in analyzing data compared to AI. Another example in terms of big data is China. China Telecom currently has 816,000 mobile base stations and 425 data centers across China. The number of subscribers reached 212 million and broadband subscribers reached 142 million.

AI is also used in sectors that require continuous presence. One of them is customer service. AI is used to answer various consumer questions whenever consumers contact them. An example is the TOBi technology built by Vodafone. This technology is in the form of a chat box that is used to serve consumers in real time so as to increase customer satisfaction.

5. Conclusion

Based on the research that has been done, it can be concluded that AI has been used very widely in the telecommunications sector. One of the drivers of the use of AI is the creation of communication technology that is in accordance with the wishes of consumers. Problems that are generally overcome by implementing AI in telecommunications are problems that require immediate response, problems related to big data analysis, and customer service problems that must remain available 24 hours a day. AI technologies increased presume communicative characters once companioned to humans, secondary the nature of considerable interplays and greater purposes for

community and social life shall need more capitulated agreement from communication scholars, picturing on a different collection of drafts and theories to clarify an any sides of phenomenon.

References

- Adekia A. A., Change, customer satisfaction and competition: issues from the strategic management context, *International Journal of Economics, Business and Management Studies*, vol. 3, no. 2, pp. 55-66, 2016.
- Allam Z., and Dhunny Z. A., On big data, artificial intelligence and smart cities, *Elsevier*, vol. 44, pp. 4, 2019.
- Alsamhi S. H., and Rajput N. S., An efficient channel reservation technique for improved QoS for mobile communication deployment using High Altitude Platform, *Springer*, vol. 115, pp. 10, 2016.
- Alsamhi S. H., Ma O., and Ansari M. S., Survey on artificial intelligence based techniques for emerging robotic communication, *Springer*, vol. 115, pp. 9, 2019.
- Balmer R. E., Levin S. L., and Schmidt S., Artificial intelligence applications in telecommunications and other network industries, *Elsevier*, vol. 44, pp. 2, 2020.
- Chen j., Social aware edge catching D2D enabled communication, *Springer*, vol. 287, pp. 335, 2019.
- Chen W., and Zheng J., A multi-agent reinforcement learning based power control algorithm for D2d communication underlying cellular networks, *Springer*, vol. 287, pp. 77, 2019.
- Dignum V., Responsible artificial intelligence: designing ai for human values, *ICT Discoveries*, vol.1, pp. 1, 2018.
- Ferdinando H., et al., VITEC: A Violence Detection Framework, *Springer*, vol. 287, pp. 3., 2019.
- Fu Y., Jiang C., Qin Y., and Yin L., Secure access and routing scheme for maritime communication network, *Springer*, vol. 287, pp. 115, 2019.
- Guibao X., Yubo M., and Jialiang L., Inclusion of artificial intelligence in communication networks and services, *ICT Discoveries*, vol. 1, pp. 3, 2018.
- Guzman A. L., Lewis S. C., Artificial intelligence and communication: A Human-Machine Communication research agenda, *Sage Publishing*, vol. 65, pp. 5, 2019.
- Khatib M. M. E., Nakeeb A. A., and Ahmed G., Integration of cloud computing with Artificial Intelligence and its impact on telecom sector – A Study Case, *Scientific Research Publishing*, vol. 11, pp. 8, 2019.
- Khrais L. T., Role of artificial intelligence in shaping consumer demand in e-commerce, *Journal of Future Internet*, vol. 12, pp. 12, 2020.
- Kumar A., Artificial intelligence for place-time convolved wireless communication networks, *ICT Discoveries*, vol.1, pp. 83, 2018.
- Laghari K. U. R., Grida I. ben Yahia., and Crespi N., Analysis of Telecommunication Management Technologies, *Institute Telecom*, vol. 2, pp. 6, 2019.
- Li C., Fan J., and Li M., Navigation performance comparison of ACE-BOC Signal and TD-Alt BOC Signal, *Springer*, vol. 287, pp. 52, 2019.
- Li Z., Wang X., Li M., and Han S., An adaptive window time-frequency analysis method based on Short-Time Fourier Transform, *Springer*, vol.1 287, pp. 91, 2019.
- Liang W., Sun M., He B., New Technology brings new opportunity for telecommunication carriers: artificial intelligent applications and practices in telecom operators, *ICT Discoveries*, vol.1, pp. 121, 2018.
- Ma J., Shi B., Che F., and Zhang S., Research on evaluation method of Cooperative Jamming Effect in Cognitive confrontation, *Springer*, vol. 287, pp. 40, 2019.
- Mikaeil A. M., Bayesian online learning-based spectrum occupancy prediction in cognitive radio networks, *ICT Discoveries*, vol.1, pp. 95, 2018.
- Nekmahmud M., and Rahman S., Measuring the competitiveness factors in telecommunication markets, *Competitiveness in Emerging Markets*. 2018
- Rahman M. H., Factors affecting customer satisfaction in mobile telecommunication industry in Bangladesh, *Journal of Business, Management and Education*, vol.1, pp. 12, 2014.
- Samek W., Stanczak S., and Wiegand T., The convergence of machine learning and communications, *ICT Discoveries*, vol 1, pp 48, 2018.
- Xia G., Yin D., Gan Y., Rui L., and Zhu Y., Deep & cross network for software-intensive system fault prediction, *Springer*, vol. 287, pp. 28, 2019.
- Xu G., Qin D., and Zhao M., Research on Fusion of Multiple Positioning Algorithms Based on Visual Indoor Positioning, *Springer*, vol. 28, pp. 325, 2019.
- Xue Q., et al., A video-selection-encryption privacy protection scheme based on Machine Learning in smart home environment, *Springer*, vol.1 287, pp. 65, 2019

Zhu Y., Yin D., Gan Y., Rui L., and Xia G., software defect prediction model based on stacked denoising auto-encoder, *Springer*, vol. 287, pp. 18 doi, 2019.

Biographies

Ir. Nurhayati, MT completed her studies at the undergraduate program in industrial engineering at the University of Sumatera Utara in 1994. Her passion for science prompted her to continue her studies in a master's program at the Bandung Institute of Technology. He completed his master's program in 1999. Several publications have been produced mainly in the field of systems modeling. He currently teaches at the Department of Industrial Engineering, Universitas Sumatera Utara. In addition, he was also assigned as the head of the manufacturing process laboratory.

Maghfira Ashila Nasution is a final year student at the Department of Industrial Engineering, Faculty of Engineering, University of Sumatera Utara. Currently she is an active assistant in the laboratory of manufacturing process at the Department of Industrial Engineering, Faculty of Engineering, Universitas Sumatera Utara.

Andri Gunawan entered the Department of Industrial Engineering, University of Sumatera Utara in 2017 as an undergraduate student. He is currently running his final year. He was also assigned as one of the assistants in the manufacturing process laboratory at the Department of Industrial Engineering, Faculty of Engineering, Universitas Sumatera Utara.

Muhammad Fadly Tanjung is a magister student at Faculty of Computer Science, University of Indonesia. He has graduated from University of Sumatera Utara. He is also active in following some organization focusing in youth empowerment.