

Current Trends of Development in Chatbot Systems

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Abstract:

Technology advancements are constantly focused at enhancing the quality of life for its consumers. A similar observation may be made about natural language processing. In recent years, chatbots, or conversational systems, have grown in popularity due to their ability to converse with humans. Chatbots may be used in a range of businesses and applications. This article will do an in-depth study of the most current chatbot systems/papers in a variety of topics. As a result, these current publications have been examined to acquire a better knowledge of how chatbot systems are presently being built and how they are being utilized in a variety of situations, including the workplace.

Keywords: Technology Advancement, Artificial Intelligence, Trends in AI, Chatbots systems

Introduction

As processing power has increased, in response to challenging world working requirements, it has been possible to make new technological improvements. Technological improvements would have been impossible to achieve without the use of artificial intelligence (AI). Natural language processing (NLP) is a critical application of artificial intelligence. Natural Language Processing (Teller, 2000) is a technique that may be used to train a machine or computer to understand and interpret human speech. Bots that engage in conversation with humans, often known as Conversational AI Bots or simply Chatbot Systems, are an important component of Natural Language Processing.

Chatbot systems have gained in popularity in recent years, owing to the wide range of applications for which they may be used. Aside from the fact that they are widely applicable, chatbot systems are popular because they are simple to use, improve customer experience, can handle large volumes of data, and are extremely cost effective [2]. The use of chatbot systems has been proved to be effective in lowering overall operational expenses [4](Milenkovic, 2019).

During the next several years, it is projected that up to 70 percent of the strain on higher-level management personnel will be managed by chatbots systems. It provides bases to attract billions of dollars towards the development phase and research of chatbot systems (Magazine, 2018).

The use of chatbots to provide product assistance to consumers is one of the most convenient methods of doing so that we can think of. The whole client experience is improved as a result, and it becomes more engaging. A recent survey found that customers prefer to communicate with chatbots rather than actual persons [6], and this tendency is predicted to continue in the future.

In order to reply to user inquiries, these chatbot systems are provided with information. Organized databases, knowledge bases, and unstructured datasets are the three forms of knowledge that chatbot systems may access (Nagarhalli et al., 2020).

Specifically, the paper's major goal is to examine recent trends during development of the chatbot systems, including how these systems have been implemented in various areas and the types of data that have been provided to these systems.

I. Review of Chatbots Systems

This section contains summaries of current papers on the topic of chatbot development.

The information that has been entered into a chatbot system is at the heart of the system. Depending on the information it has acquired, the chatbot will conduct conversations and react to inquiries. Using a new chatbot system that is devoid of information, Sameera A. Abdul-Kader and Dr. John Woods present their work (Abdul-Kader & Woods, 2017). Instead, the authors urge that website visitors look for solutions to their questions on the World Wide Web, which they may access using a search engine.

An artificial intelligence chatbot and natural language processing technology will be used to help in the execution of activities involving natural language processing. Text matching will be used to identify responses to queries, which will subsequently be saved in a structured database, according to the article's description of the study.

Che-Hao Lee and colleagues (Lee et al., 2018) observed that a strong question-answer pair is critical for the development of children's companion robots in their research. A total of around 100 student stories will be used to construct the questions for the paper. Using logistic regression, the authors of this study determine whether or not a user's query will be answered correctly. The logistic regression method is used to rate the question-answer pairs. Neither how natural language processing works nor what form of knowledge it is explained in the article.

Ly Pichponreay et al. (Pichponreay et al., 2016) advocate that this concept be broadened by including optical character recognition (OCR) for portable document format text into the Apache PDFBOX software. In order to determine the substance of the text, the research suggests that questions be constructed using a number of ways and that the responses be matched to predefined queries using string matching. Generally speaking, the paper's content is clear. However, while natural language processing is used to carry out the necessary activities, it is recognized that the use of additional approaches may improve the overall quality of the preserved materials.

Ming-Hsiang Su and colleagues (Su et al., 2017) begin with the premise that the elderly constitute a significant proportion of the population who have been conveniently

disregarded. It is difficult to spend quality time with the elderly owing to the numerous duties that one has. The authors propose the use of a chatbot system to engage older persons in small conversation and environmental conservation activities. The strategy recommended in the paper is to establish a database comprising over 2,000 message-response pairings, with each pair representing a single message. To keep track of current state information, the authors recommend using enlarged short-term memory. There is nothing mention about the unstructured data in this document.

As Shih-Hung Wu and colleagues (Wu et al., 2018) have demonstrated, it is straightforward for robots to deliver extensive tales, but it is difficult for robots to remember what they have just said. This study, which makes use of the CKIP toolkit, attempts to provide a template, parts of speech and word segmentation labelling. Additionally, the article recommends that noun identification be done using the Term Frequency – Inverse Document Frequency method (TF-IDF).

The chatbot is constructed with the help of a markup language designed specifically for artificial intelligence. It is a basic flaw in the proposed system that the chatbot was developed using out-of-date approaches; there are more effective tactics for constructing a robot that can conserve a floor that might be used instead.

Chatbots are being employed in a range of different industries as a result of the breadth of natural language processing applications available. CJB and colleagues (Baby et al., 2017) propose to automate collectively internet of things and home automation using a chatbot system. Fundamental natural language processing tasks are proposed to be carried out using a natural language toolbox, as demonstrated in this paper. Key words entered by the user are relayed to the microcontroller that will operate household appliances over the Internet of Things, allowing the chatbot system to recognize the user's input and respond appropriately.

The essay serves as an excellent illustration of how chatbots might be employed. Although the study goes beyond the fundamentals of natural language processing and keyword recognition, it does not delve much farther into the field of NLP. The effectiveness of the chatbot system is not evaluated in this research.

Godson Michael D'silva and colleagues (D'silva et al., 2017) propose, on the other hand, that an automated chatbot be used for customer service. According to the results of the poll, businesses are not always quick enough to respond to complaints from customers who use social media to lodge them. As a result, the following recommendation is made in the article:

To monitor customer complaints submitted on social media, a machine learning system should be implemented.

If the machine learning system discovers any complaints that can be taken action on, the chatbot system module will be activated. Customers will be able to communicate with this chatbot system in order to gain further information about their individual problems.. Additionally, an attempt will be made to give solutions through the use of a chat bot system. Additionally, if the situation continues, the chatbot system will aid the customer in submitting a formal complaint with the appropriate authorities.

Consumer support bots are not new, but the practice of monitoring social media for customer complaints is not new to most people. The study does not go into considerable length about the creation of chatbots or their capabilities, despite the fact that they are discussed.

A chatbot system should be developed to reply to commonly requested questions regarding a certain university, according to Bhavika R. Ranoliya et al. (Ranoliya et al., 2017). The Artificial Intelligence Markup Language (AIML) is proposed in this article. It is possible to use a variety of tags while creating chatbots. For designing chatbot systems for academic institutions, the artificial intelligence markup language provides considerable benefits over the previous two techniques, according to the findings of the study.

Among the paper's most significant shortcomings are its extensive descriptions of AIML markup language's various features and tags, but its failure to explain how a chatbot is created. Unsurprisingly, there is no mention of the chatbot's powers or accuracy in the study, which is a disappointment.

For the medical business, Divya Madhu and her colleagues (Madhu et al., 2017) have proposed the development of a chatbot system. The suggested chatbot system examines the symptoms of users and offers intelligent predictions about the chances of various diseases occurring in the future. The research also advises that the chatbot system be prepared to offer medication and dosage suggestions, according to the findings.

Despite the fact that the concept medical care considered to be emergingly useful, study have various flaws. This document offers a pseudocode that can be used to forecast illness. This pseudo-code demonstrates that the system is not scalable since it has been constructed in such an explicit manner, which is extremely difficult to accomplish. Furthermore, the report does not detail how the chatbot system was put into place, which would be helpful.

Customers who purchase a new product, particularly an electronic item, to understand the product working and feature, are required to read the entire manual. This presupposes that the customer is operating in an unfamiliar environment, as discovered by Hanjong Choi and Takeshi Hamanaka (Choi et al., 2017). Individuals' comprehension capacities vary, and some may require a significant amount of time to grasp the complexity, whilst others may do so in a short period of time. The report recommends that a chatbot system be developed to deal with this problem.

When it comes to electrical devices, the concept of using a chatbot to provide assistance to both novice and expert users is fresh. There is no guidance on how to develop a chatbot or how to use natural language in the software.

The tasks related with the article's processing are listed below. Furthermore, the report provides no information on the sort of information that was supplied to the chatbot system.

Wei Liu and colleagues (Liu et al., 2015) suggest the development of an entirely new sort of chatbot system that is similar to Siri, Alexa, or Google Assistant, among other things. According to a recent study, IBM Watson responds to inquiries by utilizing bits of information received from the query rather than comprehending the whole meaning of the question itself.

The Deep QA system, as proposed in this work, is a mechanism for totally comprehending the inquiry. The paper's recommendation to answer to users' questions advice of the use to internet leaves the system's functionality up in the air. Furthermore, the article addresses the system's usability from a user's perspective. There has been no discussion of the characteristics of the chatbot or the technology that was utilized to build it. Additionally, it offers to construct chatbot system which suppose to be an open-ended system, but information about the system's accuracy or correctness in the process is silent. Moreover, Kumar Shivam and colleagues (Shivam et al., 2018) propose a chatbot for use in a collegiate setting. Because handling student inquiries throughout the day exhausts the university's inquiry staff, the institution decided to develop a chatbot system. A chatbot system is built utilizing the Facebook Messenger API, which does natural language processing, according to this article. In addition, the pre-trained module from wit.ai is recommended for usage in this situation.

The usage of standard APIs to develop the chatbot system described in this article has a severe negative impact on NLP. NLP with respect to application is a complex field, and the study makes no attempt to address the basic problems that arise in its application.

It has been suggested by Liu et al. (Liu et al., 2017) that having access to a personal information about the users can significantly improve the quality of outcomes. To put it another way, the article argues that while answering a question, it is important to take the user's personal information into consideration. As a result of receiving personalized replies, it is envisaged that users would maintain a high level of interest.

The author of the study describes a strategy for answering questions that combines personal information that is both successful and efficient. In addition, the study takes use of the databases of the Baidu Tieba Corporation (BTC) and the Reddit Corporation (RC). Aside from that, there are no technical information in the research report. There is no information available on the technology that was utilized to construct the chatbot system or the sort of knowledge it holds aside from that. It is assumed that user data will be kept in a database.

On the other hand, Takuma Okuda and Sanae Shoda (Okuda & Shoda, 2018) call for the development of a framework for chatbots in the financial services business. (Kulkarni et al., 2017) The article goes into the reasons why financial chatbots are so important. Additionally, the study covers the different functions and capabilities of the chatbot framework, as well as their potential applications in the financial industry. In compared to the natural world, the chatbot's internal workings are somewhat different. Both the implementation of machine learning techniques and the language processing have been left out of the discussion.

Chaitrali S. Kulkarni (Kulkarni et al., 2017) suggests the development of a chatbot system for use in the banking industry. The majority of people are more careful than they should be when it comes to their finances. Customers who use banking services may get a large number of inquiries throughout the day. It is not always possible to count on customer service representatives to respond to your questions. This study offers a chatbot system to help clients with their inquiries as a consequence of the findings.

Using a variety of banking websites' frequently asked questions, the authors want to compile an authoritative resource. Using a natural language processing toolset is the goal of this

investigation. In addition, the bag of words approach is proposed for transforming words to vectors in the study. In order to find an answer to the question, the authors compare a variety of machine learning classification techniques. Finally, we use cosine similarity to map requests and answers to a single another. A rating of 87 percent is claimed by the magazine for its accuracy.

There is a lot of detail in the article regarding the technology that was utilized to construct the chatbot. However, there are certain limits to the approach that is advocated. However, despite the presence of more complicated deep learning algorithms, the authors of this study recommend that fundamental machine learning methodologies should continue to be used in the future. In order to determine question and response similarity, the cosine methodology was utilized; however, other methodologies may be used to enhance the findings.

WANG, et al. (WANG et al., 2021) deeply analyze the development trend of chatbot technology, introduce the research progress of chatbot technology in academia and industry at home and abroad, and focus on the three key technologies of chatbots, namely multi-round dialogue technology based on retrieval, generative dialogue technology and dialogue technology based on deep integration of retrieval and generation. By analyzing the problems existing in chatbot technology, they look forward to the future direction of development.

Another study Suhaili, et al. (Suhaili et al., 2021) at Conversational agents, often known as chatbots, conducted. It contains that the next major step in conversational services, allowing a device to converse with a user using natural language replies. They further mentioned conversational agents are becoming increasingly popular. Automatic responses to user inputs are created via the use of machine learning and artificial intelligence techniques and algorithms. However, despite the fact that this is a relatively new field of research, the number of people who are familiar with and use this notion has expanded substantially over the last few years. In order to better serve their customers and provide product and service recommendations, an increasing number of commercial and academic institutions are turning to artificial intelligence (AI) assistants. The key objectives of this literature study between 2011 and 2020 are to identify research trends, as well as the components and technique that have been employed, as well as the datasets and domains that have been covered, as well as the assessment metrics that have been most commonly used. There study (Suhaili et al., 2021) provides a systematic review of the literature using Kitchenham's standard SLR criteria, and it does so by searching, extracting, and evaluating all relevant publications from five recognized scientific databases, all of which are available online. Following the establishment of inclusion and exclusion criteria, in addition to a quality evaluation, the final review article was drafted. Deep learning and reinforcement learning architectures were revealed to be the most often employed methodologies for interpreting and reacting to user requests, according to the findings of the study. They (Suhaili et al., 2021) discovered that the most often utilized datasets for assessment are those from Twitter (open domain), Airline Travel Information (close domain), and the Ubuntu Dialog Corpora (open source) (technical assistance). According to the SLR research, the most popular chatbot domains are open domains such as Twitter datasets, airline and technical support chatbots, among other things. When evaluating chatbot performance, accuracy, F1-Scores,

BLEU (Bilingual Evaluation Understudy), recalls, human assessments, and precision were the most often utilized metrics to measure success (in descending order of popularity).

In another study Skrebeca (Skrebeca et al., 2021) identified that use of chatbots by business owners is expected to increase by as much as 80% in the near future, according to some predictions. Increasing use of chatbots by enterprises necessitates the development of new customer service techniques. Organizational structures like this one are essential in today's tough economy. In the course of the year, there were 19 distinct events. They further explored, It is possible to teach pupils in a more individualized manner using conversational interfaces powered by artificial intelligence. The chatbot analyses the student's responses in addition to monitoring and analyzing the student's growth. One of the most handy features of chatbots is that they allow students to access educational resources in the same manner they would if they were speaking with a friend. In the business world, personalized chatbots may play a range of functions, including sales, and they can even help students in their academic endeavors. It is becoming more common for chatbots to aid customers with finding things, placing orders and paying for them, and checking the status of their transactions. As chatbot intelligence improves on a daily and annual basis, chatbots will soon be able to do ever more complex tasks for the convenience of their users. In the next sections, they also cover chatbot theory and history, classification, and strategy, as well as current trends in chatbots powered by artificial intelligence (AI).

In a recent study Wanling et al. (Cai et al., 2022) explored the use of dialogue-based conversational recommender systems (DCRSs) to streamline feedback supply and product research is a contemporary recommendation system trend. They explained DCRSs are systems that enable users to communicate with them using natural language, enabling for more efficient feedback and product research. While they identified little empirical research has been conducted on how users perceive and interact with these systems, nothing has been done to help users in providing feedback on the advice they have received. The purpose of this research is to develop effective feedback elicitation tools for the DCRS (i.e., allowing users to critique the current recommendation during the dialogue). Each of the three prototype systems has been implemented, and each uses a unique kind of criticism: user-initiated criticism, progressive criticism, and cascade criticism, to name a few. To evaluate the three prototypes, they performed two task-oriented user tests involving a total of 292 persons. It was critical to emphasize that they were focusing on two key user activities in recommendation systems (RSs): the basic recommendation task (BRT) and the exploration-oriented job (EOT, i.e., exploring different types of items). More precisely, the statistics indicate that EOT increases user engagement, whereas BRT increases user pleasure. The kind of criticisms that EOT users engage in are more likely to have an effect on their perceptions of serendipity than other types of interaction metrics. When the recommendation chatbot gives proposals for various scenarios, the findings indicate useful critique techniques that may be utilized to facilitate meaningful interaction between users and the chatbot.

Parviainen and Rantala (Parviainen & Rantala, 2022) conducted a very useful study in healthcare, they found numerous professionals argue that chatbots are still in their infancy and cannot be relied upon to diagnose patient difficulties or make medical decisions in their place at this time. Chatbots are still in their infancy when it comes to COVID-19, despite the

fact that they are increasingly being used for health-related tasks like as answering questions, recommending treatment options, assessing symptoms, and scheduling appointments. There article took a step further and investigated how the rise of automated consultation systems such as task-oriented chatbots will affect healthcare practices and expert–client relationships in the coming years. Due to the potential for broad use of artificial intelligence in healthcare organizations to transform professional decision-making and client-expert communication, they advocated for the development of new approaches to professional ethics that are more inclusive of artificial intelligence. If their hypothesis is right, for example, an artificial intelligence chatbot may be used to boost rationality and automation in healthcare treatment while also altering traditional decision-making procedures based on epistemic probability and prudence. As a medical ethicist, the objective of this essay is to add to the growing body of knowledge about the ethical issues that chatbots face from a medical ethics perspective.

II. ANALYSIS

This section has table, which further described the published research in the area. Study consider several variables, such as the language processing approach utilized, field of study, the chatbot system's, it targeted audience , the type of knowledge employed, the machine learning algorithm used, and the unstructured data processing capabilities of the system, among other things. This investigation has been carried out to the greatest extent possible. Paper reference includes the cited references for the article.

Table: Analysis of Chatbots systems

“Paper Reference”	“Language Processing Technique used”/ “Prominent language processing technique”	“Chatbot system’s target audience or Domain of study”	“Type of Knowledge ”	“Machine Learning algorithm used”/ “Algorithm identified prominent”	“Processing of unstructured data by the system”/ “Study Processed Unstructure d data”
(Abdul-Kader & Woods, 2017)	NLTK framework	Open-ended	Not mentioned	Not used	no
(Lee et al., 2018)	Stanford tool	Children	Not mentioned	Logistic Regression	To a certain extent
(Pichponreay et al., 2016)	Not mentioned	Open-ended	Not mentioned	Not used	No
(Su et al., 2017)	Not mentioned	Elders	Not mentioned	LSTM	No
(Wu et al., 2018)	CKIP toolkit and AIML	General	Not mentioned	Not used	No

(Baby et al., 2017)	NLTK framework	Home Automation	Structured database	Not used	No
(D'silva et al., 2017)	Not mentioned	Customer service	Not mentioned	Not mentioned which	No
(Ranoliya et al., 2017)	AIML	University / College / Education	Not mentioned	Not used	No
(Madhu et al., 2017)	Not mentioned	Medical	Structured database	Not mentioned which	No
(Choi et al., 2017)	Not mentioned	Customer service	Structured database	Not mentioned	No
(Liu et al., 2015)	AIML	General	Not mentioned	Not mentioned	No
(Shivam et al., 2018)	Facebook Messenger Application Programming Interface	University / College / Education	Structured database	Not mentioned	No
(Liu et al., 2017)	Not mentioned	General	Not mentioned	Deep Neural Network	No
(Okuda & Shoda, 2018)	Not mentioned	Banking / Finance	Not mentioned	Not mentioned	No
(Kulkarni et al., 2017)	NLTK framework	Banking / Finance	Structured database	Random forest and SVM	No
(WANG et al., 2021)	multi-round dialogue technology based on retrieval, generative dialogue technology and dialogue technology	Academia and industry	Not mentioned	dialogue systems	no
(Suhaili et al., 2021)	Not mentioned	Service chatbots	Qualitative study	Deep and reinforcement learnings dominate	yes
(Skrebeca et al., 2021)	Not mentioned	Student and education	Qualitative study	Not mentioned	no

(Cai et al., 2022)	Natural language	Customer feedback	Two studies with involving 292 subjects	Dialogue-based conversational recommender systems	yes
(Parviainen & Rantala, 2022)	NLP	Health Care	Not mentioned	ML	no

IV. CONCLUSIONS

Chatbots are becoming increasingly popular for connecting with customers. Even the most complicated information may be communicated to the end user using this methodology, which has evolved into a successful and fascinating method of communication. As a result, chatbots are now being used in a wide range of industries, including retail.

Hundreds of research papers and variety of domains have chatbots systems emerging development phase, but many of the papers neglect to explain that which the language processing technique used, and what are the type of information that was used, whether or not machine learning algorithms were used, and whether or not unstructured data was handled. This is demonstrated in the review. Regarding NLP, the bulk of the papers have concentrated on the installation and modification of chatbots, which is understandable.

To improve the performance of chatbot systems, a variety of machine learning and deep learning methodologies may be applied. Based on whether or not the data is suitable for further analysis, it is possible to go beyond the principles of natural language processing and into more advanced territory. Unstructured data processing, such as text data presented as knowledge, is another field that has not been well researched. Because of this, it can be stated that the area of natural language processing has a significant deal of room to grow and improve.

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