

# Natural Language Processing in Chatbots

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## ABSTRACT

Natural language processing (NLP) is a branch of artificial intelligence that serves as the foundational architecture for modern chatbots, bridging the gap between human communication and machine understanding. A chatbot refers to a chatting robot or an intelligent conversational computer program that behaves like a human in conversation. At its core, a chatbot is a software application designed to simulate human conversation through text or voice interactions. Chatbots are essentially conversational agents designed to understand, interpret, and respond to human language, making digital interactions more intuitive and efficient. NLP chatbots are computer programs designed to interact with users in natural language, enabling seamless communication between humans and machines. They have become tools, helping businesses improve customer interactions and streamline operations. They change how businesses interact with customers and improve efficiency. This paper will delve into the multifaceted applications of NLP in chatbots.

**KEYWORDS:** *natural language processing, NLP, computational linguistics, chatbots, NLP chatbots.*

## INTRODUCTION

As digital transformation accelerates, the ability of machines to comprehend, interpret, and generate human language has evolved from rudimentary pattern matching to complex cognitive reasoning, fundamentally altering how businesses and individuals interact with technology. In an increasingly digital world, chatbots have emerged as a pivotal interface between humans and technology, revolutionizing how businesses interact with customers and how individuals access information. At the heart of this revolution lies natural language processing (NLP), a branch of artificial intelligence that empowers machines to understand, interpret, and generate human language. While early iterations of chatbots relied on rigid, rule-based systems that often frustrated users with their limited scope, the integration of NLP has revolutionized how organizations interact with their audiences. NLP has transformed chatbots from simple automated scripts into sophisticated virtual assistants capable of delivering significant value across various sectors [1].

Chatbots are a type of software program that simulates a conversation with a user through text or voice. An NLP chatbot is a type of conversational AI program designed to understand human language naturally and provide a final response accordingly. It is an advanced software program that is capable of processing human language in a natural language way and responding appropriately. You have likely interacted with ChatGPT or any other chatbot at some point, and you have noticed how these chatbots understand our language so well and respond to us as naturally as a friend. The main reason behind AI chatbots like ChatGPT, Grok, Perplexity becoming so popular and accessible today is natural language processing (NLP). Machines only understand structured language or data, not human language and pronunciation. Due to NLP, AI Chatbots are able to understand human language [2]. These intelligent conversational agents powered by natural language processing (NLP) have revolutionized customer support, streamlined business processes, and enhanced user experiences. They streamline interactions between users and computers.

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## FUNDAMENTALS OF NLP

Natural language processing is a subfield of artificial intelligence that empowers computers to understand, interpret, and generate human language. It is a technique where machine can become more human and thereby making human to communicate with the machine easily. NLP seeks to make software intelligent enough to process a natural language as humans. For example, imagine a machine that takes instructions by voice.

NLP analysis generally consists of the following three levels [3]:

- *Syntax*, the study of sentence structure. Syntax deals with the formation of a sentence from individual words. Syntax alone suggests the proper interpretation of “Jimmy loves Lucy.”
- *Semantics*, the study of context-independent meaning. This derives the meaning of a sentence based on the meanings of the words/phrases. For example, semantics determines whether the word “bank” refers to a river bank or to a financial institution.
- *Pragmatics*, the study of context-dependent meaning. Pragmatics deals with how meaning changes in the presence of a specific context and how the contexts affect the meaning of the sentences. This level is concerned with the purposeful use of language in situations.

As a foundational pillar of modern artificial intelligence, NLP encompasses a wide array of tasks, including speech recognition, text classification, natural language understanding (NLU), and natural language generation (NLG). NLP encompasses a wide range of tasks, such as information retrieval (IR), named entity recognition (NER), relation extraction, text classification, topic modeling, semantic textual similarity, machine translation, and question answering (QA).

Recently, large language models (LLMs) have shown their ability in learning universal language representations, text understanding and generation. LLMs refer to a model with a large number of parameters, vast training data, and substantial compute, enabling it to capture complex language patterns. In LLM-based NLP, pre-processing is followed by prompt engineering, which guides LLMs to produce outputs that align with extraction requirements during inference without altering the model’s parameters. Models like GPT are pushing the boundaries of language understanding, enabling nuanced and context-aware applications. The GPT (Generative Pretrained Transformer) is a large-scale language model developed by OpenAI that consists of

multiple layers of transformer blocks, each with a self-attention mechanism and a forward neural network [4]. GPT-based systems can summarize complex reports or generate creative content like essays, making them versatile in both academic and professional environments. ChatGPT uses NLP techniques to understand prompts. When you enter a prompt, the chatbot comprehends it and provides relevant replies.

## CONCEPT OF CHATBOTS

Chatbots are also known as conversational agents, interactive agents, virtual agents, virtual humans, or virtual assistants. Chatbots, as part of AI devices, are computer programs designed to carry on a dialogue with users using natural languages. Healthcare has become an attractive market for chatbot applications. The main purpose of healthcare chatbots is to help patients in less time and for less money than it would take to visit a medical professional. Healthcare chatbots have great potential, but they still have a long way to go to win over consumers.

The first chatbot (Eliza) was developed in 1966 by Joseph Weizenbaum for psychiatric patients. Since then, Chatbots have gained popularity in all the domains such as banking, e-commerce, healthcare, education, and smart homes. A chatbot describes a computer system or the situation in which human is chatting with the robot (computer).

Chatbots may be regarded as mimic systems which imitate the conversations between two individuals. They employ different degrees of human-like appearance and behavior, such as facial expressions, compassion, humor, and tone of voice. Thus, chatbots are computer programs with a conversational user interface capable of emulating natural, conversational interpersonal exchange. Fueled by artificial intelligence (AI), chatbots are becoming a viable option for human-machine interaction.

Chatbots can be integrated into various messaging platforms, websites or mobile apps to interact with customers and prospects in real time. For example, healthcare chatbot can diagnose the disease and provide basic details about the disease before consulting a doctor. It is designed to reduce the healthcare costs and improve accessibility to medical knowledge. Healthcare chatbots depend on natural language processing (NLP) that helps users to submit their health problem [5]. Figure 1 illustrates a chatbot based on three key structures in AI [6].

There are essentially two types of chatbots: (1) Fixed chatbots: These are programs with fixed information and hence offer limited help; (2) AI-based: These chatbots thrive on dynamic learning and constantly

update themselves using various customer interactions. An AI-based chatbot has three domains: databases, natural language processing (NLP), and machine learning (ML). Mostly chatbots are some kind of computer programs that use natural language processing (NLP) for interpreting the user input and generating the corresponding response. In other words, NLP helps users to submit their problem about the health. The aim of the system is to replicate a person's discussion. Chatbots interact with users using natural languages. Chatbot may ask a review of symptoms and relevant information such as past medical or surgical history. It provides response by use of an efficient Graphical User Interface (GUI). The GUI is an artificial creation invented to enable interactions between human and computers. The chatbot system helps users to freely submit their complaints and queries regarding health by voice since customer satisfaction is the major concern for developing this system [6,7].

One may also regard a chatbot as a software system that allows you to simulate real conversations between devices and users by means of a conversational interface [8]. Chatbots use three types of conversation styles [9]: static, semi-automated, and fully-automated conversation dialogue. The static conversation style is rule-based and it is easy to build. Automated refers to the generative-based model, which uses deep learning models to build interaction. This is very complex and requires a lot of training data. The semi-automated automates some parts while the rest is handled by a human. Figure 2 shows that a chatbot is designed to answer questions with proper answers [10], while

Figure 3 provides some examples of what chatbots can do [11].

## NLP IN CHATBOTS

Natural language processing serves as the bedrock upon which intelligent chatbots are built, enabling them to move beyond rudimentary, rule-based interactions to engage in more fluid and human-like conversations. NLP encompasses a suite of techniques that allow machines to process and analyze large amounts of natural language data. Within the context of chatbots, three core components of NLP are particularly crucial: natural language understanding (NLU), natural language generation (NLG), and dialogue management. Natural language understanding (NLU) is the component responsible for interpreting the user's input. Natural language generation (NLG) focuses on the creation of human-like text responses. Dialogue management acts as the central orchestrator, maintaining the flow and context of a conversation across multiple turns. These key

components work in tandem to facilitate human-like interaction. Their seamless integration is what transforms a simple automated script into a truly conversational AI experience. By providing a technical framework for understanding intent, extracting data, and generating human-like responses, NLP has unlocked new levels of personalization, efficiency, and scalability [1]. Figure 4 shows NLP chatbots [12], while Figure 5 shows how an NLP chatbot works [12].

The emergence of large language models has revolutionized NLP and, by extension, chatbots and voice assistants. Models such as GPT, Claude, Gemini, and LLaMA are trained on vast amounts of text data from books, websites, and other sources. Large language models (LLMs) rely on transformer architectures, which use mechanisms called attention layers to analyze how words relate to each other within a sentence and across sentences. The most powerful systems today use transformer-based architectures, such as BERT (Bidirectional Encoder Representations from Transformers) or GPT (Generative Pre-trained Transformer), which capture the contextual meaning of words by analyzing their relationships within entire sentences. These models use attention mechanisms and self attention layers to process sequences of words and provide more natural human like and context aware conversations. ChatGPT was developed by OpenAI and it is a powerful NLP model that uses LLMs for various functions and tasks. This model supports multiple languages like English, French, Spanish, and German. ChatGPT lacks the ability to express emotions in responses during conversations and tends to be more verbose and comprehensive [13].

## DIFFERENT TYPES OF NLP CHATBOTS

Since AI systems are designed to handle different tasks, there are different types of NLP chatbots. Different types of chatbots are shown in Figure 6 [12] and are explained as follows [2]:

- *Generative Chatbots*: These chatbots create responses from scratch using large language models. They generate original text based on context. Tools like ChatGPT and other cutting-edge large language models (LLMs) fall into this category, offering dynamic, human-like dialogue. They also use technologies such as natural language understanding (NLU) to produce human-like responses.
- *Retrieval-Based Chatbots*: Instead of generating text, these chatbots choose the most appropriate answers based on their learning. By leveraging intent recognition and content matching, they ensure consistent and accurate replies. They also

use technologies such as natural language understanding (NLU) to produce human-like responses. They are great for customer service scenarios where accuracy is critical.

- *Contextual Chatbots:* Contextual bots are virtual assistants designed to engage in human-like conversations with users, providing personalized and helpful service. They remember past interactions and maintain conversation history, making them ideal for multi-turn dialogues. If you have ever used a virtual assistant that “remembers” your last question, you have experienced a contextual chatbot in action.
- *Hybrid Chatbots:* These chatbots combine rule-based methods with NLP and machine learning. They can handle both predictable queries and open-ended questions, giving businesses the best of both worlds.

Chatbots can also be broadly classified into two types of domain [12]:

- *Open Domain Chatbots:* These chatbots can generate contextually relevant and fluent responses across a wide range of topics.
- *Closed Domain Chatbots:* These chatbots typically have a predefined set of responses and are more task specific.

### APPLICATIONS OF NLP CHATBOTS

The integration of NLP has propelled chatbots into a wide array of applications, transforming operations and enhancing user experiences across numerous sectors. The diverse applications of NLP chatbots across customer support, healthcare, finance, ecommerce, legal, human resources, and education underscore its versatility and immense value. Figure 7 shows some uses of NLP chatbots [12]. Common applications include the following [1,14-16]:

- *Ecommerce:* One of the most prevalent and impactful applications of NLP in chatbots is in ecommerce. Chatbots act as shopping assistants in ecommerce. They help with online shopping. They help customers find products. They also track orders and suggest items based on preferences. They enhance the shopping experience by assisting users with product search, recommendations, and purchase decisions. NLP powers advanced semantic search capabilities in ecommerce platforms. Instead of relying on exact keyword matches, these systems can understand the underlying intent of a customer's query, even if phrased ambiguously. This allows for more accurate product recommendations and a more intuitive browsing experience.

- *Healthcare:* In the healthcare sector, NLP-powered chatbots are revolutionizing patient care, administrative tasks, and medical research. One significant application is in medical documentation. Systems such as Dragon Medical One, used by hundreds of thousands of physicians, employ NLP to accurately transcribe spoken medical notes into structured clinical records. These systems boast impressive accuracy rates, even with complex medical terminology, significantly reducing the time healthcare professionals spend on administrative duties. Chatbots also serve as virtual therapists, offering accessible mental health support. While still evolving, NLP has also been explored for AI diagnosis support, with systems like IBM Watson attempting to assist in cancer treatment recommendations by analyzing extensive medical literature. Healthcare providers use chatbots to share medical information, book appointments, and help patients figure out their concerns. While they do not replace doctors, they can answer simple questions and help guide patients to the right resources.

- *Finance:* In finance, chatbots are employed for fraud detection by analyzing communication patterns for suspicious activity and for providing personalized financial advice. They can help users track spending, manage budgets, and answer queries about financial products through conversational interfaces. Banks deploy chatbots to assist with account inquiries, bill payments, and financial advice, giving customers secure, round-the-clock support. NLP chatbots assist users with financial tasks such as checking account balances, transferring funds, paying bills, and managing budgets.

- *Education:* NLP chatbots are utilized in educational settings to facilitate learning and provide personalized tutoring. NLP-powered tools are transforming learning and assessment. Chatbots can act as personalized tutors, answering student questions and providing explanations. More advanced applications include NLP-driven systems that can grade essays and offer detailed, personalized feedback to students, enhancing the learning experience and providing educators with valuable insights into student comprehension.

- *Virtual Assistants:* NLP chatbots serve as virtual assistants, helping users with tasks such as setting reminders, scheduling appointments, sending notifications, and providing personalized recommendations. Think Alexa, Siri, or Google Assistant, virtual helpers that can schedule

meetings, set reminders, or control smart devices with natural speech.

- *Human Resources:* NLP chatbots streamline the recruitment process by automating tasks such as resume screening, candidate pre-screening interviews, and scheduling interviews. They can engage with job applicants, answer questions about job openings and company policies, and provide status updates on application submissions.
- *Customer Service:* Chatbots streamline customer service. From ecommerce to telecom, NLP chatbots handle customer support tickets around the clock, offering quick resolutions and improving satisfaction. NLP is a smart type of technology that is providing much-improved customer service. It means customer service is changing from robotic and annoying to using tools that enable natural conversations by recognizing tone, intent, and meaning. Customer service departments can now capitalize on natural language processing with AI Chatbots to provide a higher-caliber and, importantly, scalable customer service. This includes leveraging chatbot NLP capabilities to better interpret customer inputs.
- *Travel and Hospitality:* NLP chatbots enhance the travel experience by assisting users with travel planning, booking flights and accommodations, and providing destination recommendations. They can answer travel-related queries, offer local information and travel tips, and handle customer support inquiries during the trip.

## BENEFITS

The widespread adoption of NLP in chatbots is driven by several significant benefits. Chatbots offer unparalleled scalability, capable of handling thousands of simultaneous queries, which is crucial for businesses with large customer bases. Their 24/7 availability ensures that users can receive immediate assistance at any time, improving customer satisfaction and operational efficiency. The ability of chatbots to understand and generate human language has made them invaluable tools for automation, personalization, and data analysis. Other benefits of NLP chatbots include the following [1,17]:

- *Automation:* One of the most widespread applications of NLP is in customer service automation. Chatbots equipped with NLP excel at automating responses to frequently asked questions (FAQs), tracking orders, and guiding users through troubleshooting processes. This automation not only improves efficiency but also

ensures 24/7 availability for customers, regardless of geographical location or time zones. By automating routine tasks, chatbots contribute to cost efficiency, allowing human agents to focus on more complex and high-value interactions. By automating repetitive inquiries, companies can save significantly on labor. Automation reduces response times.

- *Personalization:* NLP enables chatbots to offer highly personalized experiences. For instance, in the retail sector, chatbots can analyze customer preferences and past purchases to suggest relevant products or outfits. A notable example is H&M's chatbot, which leverages NLP to process casual descriptions like "something comfortable for the office" and translate them into style preferences, suggesting appropriate attire. This level of personalization significantly enhances the shopping experience and can drive sales. Hyper-personalization will become even more refined, with chatbots leveraging deeper insights from user data and sentiment analysis to tailor every interaction to individual needs and preferences.
- *Language Translation:* NLP enables chatbots to translate text from one language to another, facilitating communication across language barriers. Machine translation techniques, such as neural machine translation (NMT), have significantly improved the accuracy and fluency of language translation in chatbots. For example, a chatbot can use NLP to translate a user's query from English to French and provide a response in the user's preferred language.
- *Multilingual Support:* Chatbots can interpret language. NLP models can be trained or adapted to multiple languages, allowing businesses to expand their global reach without the need for a multilingual workforce. The advancements in NLP facilitate multilingual support, enabling chatbots to communicate effectively across diverse linguistic backgrounds, thereby expanding their reach and utility globally. NLP supports many languages, making it easy to build chatbots that can talk to users from different countries without creating separate systems.
- *Sentiment Analysis:* Sentiment analysis in chatbots involves using NLP to analyze the sentiment expressed in text, such as positive, negative, or neutral. Chatbots can use sentiment analysis to gauge customer satisfaction, identify potential issues, and tailor responses accordingly. For example, a chatbot can analyze customer feedback to determine overall sentiment and take

appropriate actions, such as escalating a complaint to a human agent.

- *Technical Support:* Tech companies use chatbots to handle common troubleshooting issues, like fixing a device or software problem. They guide users step-by-step and only escalate to a human technician if needed.
- *Predictive Capabilities:* Smart chatbots can predict what users might need based on past conversations and patterns. This means they can offer tailored help and suggestions, making the experience more personal and satisfying.
- *Market Intelligence:* In market intelligence, companies like Unilever utilize NLP to analyze vast amounts of social media discussions and product reviews. By understanding customer sentiment and identifying emerging trends or common complaints, businesses can proactively address issues and refine their products or services.

Figure 8 shows some benefits of NLP chatbots [12].

## CHALLENGES

Despite the remarkable progress, NLP in chatbots faces several persistent challenges. Beneath the surface of seamless conversations lie significant challenges that NLP systems must overcome to truly achieve human-like communication. From a user experience perspective, chatbots face challenges in clarifying user intent. While NLP has made remarkable strides, addressing linguistic nuances, technical limitations, ethical considerations, data privacy, and cost will be critical for the next generation of conversational AI. Other challenges of NLP chatbots include the following [1,11]:

- *Ambiguity:* One of the most fundamental challenges in NLP for chatbots is the inherent ambiguity of human language. Words and phrases often carry multiple meanings, and their accurate interpretation is heavily dependent on the surrounding context. Understanding sarcasm, irony, and subtle emotional nuances continues to be a major limitation. Resolving such ambiguities consistently remains a complex task for current NLP models. The dynamic nature of language, including slang, dialects, and cultural references, further complicates matters, as models trained on formal datasets often struggle with informal or regionally specific expressions.
- *Cost:* Another critical challenge is cost. Advanced large language models (LLMs) demand substantial computational power, making their

development and deployment potentially expensive, especially for smaller organizations.

- *Ethical Concerns:* Chatbots can inadvertently perpetuate biases and stereotypes present in training data, leading to unfair or discriminatory outcomes. Ethical concerns such as transparency, fairness, and accountability must be addressed to mitigate potential harm to users. Developers must ensure fairness, avoid reinforcing stereotypes, and maintain transparency about AI usage.
- *Data Privacy:* Voice assistants continuously process audio data, raising questions about surveillance, consent, and data security. NLP chatbots may handle sensitive information such as personal data, financial details, and health records. As NLP systems handle vast amounts of textual data, privacy becomes a paramount concern. Protecting sensitive user information and ensuring compliance with data protection regulations, such as GDPR, is essential. This also includes obtaining clear and informed consent from users regarding data collection and usage.
- *Bias:* A significant concern is the risk of bias, where models trained on skewed datasets can inadvertently reinforce and amplify existing societal prejudices, leading to unfair or discriminatory responses. Since NLP models are trained on vast datasets from the Internet, they can inadvertently inherit societal biases, leading to discriminatory or offensive outputs. Ensuring data diversity and minimizing bias during both training and deployment phases is paramount.
- *Hallucinations:* Maintaining knowledge freshness is vital to prevent chatbots from generating outdated or incorrect information, a phenomenon known as “hallucinations.” Generative models sometimes suffer from hallucinations, where they produce factually incorrect information with high confidence. Addressing these issues requires rigorous data curation, human-in-the-loop reinforcement learning, and the implementation of robust ethical frameworks.
- *Transparency:* The transparency of advanced NLP models is another ethical challenge. The “black-box” nature of many LLMs makes it difficult to understand the rationale behind their decisions, hindering trust and accountability. Efforts to make these models more interpretable are crucial for users and developers alike. Developers must ensure fairness, avoid reinforcing stereotypes, and maintain transparency about AI usage.

- *Complex Queries:* Chatbots may struggle to handle complex or multi-turn queries that require deep understanding and reasoning. Tasks such as answering open-ended questions, providing explanations, and solving complex problems pose significant challenges for NLP chatbots.
- *Integration:* NLP does not operate in isolation. Its integration with other branches of AI enhances the capabilities of chatbots and voice assistants. Integrating NLP chatbots with existing systems and platforms can be challenging, particularly in complex enterprise environments. Ensuring seamless interoperability and data exchange requires careful planning and coordination.
- *Robustness:* Another challenge is robustness. Conversational systems must handle noisy input, including speech errors, background noise, slang, and code-switching between languages. They must also be able to recover gracefully when they misunderstand a user's request.

Figure 9 shows some challenges of NLP chatbots [12].

### **FUTURE OF NLP CHATBOTS**

The future of NLP chatbots holds immense promise, driven by advancements in artificial intelligence, natural language processing, and human-computer interaction. The future is moving toward multimodal interaction—the integration of speech, text, images, and gestures into a unified conversational experience. These systems can process and generate information across various formats, including text, image, and audio. This will enable more immersive and accessible interactions. The ongoing advancements in transformer architectures and multimodal integration promise a future where conversational AI is not only indistinguishable from human interaction but also a proactive partner in navigating the complexities of the digital world. The emergence of multimodal AI will allow chatbots to process and respond to various forms of input, including text, voice, and visual cues, leading to a richer and more natural user experience. Multimodal future chatbots will seamlessly combine text, voice, images, and even gestures for a richer user experience [1]. Figure 10 shows the future of NLP chatbots [12].

Looking ahead, the evolution of NLP in chatbots points towards even more sophisticated and integrated systems. The trend is shifting from simple chatbots to advanced AI agents that can not only converse but also perform complex actions. These “agentic” systems do not just talk; they execute tasks—such as booking appointments, managing workflows, writing a blog, or conducting research—independently by

interacting with other software tools. This transition signifies a move from merely answering questions to actively assisting users in accomplishing tasks. The next generation of chatbots will focus on empathy and collaboration, working alongside humans rather than replacing them. Omnichannel integration will ensure seamless and consistent interactions across different platforms, such as web chat, email, and voice, maintaining context and continuity regardless of the communication channel. With growing concerns about AI ethics and bias, the future of NLP chatbots will prioritize ethical considerations, fairness, transparency, and accountability. The future holds enhanced contextual and emotional understanding, multilingual support, and seamless integration with everyday technologies. These developments will make NLP chatbots indispensable in improving customer service, automating tasks, and providing personalized experiences [16]. In the coming decades, the fusion of language understanding, reasoning, and emotional intelligence will reshape communication between humans and machines, dissolving the boundary between conversation and computation

### **CONCLUSION**

Natural language processing is one of the most transformative technologies in the field of artificial intelligence. It focuses on enabling computers to understand, interpret, and generate human language. It is the invisible engine behind the conversational revolution. It transforms words and sounds into meaning, intention, and action, enabling machines to communicate with humans in their own language. It has undeniably transformed the landscape of human-computer interaction, with its applications in chatbots being a prime example of its profound impact. It has transformed chatbots from simple novelties into essential tools for the modern era. From enabling basic conversational abilities to powering highly intelligent AI agents, NLP is the engine driving the evolution of chatbots and is the backbone of modern chatbots. NLP is the part of chatbot architecture responsible for understanding and processing human language input. Today, NLP is being used extensively in important sectors ranging from banking, healthcare to ecommerce and education.

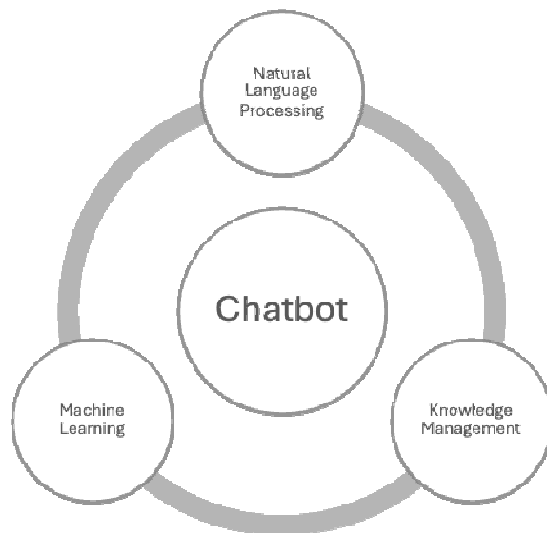
Chatbots and voice assistants represent two of the most visible and impactful applications of NLP in today's digital ecosystem. Every chatbot and voice assistant is powered by several core components of NLP working together. Chatbots are software applications designed to engage in conversations with users, either through text or voice interfaces, by utilizing artificial intelligence and natural language processing techniques. They have rapidly gained

popularity as a powerful technology for enabling automated and interactive conversations between humans and machines, mimicking like human. The future of NLP chatbots is bright, offering exciting opportunities to transform how we interact with technology, access information, and accomplish tasks in our daily lives. More information about NLP chatbots can be found in [18-21] and the following related journals:

- *Natural Language Processing Journal*
- *Journal of Emerging Technologies and Innovative Research*

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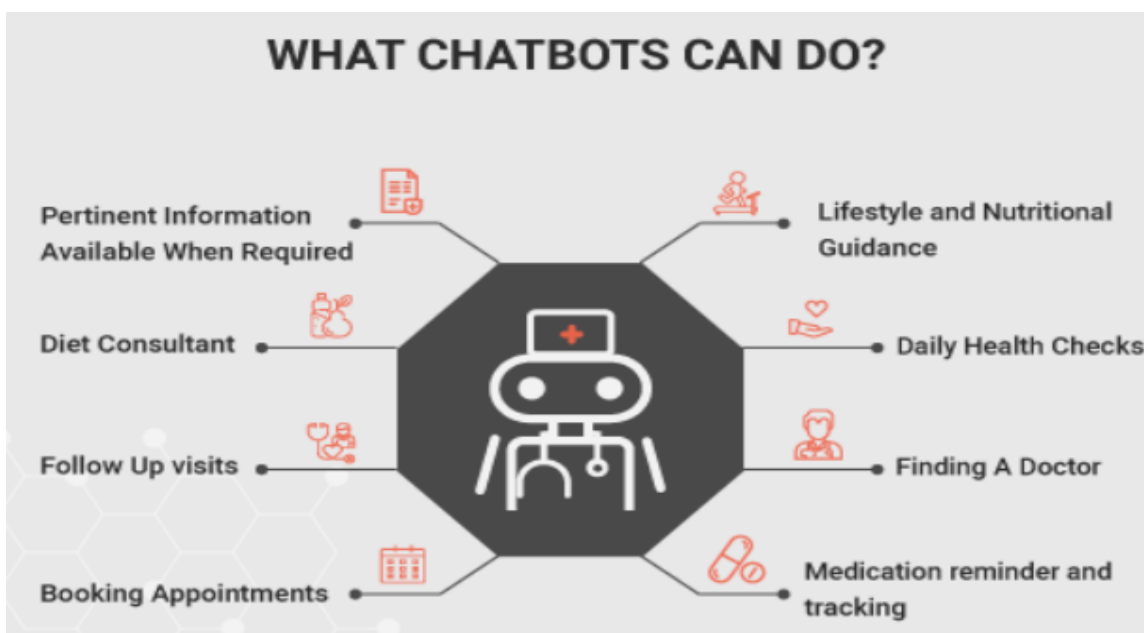
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**Figure 1 A chatbot based on three key structures in AI [6].**



**Figure 2 A chatbot is designed to answer questions with proper answers [10].**



**Figure 3 Typical examples of what chatbots can do [11].**



Figure 4 NLP chatbots [12].

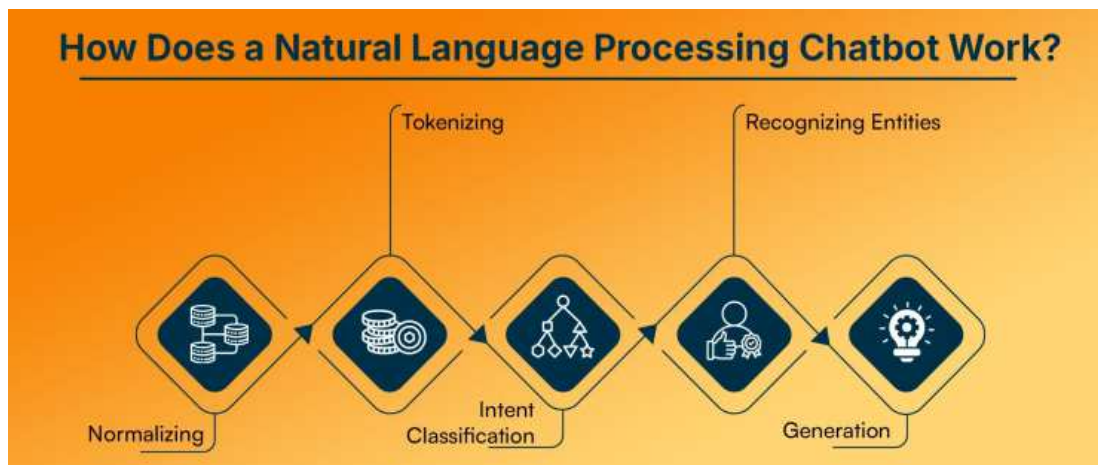


Figure 5 How an NLP chatbot works [12].

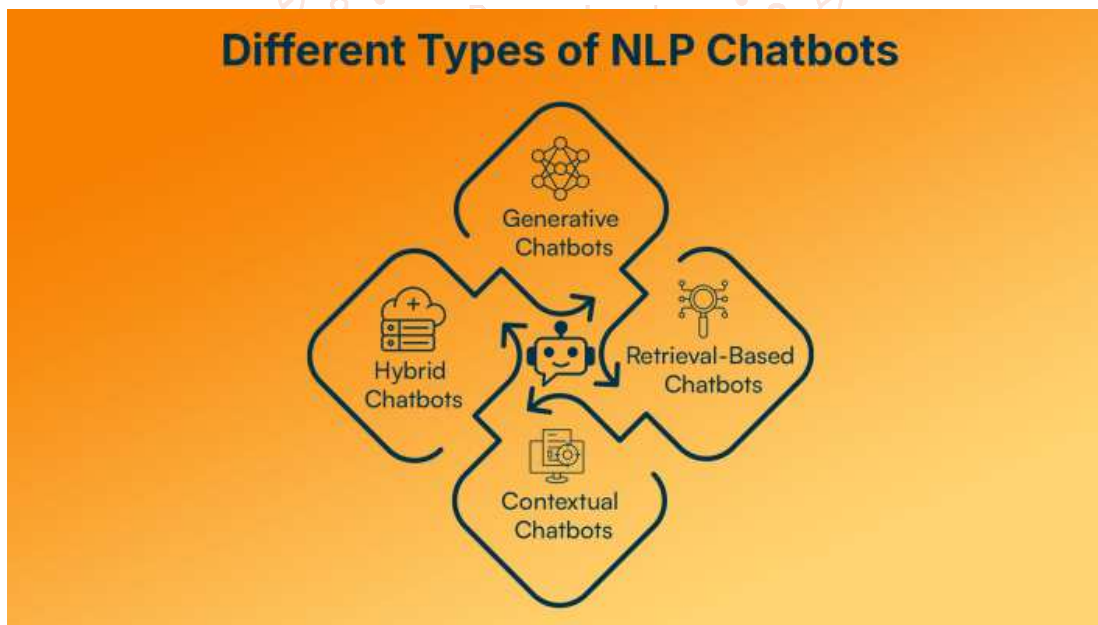


Figure 6 Different types of NLP chatbots [12].



Figure 7 Some uses of NLP chatbots [12].

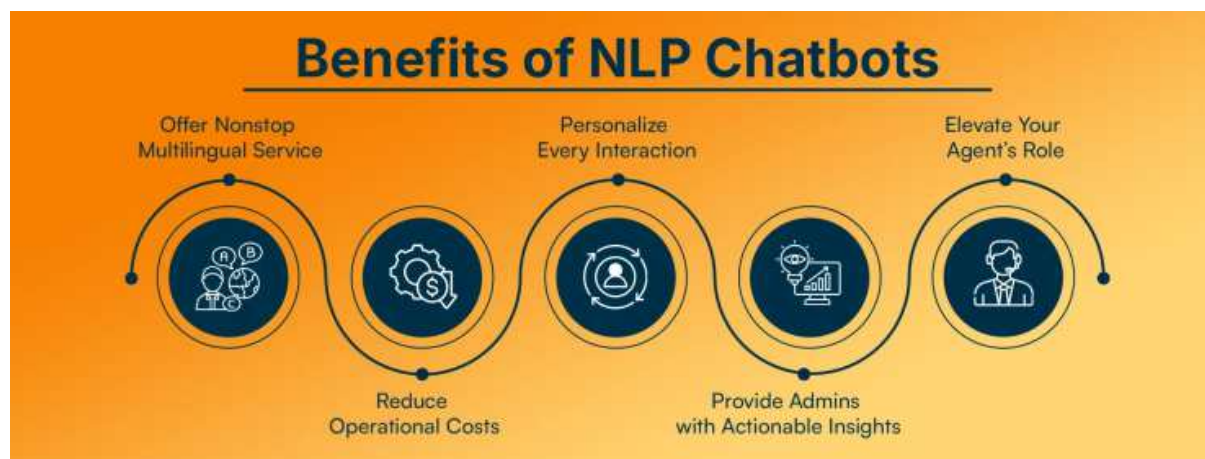


Figure 8 Some benefits of NLP chatbots [12].



Figure 9 Some challenges of NLP chatbots [12].

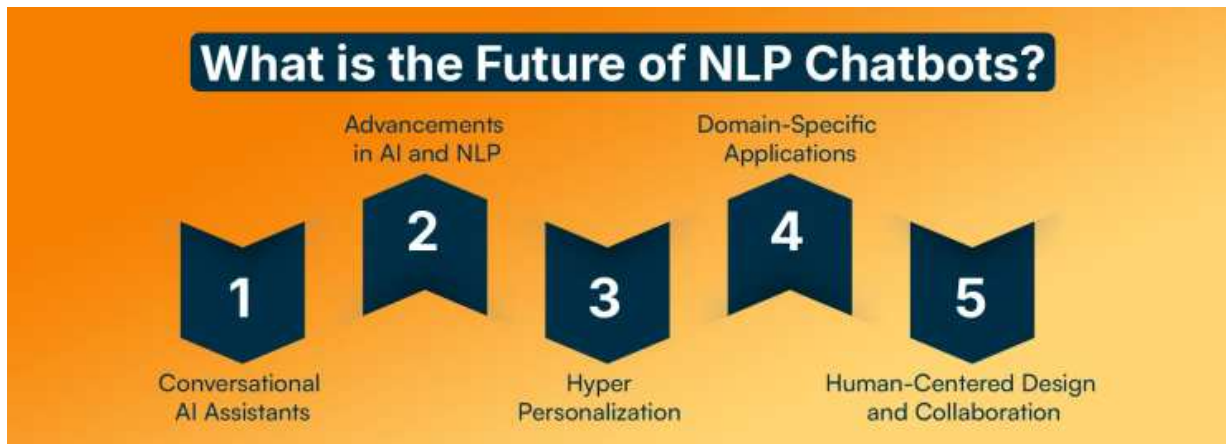


Figure 10 The future of NLP chatbots [12].

