**DESIGN AND IMPLEMENTATION OF A WHATSAPP-BASED QUESTION-ANSWER BOT FOR COMPUTER SCIENCE STUDENT HANDBOOK SUMMARIZATION FOR LASU STUDENTS:** **A TOOL FOR INFORMATION DISSEMINATION AND INQUIRY HANDLING.**

**BY**

**NAME: EZEANA MICHEAL**

**MATRIC NUMBER: 200591062**

**SUPERVISED BY**

**PROF. ENIKUOMEHIN, O. A.**

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# CHAPTER ONE

## INTRODUCTION

### 1.1 BACKGROUND OF THE STUDY

In this technological age, efficient information exchange and inquiry handling have played a significant role. One essential skill is the ability to obtain, comprehend, and apply information efficiently. This is particularly true in the educational, where students' learning outcomes and overall academic experience can be greatly impacted by the prompt dissemination of accurate information.

The computer science student handbook provides students with important information pertaining to the department. The handbook is handed to students to help them stay informed about the department policies, rules, and regulations. It helps both new and current students stay up to date on the courses, units, dress code of the department and so on. Hence, the handbook is an important resource for students during their academic journey.

However, Students face challenges in 3 major areas:

1. Accessibility: With many students coming in each year, few of them can get access to the distributed hardcopy of the student’s handbook, and this handbook is not readily available in printed format.
2. Comprehension: There are some unfamiliar terms contained in the handbook which the student wouldn’t be able to understand without proper guidance.
3. Length: The length of the student handbook can make it difficult to search for a specific information contained within it.

In this regard, the development of a text-summarization chatbot for the Computer Science Student Handbook at LASU represents a significant step forward. A summary is a piece of writing that originates from one or more texts, contains a significant portion of the information in the original text(s), and is no longer than half of the original text(s) (Hovy, 2005). Another source states that a text summary is extracting the most crucial information from a source or sources to create an abridged version tailored to certain users or tasks(Mani et al., 1999) .Before we progress let’s understand what the terms Artificial Intelligence, Natural Language Processing and Text summarization means.

The study of artificial intelligence focuses on teaching computers to perform tasks that humans are more capable at (Rich, 1985) .Artificial intelligence can manifest itself in a variety of ways, from expert systems used in medical diagnosis to board games like chess. Natural Language Processing (NLP) is a significant facet of artificial intelligence that will be covered in this project.

Natural Language Processing as defined by(Reshamwala et al., 2013), is a branch of computer science and artificial intelligence which is concerned with interaction between computers and human languages. NLP began in the 1950s as the intersection of artificial intelligence and linguistics. NLP was originally distinct from text information retrieval (IR), which employs highly scalable statistics-based techniques to index and search large volumes of text efficiently(Nadkarni et al., 2011).

The study of natural languages which are spoken by humans have reached a point in the era which computer are able to process and understand these languages to an extent. This capability has led to a wide range of applications including machine translation, natural language text processing and summarization, user interfaces, multilingual and cross language information retrieval (CLIR), speech recognition, artificial intelligence (AI) and expert systems(Reshamwala et al., 2013).

With the advancement of artificial intelligence, text summarization has a significant impact on information retrieval. Given the high number of information available through commonly used tools such as Google, Bing, Yahoo, and others. It is easy to be buried with lots of unnecessary information, retrieving useful information can become stressful and tiresome. Text summarization facilitates the retrieval of condensed information. Text summarization is a developing technique for determining the text article's summary by highlighting the main information(Bhatia & Jaiswal, 2016).

Text summarization is the process of extracting the most crucial and relevant information from a text document to produce a simplified version that preserves the original text's key meaning and content (Bhola et al., 2022). It uses natural language to automate the production of a summary, which is particularly beneficial for quickly finding key information in a lot of content(Andhale & Bewoor, 2016).

### 1.2 PROBLEM STATEMENT

Students can find useful information about academic policies, procedures, departmental structure, and support services in the LASU Computer Science Student Handbook. However, there are several issues with the current format:

1. Restricted Accessibility: It can be costly and difficult to distribute traditional printed handbooks with the increase in several students coming each year.
2. Information Overload: Students may find it challenging to quickly locate specific information in the handbook due to its length and complexity.
3. Understanding Difficulties: Students may find it difficult to comprehend key policies and resources in the handbook due to its technical and formal language.

These restrictions limit students' access to important information and make it more difficult for them to successfully navigate their academic journey.

### 1.3 AIM AND OBJECTIVES

The aim of this project is to development a text-summarization chatbot for the Computer Science Student Handbook for Lagos State University Computer Science Students.

The objectives of this project are as follows:

1. Review Existing literature on similar developed systems
2. Development of a machine learning based system that summarizes the student's handbook.
3. Implement a question-answer chatbot system to provide students with accurate information in a clear and unambiguous manner.
4. Enhance accessibility of the system through WhatsApp.
5. System Evaluation and Maintenance

### 1.4 SIGNIFICANCE OF PROJECT

The significance of this project is to have a positive impact in students’ success and experience in the university. This can be achieved by improved information retrieval by the system, Enhanced understanding of school and departmental structure in a clear and concise manner and streamline support to reduce the burden on level advisors and staffs by automating the question-and-answer routine and provide access for all students in Lagos State University.

This project serves as an AI powered advancement that can help educational institutions. It will help to improve understanding of the use and effectiveness of machine learning and artificial intelligence in schools today.

### 1.5 SCOPE AND LIMITATIONS

The project’s scope will focus on providing an accessible WhatsApp platform which users can interact with and receive answers based on questions asked in relation to student’s handbook through a processed, developed and evaluated machine learning model.

The following are the potential limitations of this project:

1. Natural Language Understanding: The system’s ability to understand the query retrieved and give a reasonable response related to the question may be limited.
2. Speed of Response: The response time of the machine learning model developed and how fast it will send answers when queried.
3. Accuracy of Response: The project will go through training and refinement to ensure that accurate information is given.

### 1.6 PROPOSED METHODOLOGY

There are 6 phases I will carry out in the proposed methodology for developing a WhatsApp-Based Question-Answer Bot for Computer Science Student Handbook Summarization for LASU Students.

#### 1.6.1 Data Collection and Preprocessing

This phase involves acquiring the Lagos State University Computer Science Student Handbook and preprocess the data to get it ready for the machine learning model. This entails eliminating any unneeded text, graphics, or tables, as well as unnecessary elements like page numbers, headers, and footers. After converting the data to plain text format, any formatting that is not necessary for the content is removed, and any grammatical mistakes, or conflicting vocabulary are fixed. The outcome of this preprocessing stage is a clean, normalized plain text file that only contains the most important information from the handbook. It also decreases the complexity of the data by eliminating any redundant or duplicate information and gets it ready for usage in the machine learning model.

#### 1.6.2 Machine Learning Model Development

Using extractive summarizing techniques, a machine learning-based text summarization model is developed in this phase. To be more precise, we will use TextRank and Latent Semantic Analysis (LSA) to determine which words and phrases in the preprocessed data are the most significant. The model will be trained using the training set, and its performance will be assessed using the testing set to gauge how well it can sum up the information. We will experiment with several architectures and fine-tune the model's hyperparameters to maximize its performance, making sure the model efficiently pulls the most pertinent information from the handbook. Through the application of extractive summarizing techniques, our goal is to create a model that can effectively summarize the handbook's material into brief but insightful summaries.

#### 1.6.3 Question-Answer bot Development

This phase entails applying natural language processing (NLP) methods to the design and development of a chatbot that responds to inquiries. Using a suitable framework like Dialogflow or Rasa, we will develop the chatbot and be able to create a conversational interface that can comprehend and reply to user queries. The machine learning model created in Phase 2 will relate to the chatbot, enabling it to offer condensed versions of the Computer Science Student Handbook. Users will be able to ask queries, and the chatbot will use the machine learning model's extractive summarization capabilities to provide precise and succinct responses. The integration will facilitate the chatbot's ability to furnish pertinent and contextual information, hence augmenting the user experience and simplifying the process for students to obtain the information they require.

#### 1.6.4 WhatsApp Integration

Using the WhatsApp Business API, this phase entails integrating the chatbot with WhatsApp. This will make it possible for us to create a WhatsApp chatbot that can converse with students and reply to their questions in a kind manner. Using the natural language processing (NLP) skills of the chatbot created in Phase 3, we will design and develop a WhatsApp chatbot that can comprehend and react to natural language inputs. With the help of the chatbot on WhatsApp, students will be able to start conversations and ask questions while getting knowledge compiled from the Computer Science Student Handbook. With the help of the WhatsApp chatbot, students will be able to obtain the information swiftly and easily they need from any location at any time thanks to a smooth and simple user experience.

#### 1.6.5 Testing and Evaluation

To guarantee the system's functionality and efficacy, testing and evaluation of the entire system are part of this phase. To evaluate the system's capacity to produce accurate and pertinent summaries, we will subject it to a series of pre-written queries that have been thoughtfully designed to address a variety of subjects and situations. We will be able to assess the system's performance through this methodical testing, pinpointing its strong and weak points and offering a thorough grasp of its potential. We can make that the system is operating as planned and offering high-quality summaries that satisfy user needs by comparing its performance to a set of predefined queries.

#### 1.6.6 Deployment

This phase involves deploying the system on a cloud or server, to ensure its accessibility and scalability. This will guarantee that the system can manage a high number of requests and queries while also allowing us to make it accessible to a big number of users. After the system is installed, we'll keep an eye on it to make sure it keeps working correctly and efficiently. We'll update it frequently and take care of any necessary maintenance. This entails keeping an eye on system performance, adding fresh data to the machine learning model, and resolving any potential technical problems. By implementing and managing the system in this manner, we can guarantee that it keeps giving users accurate and pertinent summaries and continues to be a useful tool for both teachers and students.

### 1.7 DEFINITION OF TERMS

The following terms are specified for better understanding:

1. Artificial Intelligence (AI): The development of computer systems that can carry out operations that normally demand human intellect, like problem-solving, language comprehension, picture recognition, and decision-making.
2. Natural Language Processing (NLP): A branch of artificial intelligence that studies natural language communication between computers and people, allowing computers to comprehend, translate, and produce human language.
3. Machine Learning (ML): A kind of artificial intelligence (AI) where computers can learn from data, perform better, and make decisions or predictions without explicit programming.
4. WhatsApp: A well-known messaging app that lets users share media, make audio, and video conversations, and send text messages to others. It is used for both individual and group communication.
5. Question-Answering (QA) System: A computer software created to respond to queries from users and answer their questions by giving pertinent and reliable information.
6. Chatbot: A computer software that mimics human communication with users through text or voice exchanges to deliver information, respond to inquiries, and help with tasks.
7. Summary: A brief statement or account that condenses the most important details of a document, speech, or other communication into a shorter format.
8. Text Summarization: Text summarization is the automated process of extracting the most crucial information from a lengthy text document while maintaining its context and vital meaning.
9. Information Retrieval (IR): The process for finding and obtaining the relevant information from a huge number of documents, data, or other resources.

# CHAPTER TWO

## LITERATURE REVIEW

### 2.1 INTRODUCTION TO CONVERSATIONAL AI AND CHATBOTS

Conversational AI has evolved significantly, by improvements in machine learning, deep learning, and better computing power, it has enabled the development of extremely accurate AI models (Kulkarni et al., 2019). These technologies have been integrated into a wide range of applications, including healthcare and education, showing the range of uses and growing demand for conversational agents.(Kulkarni et al., 2019). The area includes platforms with varying functionalities and stability levels, showing the different tools accessible for conversational AI development.(Daniel Strüber, 2020).

Chatbots have a wide range of uses in education, including language learning, course teaching, and educational aid.(Ghayoomi, 2023a). These AI-based solutions have advantages such as 24/7 availability and human-like interactions, which can improve the learning experience by offering quick support and unique learning opportunities.(Labadze et al., 2023a). However, developing chatbot knowledge bases is labor-intensive and costly.(Ghayoomi, 2023a). Chatbots have been used in classroom settings for foreign language instruction, with studies proposing development plans for AI chatbots specialized for certain languages, such as Korean (Park & Lee, 2021).

Conversational interfaces, such as chatbots, are widely acknowledged for improving the user experience (UX) by providing more natural and simple ways for users to communicate with technology.(Liao et al., 2020). These interfaces connect improvements to natural language processing and machine learning to enable interactions closer to conversations between people, potentially enhancing user engagement and fulfillment.(Liao et al., 2020). Conversational interfaces have the potential to greatly improve UX by providing more natural interaction modes and facilitating difficult information-seeking tasks.(Kocaballi et al., 2019).

### 2.2 NATURAL LANGUAGE PROCESSING TECHNIQUES FOR TEXT SUMMARIZATION

Natural Language Processing (NLP) approaches are necessary for improving text understanding capabilities. Object-oriented techniques in NLP facilitate knowledge representation and morphological analysis, which contribute to the understanding of natural language text.(Aref, 2000). Furthermore, combining NLP with Text Analytics and Machine Learning (ML) algorithms improves the ability to extract information from text data, tackling difficulties like context understanding and ambiguity resolution.(Ramesh, 2023). Despite advancements in NLP, difficulties such as bias, coreference resolution, and contextual understanding must be addressed to further improve text comprehension systems.(Basha et al., 2023).

Text summarizing is categorized into 2 (Prabha\* & Parvathy, 2020): extractive and abstractive. Extractive summarization is the process of identifying and collecting essential pieces of the source text, such as sentences or phrases, without modifying the original content. In contrast, abstractive summarizing entails developing new phrases and sentences to capture the substance of the source information, which may produce a more coherent and accurate representation of the original content.(Moratanch & Chitrakala, 2016). While extractive approaches rely on statistical and linguistic factors to identify and extract the most essential parts of the text.(Bhatia & Jaiswal, 2015). Abstractive methods may use complicated natural language processing techniques, such as semantic representation and sentence transformation, to generate summaries that are not limited to the source text's vocabulary.(Moratanch & Chitrakala, 2016).

#### 2.2.1 ABSTRACTIVE TEXT SUMMARIZATION METHODS

(Kouris et al., 2021) purposed a method that presents a novel framework that combines methods based on structure and semantics with sequence-to-sequence neural-based text summarization. It enhances sequence to sequence modelling. This work's primary goal is to offer a framework that can improve seq2seq deep learning models' performance in abstractive TS. The suggested framework addresses two key challenges in machine learning techniques in this direction:

1. Offering enough usage examples during the training stage to produce precise predictions.
2. Adjusting newly discovered instances to the model's specifications.

The comprehensive experimental process, which is based on the attentive seq2seq model, shows that performance can be enhanced by the suggested framework. The pointer-generator network, the transformer, the pretrained encoder transformer architectures, the reinforcement learning model, and four more seq2seq deep learning architectures are also used to further enhance the adaptability of the suggested approach.

This work proposes a novel framework for abstractive TS that blends knowledge-based methodologies with deep learning techniques. A well-defined theoretical model for creating abstractive summaries serves as the foundation for the framework.

Another method was proposed by (Khilji et al., 2021), which they worked with a variety of approaches in their efforts to create a baseline machine learning model for summarizing textual documents. The anticipated summary is generated as an output by the summarization system, which receives the original text as input. Additionally, a variety of assessment metrics were employed in the analysis of the anticipated summary. Furthermore, they have validated this baseline system using three distinct assessment metrics: BLEU, ROUGE, and a textual entailment technique. Also, they conducted a thorough analysis of the three evaluation methods that were employed and have methodically demonstrated the benefits of determining a text document's overall summarization score using a semantic-based evaluation method.

#### 2.2.2 EXTRACTIVE TEXT SUMMARIZATION METHODS

(Yadav et al., 2022) carried out text summarization using the extractive approach. In their study, the base model was created using reinforced learning with an attention layer. After analyzing its performance analysis, they suggested a deep learning-based model and used a large corpus at sentence level on a standard dataset to evaluate it using Bilingual Evaluation Understudy (BLEU), which had a value of 0.4, and Recall-Oriented Understudy for Gisting Evaluation (ROUGE), which had a value of 0.6. Comparing the suggested model to currently developed systems, the accuracy and correctness results are encouraging.

(Greg & Jiacheng, 2019) purposed their own method after study that to generate the final summary, their model selects sentences from the document, uses constituency parses to identify potential compressions, and then scores those compressions using a neural model. They built oracle extractive-compressive summaries for learning, and with this supervision, they jointly learn both of our components. The model performs best at a compression threshold of 0.45 but is useful across a wider range of 0.3 to 0.55. Without manual deletion, the model approximates the ground truth roughly 80% of the time. It outperforms standards and previous systems, demonstrating significant improvements in Recall-Oriented Understudy for Gisting Evaluation (ROUGE) scores, especially when compression and extraction methods are integrated in a joint framework. The model also performs well on mixed datasets, beating previous approaches, particularly on CNN and Daily Mail (CNNDM), where it outperforms the compression-augmented Latent Semantic Analysis (LatSum) model.

#### 2.2.3 EVALUATION MEASURES FOR TEXT SUMMARIZATION

Evaluation measures for text summarizing quality are critical for determining the effectiveness of summarization systems. The most widely used metric has been ROUGE (Recall-Oriented Understudy for Gisting Evaluation), which measures the overlap in n-grams between the generated summary and a set of reference summaries.(Hailu et al., 2020). However, ROUGE's difficulties in judging abstractive summaries and its reliance on reference summaries, which can be inconsistent due to human bias, have been noted.(Hailu et al., 2020). Interestingly, other evaluation approaches have been proposed to solve these restrictions. For example, a word embedding-based paradigm has been proposed to better capture semantic similarities.(Hailu et al., 2020). Furthermore, the Relevance Prediction technique has demonstrated potential in correlating with human task-based performance.(President & Dorr, 2006).

### 2.3 CHATBOT DEPLOYMENT PLATFORMS

Common messaging platforms for chatbot deployment include Facebook Messenger, Skype, Viber, WhatsApp, and Slack.(Venkat Narayana Rao et al., 2019). These platforms are popular for deploying chatbots because of the large number of users and the convenience they provide to both businesses and consumers. Chatbots on these platforms can perform a range of roles, including customer assistance and conversational commerce, and are augmented by technologies such as natural language processing (NLP) and machine learning (ML) to facilitate human-like interactions.(Venkat Narayana Rao et al., 2019).

WhatsApp, as a chatbot platform, has various advantages, including widespread acceptance and accessibility, allowing businesses to communicate with a large user base in real-time discussions. (Biswas et al., 2024). It assists numerous sectors by giving fast responses and help in information dismissal fractions which include customer service, sales, and marketing. Furthermore, good feedback from industry professionals indicates that the benefits of utilizing WhatsApp chatbots, such as increased customer experience and efficiency, often outweigh the challenges.(Buhalis & Cheng, 2019).

However, there are limitations to using WhatsApp as a chatbot platform. Significant considerations include ethical challenges, and data privacy and security.(Moustafa Laymouna, 2024). Technical challenges and user experience issues might potentially limit the efficiency of chatbots on WhatsApp.

When building chatbots for messaging apps, it is important to consider the objective and audience, as these aspects influence the conversational flow, means of distribution, and the iterative testing process to assure accuracy and user-friendliness.(Aashna Khater et al., 2023). The chatbot's ability to link with current systems, handle contextual awareness, and provide personalized and secure interactions are important difficulties that must be solved.

### 2.4 EXISTING CHATBOT SOLUTIONS IN EDUCATION

The use of chatbots and AI in educational setting reveals a wide range of applications and ramifications for both students and teachers. Chatbots are increasingly utilized to tailor learning experiences, help with schoolwork, and improve cognitive skills like problem-solving and critical thinking.(Labadze et al., 2023b) .They also function as virtual teaching assistants, delivering time-saving help and superior pedagogy to educators.(Labadze et al., 2023b). They are also used for language learning, teaching courses, and giving educational support, with the main benefits being their capacity to replicate human-like conversations, 24/7 availability, and easy accessibility.(Ghayoomi, 2023b).

The use of chatbots in educational contexts has been investigated in numerous case studies, revealing their ability to give academic support to students. For example, a study at Opol Community College investigated the influence of chatbot support on students' self-efficacy, revealing positive benefits and opportunities for development in academic support usage.(Dr. Neilson D. Bation, 2024). Another study discussed using the Hubert.ai chatbot to review students' feedback in a machine learning course, demonstrating the practical applicability of chatbots in education.(Aleedy et al., 2022).

The review of strengths and weaknesses in modern chatbot implementations, such as ChatGPT, offers a complex view. ChatGPT, an advanced language model, provides significant benefits in strengthening communication strategies across many platforms, including social media, customer service, and content production.(Danijela Lalić, 2023). Its ability to interpret and produce human-like text enables effective and engaging interactions with users. However, implementing such technology is not without its obstacles. These may include the possibility of misinterpretation, the necessity for continual updates to be relevant, and the risk of excessive dependence on automated communication, which could result in a detachment of client relationships.

### 2.5 COMPUTER SCIENCE STUDENT HANDBOOK CONTENT ANALYSIS

The computer science student handbooks are valuable guides, providing insights into many aspects of the academic journey. The handbook contains thorough explanations of academic program structures, curriculum summaries, policies and procedures, faculty profiles, and support services. By analyzing these components, students obtain a better understanding of program requirements, administrative processes, and available resources, which improves their overall educational experience and facilitates their achievement in computer science.

The topics in the computer science student handbook include an overview of academic program objectives, details on curriculum structure and course requirements, explanations of academic policies and procedures, profiles of former and current faculty members, historical background of the department or university, and information on student conduct and expectations. Furthermore, CS student handbooks often include information about enrollment procedures, add/drop processes, exam protocols, and resources accessible to help students learn and grow. By completely covering these issues, CS student handbooks are important resources for students embarking on their academic path in computer science.

The importance for clarity and precision in educational resources emphasizes how important it is to appropriately summarize information from handbooks for student inquiries. Precise summaries guarantee that learners have relevant and accurate data, which is crucial for their education and decision-making procedures.(Alenitsyn et al., 2020). It's interesting to note that although information accuracy is important, technology plays a crucial role in making accurate summaries more accessible. For instance, large language model (LLM) chatbots have proven to be able to condense complex material into brief summaries, albeit their effectiveness varies and occasionally has drawbacks like inaccurate or out-of-date information.(Sosa et al., 2024).

### 2.6 CHALLENGES AND OPPORTUNITIES IN WHATSAPP-BASED CHATBOT DEVELOPMENT

The development of a WhatsApp chatbot has several obstacles, such as handling large messages volumes, integrating multimedia content for a variety of applications, and guaranteeing rapid and reliable information retrieval. Studies emphasize the value of using Agile approaches for iterative development and centralized communication systems. Furthermore, future research and development is interested in the potential of chatbots to facilitate multimedia engagement in low-resource environments.(Teo & Ahmad Khiri, 2021).

While messaging platforms have made improvements in securing communication channels through encryption, there is an urgent need for extensive security and privacy measures that extend beyond confidentiality to include the protection of personal metadata and the execution of robust security policies.(Zhang et al., 2017). The development and execution of such safeguards is crucial for protecting user data from unwanted access and restoring trust in digital communication systems.

Chatbots on WhatsApp offer a new way to improve accessibility and student participation in classrooms. Through the integration of WhatsApp as a customer relationship management tool in the education sector, educational institutions can take use of the real-time capabilities and extensive usage of the platform to establish a more engaging and dynamic learning environment.(Williams, 2023b). This approach may improve long-term connections among all parties involved by facilitating communication between students, instructors, and support personnel.

### 2.7 EVALUATION METHODS FOR CHATBOT PERFORMANCE

Chatbots' effectiveness can be measured by their correctness, conciseness, readability, intent recognition, emotional understanding, and the quality of therapeutic or medical responses. These requirements are critical for ensuring that chatbots give consumers with credible and helpful information across numerous applications, including customer service and healthcare.(Pawlik et al., 2022).

User-centric evaluation methods for chatbots include surveys, interviews, and user feedback analysis. These methodologies seek to evaluate the effectiveness, efficiency, and user satisfaction of chatbot systems.(Maroengsit et al., 2019). Surveys, as a quantitative technique, can provide extensive insights into user experiences and preferences, as evidenced in the heuristic review of COVID-19 chatbots, which employed a survey instrument to evaluate user experience and chatbot usability.(Höhn & Bongard-Blanchy, 2021). Interviews provide qualitative depth by revealing complex user positions and interpretations of interactive technology, as proven in the research of users' subjective evaluations of an information system.(Raita, 2012). User-centric evaluation approaches for chatbots are critical for understanding user requirements and improving chatbot design. Surveys and interviews yield structured and in-depth insights, respectively, whereas user feedback analysis provides a scalable method for evaluating user opinions and actions.

Comparative studies in chatbot evaluation frequently include human specialists who analyze the applicability and usability of chatbots in various domains, as well as alternative information retrieval methods to benchmark performance. In the area of legal information retrieval, human experts evaluated the performance of a "multilayered" strategy combining doc2vec and citation network analysis, which was judged to be sufficiently accurate.(Novotn´a & Novotn´a, 2021). While the literature describes ways for evaluating chatbot performance and includes human experts in the process, there is a scarcity of direct comparative research pitting chatbots against human experts and alternative information retrieval methods in a head-to-head comparison. Future research may benefit from such comparative studies to better understand the strengths and limitations of chatbots in information retrieval tasks.

### 2.8 FUTURE DIRECTIONS IN CHATBOT RESEARCH AND DEVELOPMENT

Conversational AI and chatbot technologies are rapidly evolving, with improvements in core structures and applications across multiple disciplines. The integration of machine learning (ML), natural language processing (NLP), and deep learning (DL) techniques has been critical to these improvements, boosting the capacity of chatbots to enable more human-like interactions. (Aslam, 2023). These technologies are growing more complex, enabling more tailored and contextually relevant interactions. However, the potential for abuse and the need for ethical frameworks are crucial factors that must be addressed to enable the responsible development and deployment of these technologies.

WhatsApp-based chatbots have a wide range of possible applications and extensions in education, as they can help with numerous areas of learning. According to the literature, chatbots can be integrated into the educational process, delivering prospective, continuous, and retrospective support.(Tsivitanidou & Ioannou, 2021). Chatbots can improve access to learning materials, provide tailored support, and help address specific challenges in education. (Subiyantoro et al., 2023). WhatsApp-based chatbots in education are effective tools for improving learning experiences, providing individualized support, and optimizing administrative duties.

The extensive use of chatbots in academic contexts has brought ethical concerns that must be carefully investigated. The usage of AI chatbots for creating written content has increased significantly, provoking questions about the ethical use of such technology in academic writing.(Khan, 2023). Furthermore, the balance between developing student autonomy and the risk of over-reliance on AI for educational reasons is an important ethical challenge.(Williams, 2023a). The use of chatbots in academic contexts creates both benefits and ethical challenges. The advantages of increased efficiency and individualized learning experiences must be balanced against the hazards of jeopardizing academic integrity, privacy, and the distinctive nature of academic labor. To properly traverse these obstacles, clear criteria and ethical frameworks must be established, ensuring that the adoption of chatbots supports educational growth while without weakening ethical standards.

# SUMMARY OF LITERATURE

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Author** | **Year** | **Paper Title** | **Methodology Used** | **Limitations** |
| Kulkarni et al. | 2019 | Conversational AI: An Overview of Methodologies, Applications and Future Scope | This paper also provides a comprehensive account of some of the research opportunities in the Conversational AI domain and thus setting up the stage for future research and innovation in this field. | The paper primarily focuses on applications in customer service, language translation, and speech recognition, with limited discussion of other potential applications. |
| Daniel Strüber | 2020 | A Maturity Assessment Framework for Conversational AI Development Platforms | A framework is proposed to assess conversational AI platforms' maturity, identifying key features and categorizing platforms by their ability to understand and respond to user inputs. | The framework operates at a high level of abstraction, which may make it difficult to apply in practice, particularly for complex platforms with many features and nuances. |
| Ghayoomi, Masood | 2023 | Applications of Chatbots in Education | The main research studies on chatbots for the educational domain are reviewed and general construction of a chatbot as well as the evaluation metrics of chatbots are explained; and the available chatbot tools and systems used in education, in the general sense, are collected. | The framework has not been empirically validated through extensive testing or user feedback, which could strengthen its reliability and effectiveness. |
| Labadze et al. | 2023 | Role of AI chatbots in education: systematic literature review | AI chatbots have the potential to completely transform education by offering better learning experiences, on-demand help, and virtual teaching aids. This report examines 67 research and highlights the advantages for teachers (time-saving, enhanced pedagogy) and students (help with homework, tailored learning, skill development). It also highlights issues and problems that need to be resolved, like dependability and moral considerations. | The review included both qualitative and quantitative studies, but did not assess their methodological quality. |
| Park & Lee | 2021 | Utilizing a chatbot builder for developing an AI chatbot for Korean language education | This study's methodology included research of the literature on chatbot building and language learning before creating a chatbot with Dialogflow, a chatbot builder. To assess the efficacy of the chatbot, pilot research was carried out with twenty Korean language learners. Information was gathered via surveys, interviews, and chatbot interaction logs. Thematic analysis and descriptive statistics were used to examine the data. | The small sample size (20 participants), limited generalizability to other languages or contexts, reliance on the capabilities and limits of the chatbot creator and need for additional research on long-term effectiveness and user engagement are some of the drawbacks of this study. |
| Aref | 2000 | Object Orientation in Natural Language Processing | The uses of object-oriented techniques in knowledge representation and morphological analysis are described. | While object-oriented techniques can improve code organization and maintainability, they may not always result in optimal performance compared to more low-level or specialized approaches. The paper provides empirical evaluations of the performance of the proposed method compared to alternative NLP techniques. |
| Prabha & Parvathy | 2020 | Extractive and Abstractive Text Summarization Techniques | This paper deals with the study of extractive as well as abstractive strategies in text summarization. Overall objective of this paper is to provide a significant direction to the researchers to learn about different strategies applied in text summarization. | The passage doesn't mention how well summarization tools handle complexities like context or inference. Summarization might struggle to grasp the true meaning if it relies only on keywords or sentence structure. |
| Kouris et al. | 2021 | Abstractive Text Summarization: Enhancing Sequence-to-Sequence Models Using Word Sense Disambiguation and Semantic Content Generalization | The overall methodology is based on a well-defined theoretical model of knowledge-based content generalization and deep learning predictions for generating abstractive summaries. | The reliance on ontological knowledge resources may limit the framework's applicability to domains without well-established ontologies. |
| Khilji et al. | 2021 | Abstractive Text Summarization Approaches with Analysis of Evaluation Techniques | The methodology used in this work involves developing a baseline machine learning model to summarize textual documents, experimenting with both extractive and abstractive approaches, and evaluating the predicted summary using three different metrics: BLEU, ROUGE, and Textual Entailment. | The model's performance is heavily dependent on the quality of text preprocessing, which can be a challenging task, especially for noisy or unstructured text data. |
| Yadav et al. | 2022 | Extractive text summarization using deep learning approach | In this paper, initially, reinforced learning (with attention layer) was used as the base model. | The evaluation is solely based on automated metrics, which may not accurately reflect human judgment and understanding of summary quality. |
| Greg & Jiacheng | 2019 | Neural Extractive Text Summarization with Syntactic Compression | This paper presents a neural model for single-document summarization based on joint  extraction and syntactic compression. Our model chooses sentences from the  document, identifies possible compressions based on constituency parses, and  scores those compressions with a neural model to produce the final summary. | The applicability of the proposed approach to diverse datasets and domains remains to be explored, as the experimental results are primarily based on the CNN/Daily Mail and New York Times datasets |
| Teo & Ahmad Khiri | 2021 | FCSIT WhatsApp Chatbot | Agile Kanban methodology was used to develop the system which promotes the use of a Kanban board to visualize the development stages | The chatbot is limited to providing information related to academic studies within the FCSIT faculty |
| Subiyantoro et al. | 2023 | Exploring the Impact of AI-Powered Chatbots (Chat GPT) on Education: A Qualitative Study on Benefits and Drawbacks | The study employs a qualitative approach, gathering data through in-depth interviews and participatory observations in multiple educational institutions. | The study only focuses on Chat GPT and may not be representative of other AI-powered chatbots. |

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# CHAPTER THREE

## METHODOLOGY

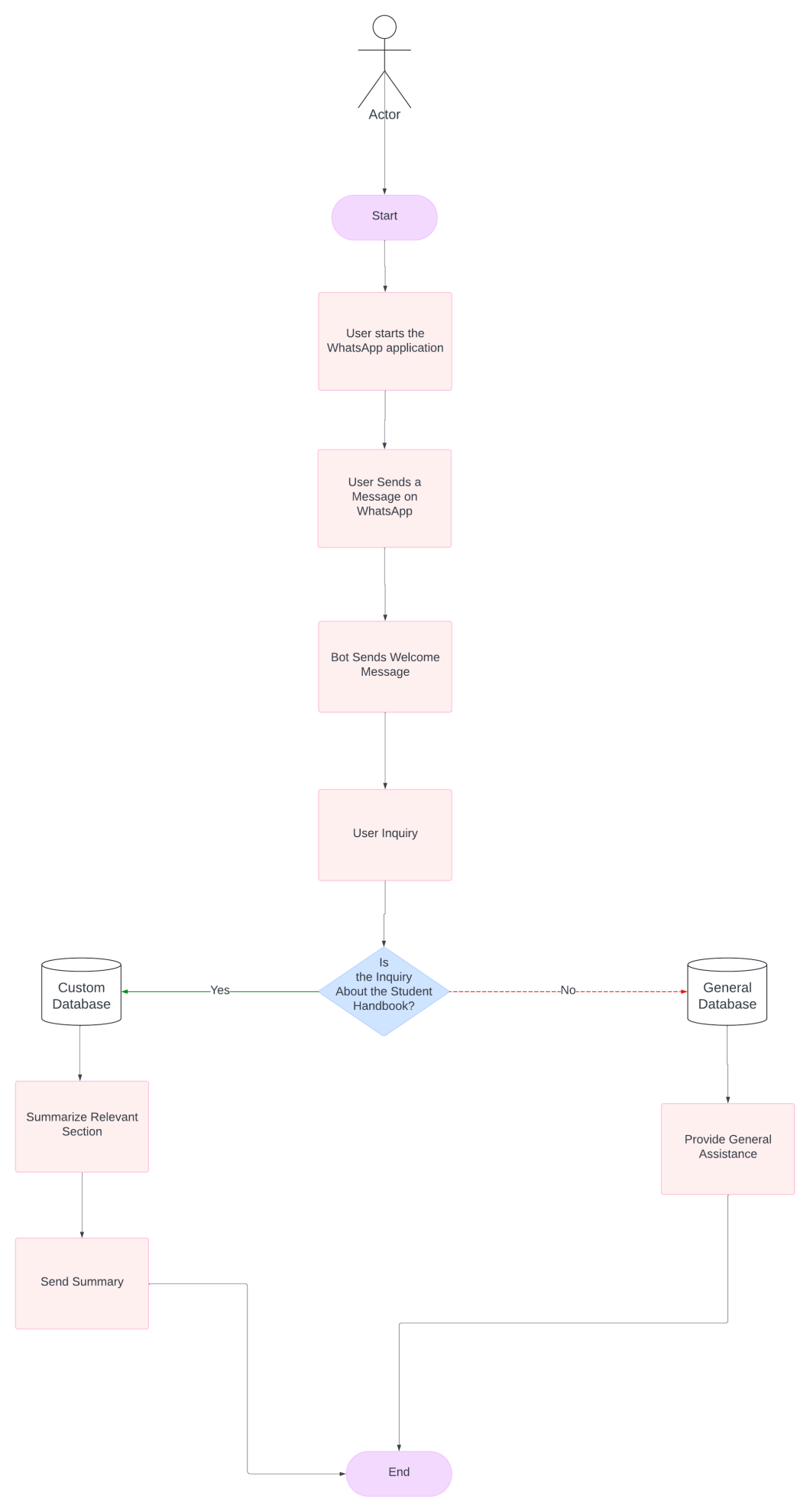
### 3.1 RESEARCH APPROACH

The research approach chosen for the development of this software is the DSR (Design Science Research). This is chosen because it is a structured methodology that assists in the design and development of new software solutions. In the context of this research, the DSR approach will guide the entire process of designing, developing and production of this software product.It will also help in further innovations and progress relevant to this research in the future.

#### 3.1.1 SOFTWARE PROCESS MODEL

The software model chosen for the development of this product is the Agile development model, This was chosen in line with the DSR Methodology. The Agile development model is an iterative process of software development pocess that involves the planning, design, development, test, deployment and review of the application while giving ways to further improvement of the software.Given the flexibility, iterative process and the risk management is necessary for the development of the text summarization model and connecting a chatbot for user friendliness.

### 3.2 ARCHITECTURAL MODEL OF THE APPLICATION



The architectural model of the software developed is as a UML (Unified modelling langusge) Use case disgram which shows the user interaction is handled.Below is the algorithm for the detailing this:

**Step 1: Start**

-User starts the whatsapp application and is ready to interact with the bot.

**Step 2: User Sends a Message on WhatsApp**

-The user interacts with the bot by sending a message.

**Step 3: Welcome Message**

-The bot sends a welcome message and provides instructions on how to use the bot.

**Step 4: User Inquiry**

-The user asks a question or requests information.

**Step 5: Is the Inquiry About the Student Handbook?**

-An algorithm is run to detect if the user's inquiry pertains to the student handbook.

--If YES, proceed to Step 6 (Summarize Relevant Section) and access the custom knowledge base.

--If NO, proceed to Step 8 (Provide General Assistance) and access the general knowledge base.

**Step 6: Summarize Relevant Section**

-The bot retrieves and summarizes the relevant section of the student handbook from the custom knowledge base.

**Step 7: Send Summary**

-The bot sends the summary to the user.

**Step 8: Provide General Assistance**

-The bot handles other inquiries or directs the user to appropriate resources using the general knowledge base.

**Step 9: End**

-End of the user's interaction with the bot.

### 3.3 DEVELOPMENT TOOLS AND TECHNOLOGIES

For the development of the text summarization and chatbot system the following technologies are leveraged:

#### 3.3.1 INTEGRATED DEVELOPMENT ENVIRONMENT (IDE)

1. Visual Studio Code: Visual studio code is a popular IDE (Integrated Development Environment) used for development purposes. it has many widely available extensions for users needs. The platform facilitates easy use for the development of applications and supports various programming languages.
2. Python Programming Language: Python programming language is a popular programming language with a wide range of uses extending from data analysis to web development and also deep learning among others. Because of its simplicity and effectiveness it is chosen in the development of this software.

#### 3.3.2 BOT API

1. Google Gemini: Google Gemini is a large language model developed by google.Natural conversation is an area in which Google's Gemini 1.5 sophisticated language model shines. With its enormous 1 million token context window, it can recall and refer to previous sections of your conversation for a more seamless experience. Because of this and its enhanced ability to discern your intent, Gemini 1.5 communicates with you more like a buddy than a machine. Google makes the api for gemini-1.5-flash, which exels more in speed and efficiency, available to use.

#### 3.3.3 CUSTOM KNOWLEDGEBASE

1. CSV(comma-separated values):  CSV files are a useful option for quick reference guides because of their ease of use and readability. CSV files can act as a simple knowledge base for structured data. They're great for storing lists or tables of information, like frequently asked questions or basic product details.

#### 3.3.4 BACKEND API CONNECTION

1. Flask:Flask is a lightweight and flexible python web development tool, it works well as a backend tool for APIs. In contrast to larger frameworks, Flask allows fine-tuning the functionality of APIs created. It is therefore perfect for creating focussed, straightforward APIs. This will be used to connect with the whatsapp platform.

#### 3.3.5 WHATSAPP API CONNECTION

1. Meta For Developers:Meta for Developers provides a wealth of resources for working on the WhatsApp Business Platform. With the use of this platform, businesses can communicate with clients using the messaging app they already enjoy, utilizing WhatsApp's enormous reach. The WhatsApp Business Platform provides developers with APIs to automate processes, customize user experiences, and easily incorporate WhatsApp into current workflows.

#### 3.3.6 VERSION CONTROL

1. Git: Git gives developers the ability to efficiently track changes and work together. Because it's a distributed system, all developers have access to the full project history, which promotes efficient teamwork. Git's branching feature lets developers test out code without impacting the main project, and merging these changes back in is a smooth process. For developers of all stripes, Git is a vital tool.
2. Github: Used alongside git, GitHub offers developers an easy-to-use platform for storing and managing their projects. Consider it Git with enhanced capabilities, At its core, GitHub still offers version control, but it also offers social coding components, issue tracking, and tools for code collaboration. Through pull requests, developers may discuss modifications, exchange code, and benefit from each other's work. Because of this, GitHub is a great place for open-source development and helps to create a lively community among programmers.

#### 3.3.7 EVALUATION, TESTING AND DEBUGGING

1. Manual Testing: One crucial aspect of assessing extractive summarization methods is still manual testing. The system's output is compared by human evaluators to a reference summary prepared by a person, with special attention paid to important factors including factual accuracy, completeness, readability, and impartiality. Although it can be subjective, time-consuming, and costly to scale, this offers insightful information about the summary's overall quality and human-friendliness.
2. ROGUE(Recall-Oriented Understudy for Gisting Evaluation): Using python, the rogue scores for the summary generated and used to evaluate the performance.it offers an automated and objective alternative. It computes the overlap between a reference and the generated summary in terms of n-grams, or word sequences. Various features of this overlap are measured by different ROUGE scores, such as longest shared sequences (ROUGE-L) or single-word matches (ROUGE-1). ROUGE is a quick and scalable method of system comparison, but its emphasis on word overlap means that meaning, fluidity, and general flow are not guaranteed to be well-summarized.

# CHAPTER FOUR

## IMPLEMENTATION AND RESULT

### 4.1 TECHNICAL REQUIREMENTS

### 4.2 TEXT SUMMARIZATION

### 4.3 INTEGRATING CHATBOT

### 4.4 LINKING TO WHATSAPP

# REFERENCES

Aashna Khater, Asher Jacob, Shrihari Jhawar, Ishita Shah, & Dr. Girish Potdar. (2023). Chatbot Development Through the Ages : A Survey. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 262–271. https://doi.org/10.32628/CSEIT2390329

Aleedy, M., Atwell, E., & Meshoul, S. (2022). *Using AI Chatbots in Education: Recent Advances Challenges and Use Case*. 661–675. https://doi.org/10.1007/978-981-19-1653-3\_50

Alenitsyn, A. G., Butikov, E. I., & Kondratyev, A. S. (2020). Concise Handbook of Mathematics and Physics. *Concise Handbook of Mathematics and Physics*. https://doi.org/10.4324/9781003068785

Andhale, N., & Bewoor, L. A. (2016). An overview of Text Summarization techniques. *Proceedings - 2nd International Conference on Computing, Communication, Control and Automation, ICCUBEA 2016*. https://doi.org/10.1109/ICCUBEA.2016.7860024

Aref, M. M. (2000). Object Orientation in Natural Language Processing. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *1821*, 591–600. https://doi.org/10.1007/3-540-45049-1\_71

Aslam, F. (2023). The Impact of Artificial Intelligence on Chatbot Technology: A Study on the Current Advancements and Leading Innovations. *European Journal of Technology*, *7*(3), 62–72. https://doi.org/10.47672/EJT.1561

Basha, M. J., Vijayakumar, S., Jayashankari, J., Alawadi, A. H., & Durdona, P. (2023). Advancements in Natural Language Processing for Text Understanding. *E3S Web of Conferences*, *399*. https://doi.org/10.1051/E3SCONF/202339904031

Bhatia, N., & Jaiswal, A. (2015). Trends in Extractive and Abstractive Techniques in Text Summarization. *International Journal of Computer Applications*, *117*(6), 21–24. https://doi.org/10.5120/20559-2947

Bhatia, N., & Jaiswal, A. (2016). Automatic text summarization and it’s methods - a review. *Proceedings of the 2016 6th International Conference - Cloud System and Big Data Engineering, Confluence 2016*, 65–72. https://doi.org/10.1109/CONFLUENCE.2016.7508049

Bhola, A., Mullapudi, J., Kollipara, S., & Sanaka, T. (2022). Text Summarization Based On Ranking Techniques. *Proceedings of 5th International Conference on Contemporary Computing and Informatics, IC3I 2022*, 1463–1467. https://doi.org/10.1109/IC3I56241.2022.10072962

Biswas, N., Biswas, S., & Maity, S. (2024). *Analysis of Chatbots*. 62–81. https://doi.org/10.4018/979-8-3693-1830-0.CH004

Buhalis, D., & Cheng, E. S. Y. (2019). Exploring the Use of Chatbots in Hotels: Technology Providers’ Perspective. *Information and Communication Technologies in Tourism 2020*, 231–242. https://doi.org/10.1007/978-3-030-36737-4\_19

Daniel Strüber, P. L. ,Johan A. ,Thorsten B. (2020). *A Maturity Assessment Framework for Conversational AI Development  Platforms*. https://doi.org/10.48550/ARXIV.2012.11976

Danijela Lalić, D. B. O. T. S. D. O. I. E. A. M. N. S. ,Faculty O. T. S. D. O. I. E. A. M. N. S. ,Jelena S. M. (2023). *LEVERAGING CHATGPT FOR CREATIVE COMMUNICATION STRATEGIES: EXPLORING PROS AND CONS*. 332–337. https://doi.org/10.24867/IS-2023-T6.1-14\_03041

Dr. Neilson D. Bation, O. C. C. M. O. P. (2024). The Perceived Value of Chatbot Support in Enhancing College Student Self-Efficacy. *International Journal of Social Science and Human Research*, *07*(01). https://doi.org/10.47191/IJSSHR/V7-I01-47

Ghayoomi, M. (2023a). Applications of Chatbots in Education. *Trends, Applications, and Challenges of Chatbot Technology*, 80–118. https://doi.org/10.4018/978-1-6684-6234-8.CH004

Ghayoomi, M. (2023b). Applications of Chatbots in Education. *Trends, Applications, and Challenges of Chatbot Technology*, 80–118. https://doi.org/10.4018/978-1-6684-6234-8.CH004

Greg, D., & Jiacheng, X. (2019). *Neural Extractive Text Summarization with Syntactic Compression*. https://doi.org/10.48550/ARXIV.1902.00863

Hailu, T. T., Yu, J., & Fantaye, T. G. (2020). A Framework for Word Embedding Based Automatic Text Summarization and Evaluation. *Information*, *11*(2). https://doi.org/10.3390/INFO11020078

Höhn, S., & Bongard-Blanchy, K. (2021). Heuristic Evaluation of COVID-19 Chatbots. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *12604 LNCS*, 131–144. https://doi.org/10.1007/978-3-030-68288-0\_9

Hovy, E. (2005). Text Summarization. *The Oxford Handbook of Computational Linguistics*, *9780199276349*. https://doi.org/10.1093/OXFORDHB/9780199276349.013.0032

Khan, R. A. (2023). Ethical Considerations for using Chatbots in Research. *Health Professions Educator Journal*, *6*(1). https://doi.org/10.53708/HPEJ.V6I1.2626

Khilji, A. F. U. R., Sinha, U., Singh, P., Ali, A., & Pakray, P. (2021). Abstractive Text Summarization Approaches with Analysis of Evaluation Techniques. *Communications in Computer and Information Science*, *1406 CCIS*, 243–258. https://doi.org/10.1007/978-3-030-75529-4\_19

Kocaballi, A. B., Laranjo, L., & Coiera, E. (2019). Understanding and Measuring User Experience in Conversational Interfaces. *Interacting with Computers*, *31*(2), 192–207. https://doi.org/10.1093/IWC/IWZ015

Kouris, P., Alexandridis, G., & Stafylopatis, A. (2021). Abstractive Text Summarization: Enhancing Sequence-to-Sequence Models Using Word Sense Disambiguation and Semantic Content Generalization. *Computational Linguistics*, *47*(4), 813–859. https://doi.org/10.1162/COLI\_A\_00417/1967356/COLI\_A\_00417.PDF

Kulkarni, P., Mahabaleshwarkar, A., Kulkarni, M., Sirsikar, N., & Gadgil, K. (2019). Conversational AI: An Overview of Methodologies, Applications &amp; Future Scope. *Proceedings - 2019 5th International Conference on Computing, Communication Control and Automation, ICCUBEA 2019*. https://doi.org/10.1109/ICCUBEA47591.2019.9129347

Labadze, L., Grigolia, M., & Machaidze, L. (2023a). Role of AI chatbots in education: systematic literature review. *International Journal of Educational Technology in Higher Education*, *20*(1). https://doi.org/10.1186/S41239-023-00426-1

Labadze, L., Grigolia, M., & Machaidze, L. (2023b). Role of AI chatbots in education: systematic literature review. *International Journal of Educational Technology in Higher Education*, *20*(1). https://doi.org/10.1186/S41239-023-00426-1

Liao, Q. V., Geyer, W., Muller, M., & Khazaen, Y. (2020). *Conversational Interfaces for Information Search*. 267–287. https://doi.org/10.1007/978-3-030-38825-6\_13

Mani, I., House, D., Klein, G., Hirschman, L., Firmin, T., & Sundheim, B. (1999). The TIPSTER SUMMAC Text Summarization Evaluation. *9th Conference of the European Chapter of the Association for Computational Linguistics, EACL 1999*, 77–85. https://doi.org/10.3115/977035.977047

Maroengsit, W., Piyakulpinyo, T., Phonyiam, K., Pongnumkul, S., Chaovalit, P., & Theeramunkong, T. (2019). A Survey on Evaluation Methods for Chatbots. *ACM International Conference Proceeding Series*, *Part F148391*, 111–119. https://doi.org/10.1145/3323771.3323824

Moratanch, N., & Chitrakala, S. (2016). A survey on abstractive text summarization. *Proceedings of IEEE International Conference on Circuit, Power and Computing Technologies, ICCPCT 2016*. https://doi.org/10.1109/ICCPCT.2016.7530193

Moustafa Laymouna, Y. M. L. S. E. L. (2024). *Roles, Users, Benefits and Limitations of Chatbots in Healthcare: Rapid Review (Preprint)*. https://doi.org/10.2196/PREPRINTS.56930

Nadkarni, P. M., Ohno-Machado, L., & Chapman, W. W. (2011). Natural language processing: an introduction. *Journal of the American Medical Informatics Association*, *18*(5), 544–551. https://doi.org/10.1136/AMIAJNL-2011-000464

Novotn´a, T., & Novotn´a, N. (2021). Human Evaluation Experiment of Legal Information Retrieval Methods. *Frontiers in Artificial Intelligence and Applications*, *346*, 131–137. https://doi.org/10.3233/FAIA210328

Park, J., & Lee, H. (2021). 한국어 교육용 AI 챗봇 개발을 위한 챗봇 빌더 활용 방안. *Teaching Korean as a Foreign Language*, *63*, 51–91. https://doi.org/10.21716/TKFL.63.3

Pawlik, Ł., Płaza, M., Deniziak, S., & Boksa, E. (2022). A method for improving bot effectiveness by recognising implicit customer intent in contact centre conversations. *Speech Communication*, *143*, 33–45. https://doi.org/10.1016/J.SPECOM.2022.07.003

Prabha\*, PL., & Parvathy, Dr. M. (2020). Extractive and Abstractive Text Summarization Techniques. *International Journal of Recent Technology and Engineering (IJRTE)*, *9*(1), 1040–1044. https://doi.org/10.35940/IJRTE.A2235.059120

President, S. F., & Dorr, B. J. (2006). *Text Summarization Evaluation: Correlating Human Performance on an Extrinsic Task with Automatic Intrinsic Metrics*. https://doi.org/10.21236/ADA455670

Raita, E. (2012). User interviews revisited. *NordiCHI 2012: Making Sense Through Design - Proceedings of the 7th Nordic Conference on Human-Computer Interaction*, 675–682. https://doi.org/10.1145/2399016.2399119

Ramesh, N. (2023). Natural Language Processing and Text Analytics: Techniques and Applications. *Cutting-Edge Technologies in Innovations in Computer Science and Engineering*. https://doi.org/10.59646/CSEBOOKC2/004

Reshamwala, A., Mishra, D., & P Pawar. (2013). Review on natural language processing. *Engineering Science and Technology: An International Journal (ESTIJ)*, *3*(1), 113–116. https://www.researchgate.net/profile/Alpa-Reshamwala/publication/235788362\_REVIEW\_ON\_NATURAL\_LANGUAGE\_PROCESSING/links/00463516276f412048000000/REVIEW-ON-NATURAL-LANGUAGE-PROCESSING.pdf

Rich, E. (1985). Artificial intelligence and the humanities. *Computers and the Humanities*, *19*(2), 117–122. https://doi.org/10.1007/BF02259633

Sosa, B. R., Cung, M., Suhardi, V. J., Morse, K., Thomson, A., Yang, H. S., Iyer, S., & Greenblatt, M. B. (2024). Capacity for large language model chatbots to aid in orthopedic management, research, and patient queries. *Journal of Orthopaedic Research : Official Publication of the Orthopaedic Research Society*. https://doi.org/10.1002/JOR.25782

Subiyantoro, S., Degeng, I. N. S., Kuswandi, D., & Ulfa, S. (2023). Exploring the Impact of AI-Powered Chatbots (Chat GPT) on Education: A Qualitative Study on Benefits and Drawbacks. *Jurnal Pekommas*, *8*(2), 157–168. https://doi.org/10.56873/JPKM.V8I2.5206

Teo, K. H., & Ahmad Khiri, M. J. (2021). FCSIT WhatsApp Chatbot. *Trends in Undergraduate Research*, *4*(1), c41-51. https://doi.org/10.33736/TUR.2866.2021

Tsivitanidou, O., & Ioannou, A. (2021). Envisioned Pedagogical Uses of Chatbots in Higher Education and Perceived Benefits and Challenges. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *12785 LNCS*, 230–250. https://doi.org/10.1007/978-3-030-77943-6\_15

Venkat Narayana Rao, T., Jyothsna, V., & Jhansi Laxmi, S. (2019). An Emerging Role of Chatbot in Businesses as a Novel Interactive Tool. *International Journal on Recent and Innovation Trends in Computing and Communication*, *7*(2), 36–39. https://doi.org/10.17762/IJRITCC.V7I2.5230

Williams, R. T. (2023a). The ethical implications of using generative chatbots in higher education. *Frontiers in Education*, *8*. https://doi.org/10.3389/FEDUC.2023.1331607/PDF

Williams, R. T. (2023b). *WhatsApp as a Tool for Customer Relationship Management in Education: Opportunities, Challenges, and Future Directions*. https://doi.org/10.20944/PREPRINTS202311.1119.V1

Yadav, A. K., Singh, A., Dhiman, M., Vineet, Kaundal, R., Verma, A., & Yadav, D. (2022). Extractive text summarization using deep learning approach. *International Journal of Information Technology*, *14*(5), 2407–2415. https://doi.org/10.1007/S41870-022-00863-7

Zhang, L., Ji, Q., & Yu, F. (2017). The Security Analysis of Popular Instant Messaging Applications. *2017 International Conference on Computer Systems, Electronics and Control, ICCSEC 2017*, 1324–1328. https://doi.org/10.1109/ICCSEC.2017.8446863