

Socializing NLG, NLP & NLU through AI : Real-world application and future perspectives

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Abstract

The usage of wide-ranging fields of technology has seen the inclusion of AI industries and its development with time which has allowed the industries to grow around the world. This research attempts to explain and broaden the scope of some aspects of Artificial Intelligence and in this specific case AI includes NLP, NLU and NLG. This paper starts from explaining its core components of AI, then continues with the discussion and explanation of AI architecture in the form of a visual presentation. A literature review commences with the sentiment analysis of Chat GPT 2024-2025 reviews. The analysis was demonstrated using a pie chart that represented positive, neutral and negative sentiments. Additionally, a time-distribution graph illustrates the data proves the increased use of AI over time. The paper also tackles the important barriers that stop AI from becoming the ground breaking technology. As part of the introduction, the definitions and basic prerequisites of AI, NLP, NLU and NLG will be reviewed so as to help understand their usages. In the end, the study covers the change in AI and its improvements, stressing on its integration in human involvement.

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The end of the paper gives suggestions as to how AI can be simplified to reach out to many people, in turn creating awareness and adoption.

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I. Introduction

As with any Communications Technology, processing and understanding Natural Language serves as a bridge between humans and machines. NLU, or Natural Language Understanding, is one of the broadest terms in AI technology that broadly works with recognizing and interpreting user inputs and their meaning to organize it efficiently for further processing [1]. With the effectiveness of AI on the rise, the scope of natural language processing keeps increasing, even from standard algorithmic methods such as tokenization and part of speech recognition to more advanced analytic actions such as figure of speech recognition, or information retrieval. To tackle the chaotic nature of human speech, an active enhancement of natural language processing and embedding based modelling is being developed [2]. The overall interconnection between Artificial Intelligence, Machine Learning, Deep Learning, and Natural Language Processing is shown in Figure 1.

Natural Language Generation is the last step of the NLU and NLP system, which outputs human-like text from structured data. Natural

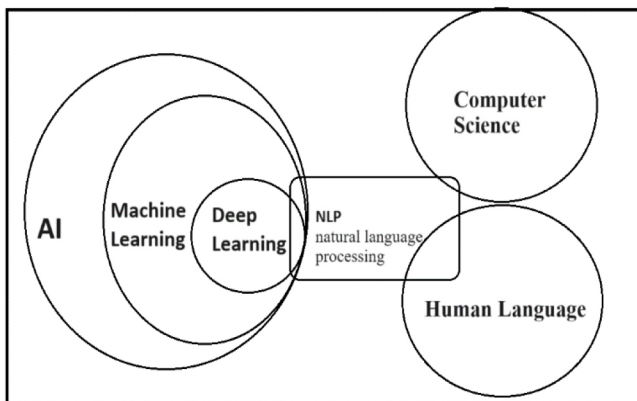


Figure 1
Architecture of AI

language generation is necessary to make language production in applications such as content generation, storytelling, or chatbot conversations interactive and more human-like. [3] The merging of NLU, NLP, and NLG makes possible the design of advanced dialog agents and virtual assistants, which are today an integral part of our lives.[4] Such technologies are illustrated by automated content generators, AI-driven chatbots, and voice-controlled devices.

Analysing the dataset concerning reviews of ChatGPT from 2024 and 2025, we would try to demonstrate the implications of the AI components through sentiment analysis. ChatGPT is capable of text comprehension and production at advanced levels which makes it an exemplary case of the powerful integration of NLU, NLP, and NLG technologies. We hope to gain further insights regarding the integration of AI technology into industries and the factors that shape the society's perception towards the adoption of conversational systems through AI by analysing the data provided by users.

Financial companies will employ NLG to generate financial reports, NLU to review sentiment about the business, and NLP to identify fraud instances. AI-enabled tutorial software used in classrooms will understand questions of the students, provide appropriate feedback and develop customized lesson plans. It is expected that even greater advancement in the field of human-computer interaction, especially in NLP, NLG, and NLU will come after deep learning, particularly through transformer architectures improves even further.

The foundations of AI-driven language processing, adoption potential obstacles and the changing role of AI in practical applications are all covered in this paper. We offer insights into how AI is seen and gradually incorporated into daily life through sentiment analysis of ChatGPT reviews. The future of AI-driven communication is being shaped by the dynamic interaction of NLU, NLP, and NLG, which keeps pushing the limits of what machines can comprehend and convey.

II. Literature Review

Motivation

Although artificial intelligence (AI) has revolutionized many sectors, adoption of AI has been fraught with difficulties such as perceived reliability ethical problems, and trust issues. Natural Language Processing (NLP), Natural Language Generation (NLG), and Natural Language

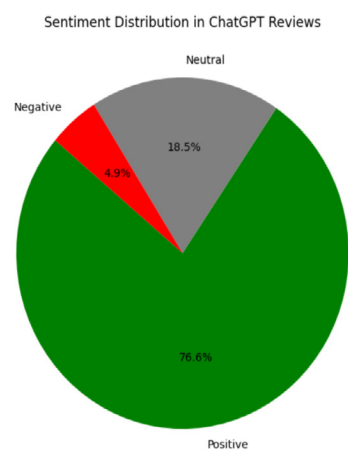


Figure 2

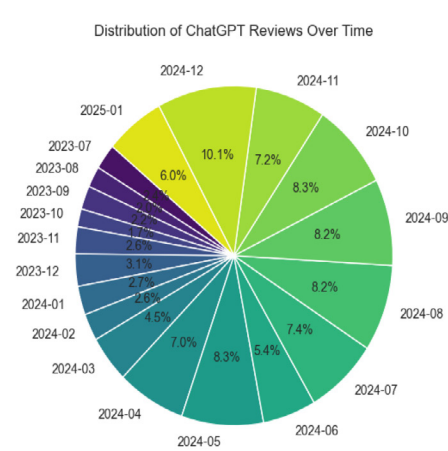


Figure 3

Understanding (NLU) are all seamlessly integrated in ChatGPT which is one of the most sophisticated AI models available today. Because of that powerful combination, ChatGPT can successfully comprehend, produce and interpret human language, making it a perfect model to research for AI adoption. So, we took one latest dataset of 2024 and 2025 reviews of AI and we performed a sentiment analysis on a dataset comprising more than 300,000 ChatGPT reviews in order to comprehend how the general public views AI-driven conversational models. We divided the reviews into three groups using NLTK’s Sentiment Intensity Analyzer: Positive, Neutral and Negative. The overall sentiment and time-based distribution of ChatGPT reviews are shown in Figure 2 and Figure 3, where most reviews are positive and their frequency varies across different months.

Our analysis’s findings, which are shown in Figure are extremely important to recent developments in AI adoption because they are based on updated and current data from 2024 and 2025. According to the data, only 4.9% of the evaluations are unfavourable, 18.5% are neutral and 76.6% are good. This noteworthy majority of favourable comments clearly shows that users are beginning to adopt AI-based products more and more.

Our research is significantly supported by this image which offers statistical proof that users are progressively embracing AI in spite of early reservations.[5] Strong support for our paper is provided by the sentiment distribution in ChatGPT reviews which reaffirms the growing integration of AI especially in fields like NLP, NLU, and NLG, into everyday life.

Analysing the obstacles to AI’s widespread adoption while recognizing that improving user sentiment is one of the main driving

forces for this paper. The study's findings support our belief that AI adoption is rising and this research attempts to investigate the causes of this pattern. We will examine the barriers that stand in the way of AI becoming a truly revolutionary technology including bias, ethical problems and data privacy difficulties while also showing practical uses of AI that are already having a big impact.[6] The study will also look at AI's potential in the future when better models and openness may increase user confidence even more.

This analysis reveals that AI is evolving in our daily lives, and we need to incorporate it into our daily routine. Due to this, in our paper we are highlighting the challenges of adopting AI in daily routines, its architecture, how it works, and its core components with examples.

Analysing socializing artificial intelligence (AI), its real-world applications and also taking a look to the future shows an exciting adventure at the centre of technology and human interaction. We present a narrative that simplifies the difficulties of integrating AI into our daily lives in this overview of the writing. The voyage covers the current area of artificial intelligence applications, explores the complex world of social AI and focuses on the developing possibilities that will impact negatively this game-changing technology in the future.

1. Development of Ethical AI

AI's capacity to keep to ethical standards is important to its uptake. This requires creating objective, open and responsible algorithms. Ethical AI ensures that AI systems make decisions that just don't reinforce or magnify already-existing problems with society. Biased AI in loan approvals or employment processes, for example: has drawn a lot of attention. Diverse and representative datasets are necessary for AI training in order to overcome such barriers. Furthermore, there needs to be a strong structure in place for reviewing and tracking AI activity. Avoiding abuse, such as deepfakes or autonomous weapons, is another part of developing AI ethically. To address this problem, companies such as Google and IBM have already set up AI ethics boards address these concerns.

2. AI Explainability

The ability of AI systems to give logical answers for their choices is known as clarity or interpretability. Many AI systems, especially deep learning models, operate as "black boxes," making it difficult for even developers to explain how results happen. Even in industries like health,

where judgments could mean the difference between life and death, or finance, where major financial risks are involved, this lack of information develops mistrust. The goal of explainable AI (XAI) is to increase the transparency of AI systems by breaking their decision-making procedures into simpler parts. For instance, machine learning predictions can be understood using methods such as SHAP (Shapley Additive Explanations). [7] Users and stakeholders are more inclined to trust AI if they know the theory behind its actions.

3. Protection and Privacy of Data

Because AI uses huge amounts of data for training, data security and privacy are challenges. The public's trust in technology has been damaged by well-known data breaches and illegal use of personal data. In order to solve this, AI systems require privacy-preserving methods like differential privacy, which introduces noise into datasets to preserve private information and centralized learning which processes data locally without sharing it.[8] Laws like the California Consumer Privacy Act and the General Data Protection Regulation (GDPR) have established standards for how AI systems manage data. Businesses that put user consent, honesty in data use, and safe storage procedures first are more likely to win over the public and encourage wider adoption of AI.

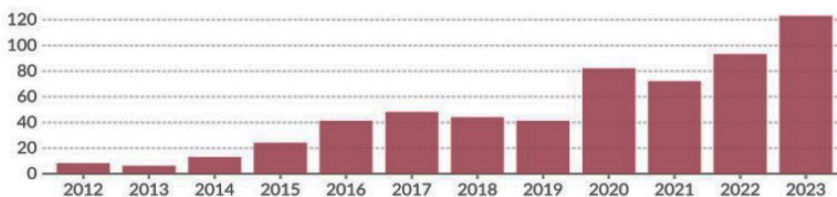
5. Education and Public Awareness

An important factor of the use of AI is the general public's awareness of the technology. Fear and rejection are caused by ideas that are stoked by

Global annual number of reported artificial intelligence incidents and controversies

Our World
in Data

Notable incidents include a "deepfake" video of Ukrainian President Volodymyr Zelenskyy surrendering, and U.S. prisons using AI to monitor their inmates' calls.



Data source: AI Incident Database via AI Index (2024)

OurWorldinData.org/artificial-intelligence | CC BY

Note: Does not yet include incidents reported in 2022, as incidents must first undergo a vetting process. Reported incidents likely undercount actual incidents, especially in the earliest years of tracking.

Figure 4 [9]

melodrama and fiction about science.[9] Efforts for public awareness and educational programs can simplify AI by addressing common misconceptions and underlining its advantages. While governments as well as companies can use media to communicate success stories and responsible use cases, schools and colleges can implement educational programs. For instance, displaying how AI-powered solutions have aided in environmental preservation or pandemic control can shift the public’s viewpoint from one of fear to one of hope. The number of reported AI incidents and controversies worldwide is summarized in Figure 4, indicating a significant rise in recent years.

AI (Artificial intelligence):

Even though it is predominantly applied in customer service, chatbot solutions are suggested by IBM, Google and Microsoft to have applications in other industries.[12] AI has numerous functionalities as it comprises technologies that enable software to perform human activities. The core element of glory is AI powered chatbots. Chatbots, with the aid of modern NLP algorithms are capable of processing and understanding the input text as well as deducing and listing available actions which they can perform specific tasks which are usually executed by human beings.[13] Chatbots powered by artificial intelligence are called natural language

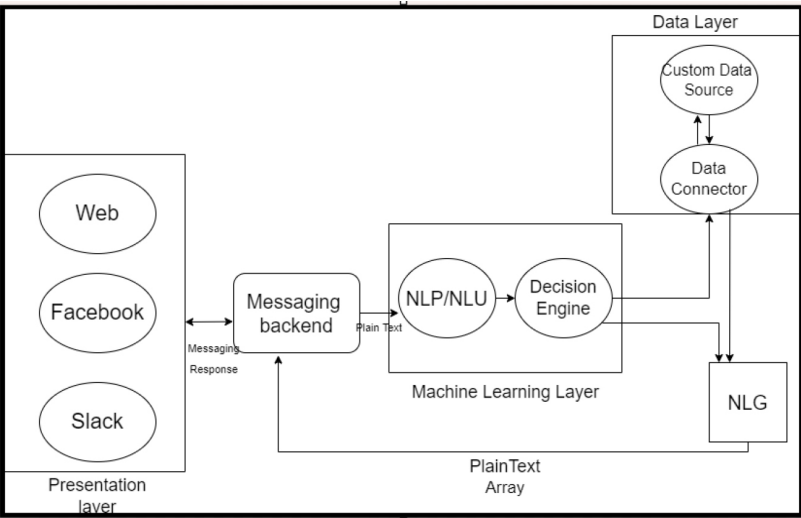


Figure 5
Process of AI

processing chatbots. Advanced algorithms in natural language processing allow chatbots to accept message and perform action of acknowledge, reason and identify the speech or actions taken. The overall process of Artificial Intelligence is illustrated in Figure 5, providing a graphical representation of the key stages and workflow involved in AI operations.

NLP (Natural language processing)

NLP or natural language processing is the core element in the fields of language recognition technology for the likes of Google and Apple's Siri. It has two major parts: Automatic natural language generation and comprehension. Natural language is a uniquely human way of communicating through both the written and spoken form. NLP aims to enable machines to understand and execute such commands. However, to comprehend such instructions require much more effort than to just create since the framework and design of natural language is exceptionally intricate.

Applications: - **Chatbots & Virtual Assistants** (ex. ChatGPT, Siri, Alexa and Google Assistant)

NLG (Natural language generation)-

To produce an acceptable response, NLG (Natural Language Generation) uses text realisation and text planning. To put it simply, language generation is in task of creating correctly formed words and sentences [10]. NLP's main challenge is the ability to understand the complexities of natural human language. Language's structure is usually complex when it comes to syntax, lexis and other speech-related elements like similes and metaphors [11]. A word can be interpreted as a verb or a noun; a sentence can be delivered in a variety of ways; an input can also have more than one meaning etc.

Applications: - **AI-Powered Code Generation** (ex. GitHub Copilot, OpenAI Codex etc.)

NLU (Natural language understanding)

The ultimate objective of the artificial intelligence field known as "Natural Language Understanding" (NLU) is to enable computers to understand and extract meaning from human language so they can effectively analyse and respond to text or speech input. The rapid growth of artificial intelligence (AI) is a result of many significant aspects. Artificial intelligence (AI) systems can now learn from massive datasets, adapt and

keep improving through developments in deep learning and machine learning. Training complicated models is now quicker and more effective because of the availability of powerful processing units like GPUs and specialized CPUs.

Applications: - **Healthcare & Medical Diagnosis** (ex. IBM Watson Health, Buoy Health etc.)

The increasing adoption of technology in various fields for automation, data handling and decision-making showcases AI's adaptability. As a result of progress in Natural Language Processing, virtual assistants and chatbots are now widely integrated. In contextually appropriate situations, AI can produce written content; thanks to Natural Language Generation.[14] The capability and response of machines to human speech is enhanced through Natural Language Understanding, thus aiding in making interactions between humans and AI better. AI is revolutionizing patient care and research in healthcare through its use in testing, surgical visualization and medicinal purposes. Despite these trends, ethical debates and social impact of AI remains a pertinent issue.

III. Future Prespective

Artificial Intelligence (AI) is on the verge of revolutionary developments that will reshape industry, daily life and interpersonal relationships.[15] AI will be able to process, understand and produce language that is similar to that of humans with more contextual awareness and emotional intelligence because of the ongoing advancements in Natural Language Processing (NLP), Natural Language Understanding (NLU) and Natural Language Generation (NLG). Chatbots, virtual assistants and AI-powered customer support systems will have more organic and meaningful discussions as a result, improving the smoothness and intuitiveness of human-machine interactions.

Automation will change the workforce as AI systems develop by eliminating repetitive activities, streamlining workflows and generating new job categories that call for specific AI training. Robots and smart gadgets driven by AI will boost customization by providing customized suggestions, anticipatory reactions and flexible interactions that enhance user experience in a variety of sectors.[16] However, Rapid advancement, necessitates ethical considerations, such as responsibility, transparency, privacy protection and prejudice prevention.[17] AI decision-making needs to be impartial, equitable and explicable in crucial areas including banking, healthcare, security and recruiting. The development of

autonomous systems will also bring up issues of governance, human-AI cooperation and the morality of AI-driven innovation and judgment.[18]

AI will generate solutions in engineering, product design and architecture through the use of AI models in the field of generative design [19]. Also, AI will foster environmental sustainability by aiding in climate trend forecasting, energy inefficiencies and granting inventions that enhance the environment.[20] A new epoch of adaptive and cooperative AI will also be created by advanced Natural Language Processing and Natural Language Understanding which has empowered AI to execute highly contextual and human-like conversations.[21] AI will know more about user opinions and enhance its understanding, predicting and responding to human emotions through sentiment analysis applied on recent ChatGPT reviews. The future needs to counterbalance ethical responsibility with the expansion of technological development to guarantee that AI enhances human life while maintaining safety, equity and confidence is shown to humans. [22] As research continues, AI will remain a key factor in transforming communication, automation, innovation and paving new paths to a smarter and more connected world which will undoubtedly change the world for the better.

IV. Conclusion

Research on NLP, NLU and NLG in AI applications have shown how profoundly they affect human-machine interactions and greatly improve communication in a variety of industries.[23] These technologies are constantly developing to enable more organic, flexible and context-aware interactions in a variety of fields, including healthcare, finance, education and customer service. It is anticipated that future discoveries will enhance AI's capacity to understand, produce and react to human language with even higher accuracy and fluency as breakthroughs in deep learning, recurrent neural networks (RNNs) and transformer-based architectures push the limits of language processing.

But despite these developments, there are still difficulties. To guarantee justice and inclusivity, ethical issues like bias in language models, responsible AI use and data privacy must be addressed.[24] Strong standards are needed to control AI-generated material because security threats and false information are also major issues. Additionally, the dynamic nature of language keeps pushing researchers to create NLP systems that are more culturally sensitive and context aware.

This research effort incorporates sentiment analysis on the most recent ChatGPT evaluations from 2024 and 2025 to provide a better understanding of the acceptance and perception of these AI-driven technologies in the real world. Examining user input aids in determining how AI affects human interactions and where it may be improved as ChatGPT is a shining example of the smooth fusion of NLU, NLP and NLG.

AI-driven language processing is heading toward more ethical, human-like and adaptable communication in the future, making sure that technological developments are consistent with cultural norms. Maintaining AI's positive social effects while reducing its threats will require finding the ideal balance between innovation and moral obligation. The future generation of intelligent systems will be shaped by the synergy between NLP, NLU and NLG as research advances, redefining human-machine interaction in a world increasingly driven by AI.

References

- [1] L. Danlos and A. El Ghali, "A complete integrated NLG system using AI and NLU tools," in *Proceedings of COLING'02* (2002).
- [2] C. Su, G. Tur, D. Hakkani-Tür, and L. Heck, "A re-ranker scheme for integrating large scale NLU models," in *Proc. IEEE Spoken Language Technology Workshop (SLT)* (2018).
- [3] W. Chen, J. Chen, H. Xiong, W. Wang, and W. Y. Wang, "Logical natural language generation from open-domain tables," *arXiv preprint arXiv:2004.10404* (2020).
- [4] S. Yanouz, B. A. Abdelhakim, and M. Benhmed, "A smart chatbot architecture based on NLP and machine learning for health care assistance," in *Proc. 3rd Int. Conf. on Networking, Information Systems & Security* (2020).
- [5] S. Arora, P. Kumar, S. P. Singh, and R. K. Gupta, "Artificial intelligence and virtual assistant working model," in *Mobile Radio Communications and 5G Networks: Proceedings of MRCN 2020*, Singapore: Springer Singapore, pp. 163–171 (2020).
- [6] P. M. Mah, I. Skalna, and J. Muzam, "Natural language processing and artificial intelligence for enterprise management in the era of industry 4.0," *Applied Sciences*, vol. 12, no. 18, pp. 9207 (2022).

- [7] S. M. Mohammad, "Artificial intelligence in information technology," *SSRN Electronic Journal* (2020). [Online]. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3625444
- [8] K. R. Chowdhary, "Natural language processing," in *Fundamentals of Artificial Intelligence*, Springer, pp. 603–649 (2020).
- [9] AI Incident Database via AI Index, "Global annual number of reported artificial intelligence incidents and controversies" [dataset], AI Incident Database via AI Index, *AI Index Report*, processed by *Our World in Data* (2024). [Online]. Available: <https://ourworldindata.org/grapher/annual-reported-ai-incidents-controversies>
- [10] S. Gehrmann, T. Clark, E. Salesky, S. Waseem, W. X. Shi, P. Stenetorp, and D. Jurafsky, "The GEM benchmark: Natural language generation, its evaluation and metrics," *arXiv preprint arXiv:2102.01672* (2021).
- [11] A. B. Saka, O. A. Oyedele, O. A. Ogunseye, and A. O. Ajayi, "Conversational artificial intelligence in the AEC industry: A review of present status, challenges and opportunities," *Advanced Engineering Informatics*, vol. 55, p. 101869 (2023).
- [12] M.-F. de-Lima-Santos and W. Ceron, "Artificial intelligence in news media: Current perceptions and future outlook," *Journalism and Media*, vol. 3, no. 1, pp. 13–26 (2021).
- [13] D. Rahmani and H. Kamberaj, "Implementation and usage of artificial intelligence powered chatbots in human resources management systems," in *Proc. Int. Conf. on Social and Applied Sciences*, University of New York Tirana (2021).
- [14] G. Frisoni, M. Caccia, F. Conia, A. Lenci, R. Navigli, and M. Ronzano, "NLG-Metricverse: An end-to-end library for evaluating natural language generation," in *Proc. 29th Int. Conf. on Computational Linguistics (COLING 2022)* (2022).
- [15] B. MacCartney, *Understanding Natural Language Understanding*, presented at the ACM SIGAI Bay Area Chapter Inaugural Meeting, San Mateo, CA, USA. [Online]. Available: <https://www.youtube.com/watch?v=vcPd0V4VSNU>
- [16] K. Hamilton, T. Anderson, A. Bentz, and L. Zettlemoyer, "Is neuro-symbolic AI meeting its promises in natural language processing? A structured review," *Semantic Web Preprint*, pp. 1–42 (2022).

- [17] A. Nair and A. Loomba, "A study on how sentiment analysis plays a multifaceted role in customer experience with special reference to Indian fintech industry," (2024).
- [18] D.-M. Park, S.-S. Jeong, and Y.-S. Seo, "Systematic review on chatbot techniques and applications," *Journal of Information Processing Systems*, vol. 18, no. 1, pp. 26–47 (2022).
- [19] Y. Liu, W. Chen, Z. Liu, X. Zhang, M. Chen, and M. Sun, "GPTEval: NLG evaluation using GPT-4 with better human alignment," arXiv preprint arXiv:2303.16634 (2023).
- [20] J. Wang, Z. Wang, H. Li, Y. Liu, and X. Zhao, "Is ChatGPT a good NLG evaluator? A preliminary study," arXiv preprint arXiv:2303.04048 (2023).
- [21] H. Telychko, A. Kuzmenko, O. Vasylieva, and M. Chorna, "Personalized training with the help of automation and assistant based on artificial intelligence," *EasyChair Preprint*, no. 9958 (2023).
- [22] M. S. Vigil, M. S. Vineeth, A. K. Nair, and J. Thomas, "Crime information collection system using chatbot," in *AIP Conference Proceedings*, vol. 2587, no. 1 (2023).
- [23] A. K. Kar, P. S. Varsha, and S. Rajan, "Unravelling the impact of generative artificial intelligence (GAI) in industrial applications: A review of scientific and grey literature," *Global Journal of Flexible Systems Management*, vol. 24, no. 4, pp. 659–689 (2023).
- [24] R. K. Solanki, P. K. Patel, R. K. Vyas, and D. K. Patel, "Building a conversational chatbot using machine learning: Towards a more intelligent healthcare application," in *Handbook of Research on Instructional Technologies in Health Education and Allied Disciplines*, IGI Global, pp. 285–309 (2023).

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