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Using Chatbot in E-commerce to Improve Profit: Artificial Intelligence in practice

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ABSTRACT

Recently, chatbots based on artificial intelligence have brought unprecedented business potential. The use of intelligent machines such as chatbots is increasing in our lives every day and will be able to replace humans performing certain tasks, providing better benefits and enhancing business profits. This article presents a new approach to creating an online sales chatbot to provide customer support and increase sales. The system uses machine learning to understand natural language. The chatbot is based on modular architecture and uses machine learning algorithms. Preliminary results have shown that the proposed approach provides promising results compared to other state-of-the-art approaches.

Keywords: Artificial intelligence; chatbots; conversational agents; Machine Learning; NLP.

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1. INTRODUCTION

The rise of online commerce over the past two decades has had a significant impact on society and the way business is conducted on a global scale. As well as transforming the retail industry, it has had many positive effects on both businesses and consumers on a personal level [1]. The ability to shop online has had a monumental impact on consumers around the world.

In recent years, users have become more reliant on e-commerce than ever before, and outlets such as Amazon are taking down giants within the industry such as Walmart with absolute ease [2].

Customer needs and expectations are growing by day, and to win customers, we must satisfy them and try to optimize the energy and effort they put into getting the product, especially in the context of e-commerce.

There are many ways to satisfy customers and increase profits, among them chatbots. A chatbot could bring a remarkable benefit to e-commerce: not only can it chat with customers, but it can also perform human tasks such as taking customer orders and processing them like a human [3].

In the 1990s, researchers started to develop conversational agents, or chatbots, that could understand and respond to human speech in natural language. These early chatbots were restricted in their functional scope, but they laid the groundwork for the development of more sophisticated chatbots in the following decades [4].

Chatbots represent a major technological advance, profoundly transforming interactions between humans and digital systems. Their evolution, powered by constant advances in artificial intelligence, natural language processing and machine learning, means that they are becoming increasingly sophisticated tools, capable of responding to the varied needs of users in an efficient and personalized way.

One of the key strengths of chatbots lies in their ability to improve operational efficiency across a wide range of sectors. Whether it's in customer service, where they offer fast and accessible 24/7 assistance, or in healthcare, where they support patient diagnosis and monitoring, chatbots provide innovative and reliable solutions. They also contribute to education by offering virtual tutors, and to e-commerce by improving the shopping experience through intelligent recommendations and instant responses.

What's more, their integration with artificial intelligence makes them particularly flexible and adaptable. Thanks to natural language processing, chatbots understand linguistic nuances and provide tailored responses, making interactions more human.

Their ability to learn from data and past interactions enhances their accuracy and relevance over time. As a result, they not only reduce costs for businesses, but also improve user satisfaction and experience.

However, the use of chatbots is not without its challenges. Among them, data confidentiality and security are major concerns. Users often share sensitive information with chatbots, so strict standards are needed to ensure that this data is protected. In addition, ethics in their design and use are essential to avoid bias, inappropriate responses or manipulation.

Research conducted in the United States indicates that most individuals (62%) prefer using chatbots for communication with businesses [5].

In practice, several famous chatbot exist, for instance, Sephora uses a chatbot to recommend products, while H&M suggests outfits that match the user's style. We cite here the most used Chatbot Platforms such as WhatsApp, Facebook Messenger, Alexa and Google Assistant and Twitter [6].

Chatbots are playing a key role in online commerce. They improve the shopping experience and increase customer loyalty in several ways:

- Product recommendations: Chatbots suggest items based on user preferences or purchase history.
- Navigation assistance: They guide users in their search for specific products or services.
- Personalizing promotions: Based on the data collected, chatbots can suggest customized offers.
- Order tracking and returns management: Allow customers to track the status of their purchases or organize a return.

Chatbots are much more than just a technological tool, therefore they represent an evolution in the way we interact with digital technology. Their ongoing development is opening promising prospects in many areas, with huge potential for improving productivity, simplifying complex processes and making services more accessible.

With responsible design and judicious integration, chatbots have the power to transform our societies by making technologies smarter, more efficient and more human.

With the advent of artificial intelligence, AI-based chatbots have emerged. These chatbots use dialogue systems to enable natural language conversations with users using speech, text or both. AI-based chatbots are more effective and relevant, as they can simulate human face-to-face communication [7].

The aim of this paper is twofold. First, this paper attempts to introduce the chatbot technology, its types, and its impact in e-commerce. Second, this paper proposes a new approach to improve e-commerce benefits using a new AI-based-chatbot.

We focus on the development of natural language conversations, a core feature of AI chatbots, to facilitate a more flexible exchange of information between humans and chatbots.

The rest of the paper is organized as follows: In Sec. 2, we introduce chatbot technology, its types, and its impact on e-commerce. Sec. 3 overviews the main related work in this area. Sec. 4 presents the proposed approach in detail. Finaly, Sec. 5 draws the conclusion of the research and briefly discusses future work.

2. PRELIMINARIES

The term "chatbot" is a term combining the words "chat" (instant messaging) and "bot" (automatic or semi-automatic software agent). It refers to a program capable of interacting with human users in the form of textual conversation [8].

An AI chatbot is a program designed to simulate a conversation with a human. It can analyze queries entered by users and provide automatic responses, all without human intervention [9].

These bots are designed to enhance their understanding and responses through the application of advanced AI techniques, such as natural language processing (NLP), machine learning (ML), and deep learning (DL), which facilitate continuous improvement in their capabilities.

These technologies enable the chatbot to engage in coherent discourse, manage intricate requests, offer bespoke recommendations, and perpetually enhance its cognitive capabilities.

The chatbot typically manifests as a small messaging window on the Web or on mobile applications. Also known as conversational agent, a chatbot is used to respond to user queries about a product or service.

In general, chatbots function as the primary interface for customer service. These bots provide prompt responses to customers, resolving basic issues, and assisting companies in the management of substantial volumes of requests.

Furthermore, they serve to enhance customer experience by offering a fast, personalized service. The integration of chatbots into digital marketing has also enabled brands to interact with their customers in a more interactive and engaging way.

Generally, we distinguish three types of chatbot [10]:

- Simple chatbot: this chatbot is characterized by its limited capacity, which is programmed to respond to specific questions according to predefined scenarios and following a linear conversation tree.
- Intelligent chatbot, which is distinguished by its capacity to use AI, thereby facilitating the comprehension of natural language and the acquisition of proficiency in addressing more intricate inquiries through the aggregation and analysis of data derived from prior interactions.
- Hybrid chatbot that combines the strengths of both artificial intelligence and human intervention. If the AI tool fails to respond to the user's request, the responsibility is transferred to a human agent.

Our research focuses on chatbots based on AI. An AI chatbot involves several components [11]:

- NLP: The chatbot employs NLP techniques to analyze user queries and extract their meaning.
- Information processing: involves the chatbot matching the query with predefined intentions to ascertain the user's objective.
- The generation of a response is dependent upon the intention detected, with the

chatbot deriving an adapted response from a knowledge base or a language generation engine.

- Conversational interaction: the chatbot maintains a conversational context by learning previous exchanges.
- Learning: conversations are recorded to continuously train the underlying AI model and improve its performance.

The architecture of an AI chatbot is designed to efficiently handle many simultaneous conversations with users, with the bot able to be integrated into a multitude of channels, including websites, mobile applications, social networks, and SMS. AI chatbots are ideal for a wide range of applications requiring intelligent conversational support for the user.

Within the context of customer service, for instance, these bots can respond to a high volume of frequently asked questions on a 24-hour basis, executing routine operations on demand, such as updating addresses or tracking orders, and qualifying complex requests to direct customers to the appropriate personnel. This enables teams to be relieved of repetitive tasks, allowing them to focus on dedicated cases that necessitate human expertise.

In the context of sales and marketing, the chatbot plays a pivotal role in stimulating and facilitating the purchasing process. It does so by recommending suitable products at opportune moments, assisting customers in their information searches, proposing highly personalized promotions, and helping them complete their orders. The chatbot's intuitive conversation capabilities enable it to discern latent customer needs and offer the most relevant products or services.

In the context of industry technology, the AI chatbot has emerged as a pivotal tool for employees, functioning as a daily ally. It is capable of autonomously resolving numerous technical issues, providing step-by-step guidance to users through internal procedures, and addressing a wide range of queries pertaining to the company, employee benefits, leave application processes, and related topics. This capacity to alleviate the workload of IT teams is a significant benefit of the chatbot.

In the healthcare domain, the AI chatbot plays a crucial role in informing patients about their medical conditions, available treatments, and the progression of examinations. It facilitates appointment booking with healthcare professionals, offers adapted preventative guidance, ensures ongoing health parameter monitoring, and reminds individuals to take prescribed medication [12].

The potential for integrating AI chatbots is extensive, with their ability to enhance user experiences across various sectors by providing individualized conversations and recommendations.

3. RELATED WORKS

One of the major challenges in the development of an automated customer support system is

the categorization of natural language. This subject has been the focus of numerous studies. Therefore, we will address the selection of appropriate techniques to ensure the functionality of chatbot, as well as the selection of techniques that are employed in the correct manner.

In this section, we'll present the main works related to e-commerce based on chatbots.

The authors in [13] built a chatbot for a university shopping mall that automates user interactions and improves customer experience. The problem addressed by the authors is the lack of automation in customer service for e-commerce at university shopping malls, making interaction with customers slow and inefficient. The developed chatbot relies on a rules-based system, where pre-defined answers are generated based on questions asked by users. The chatbot assists with product research, provides information on promotions, and answers common queries. The chatbot showed an improvement in response time reduction and an increase in interactions between users and the platform.

Another approach proposed by [14] which explores the implementation of chatbots in online commerce and their role open innovation, where companies integrate external ideas to improve their services. Furthermore, the paper investigates how chatbots can be integrated into online commerce to improve user experience, optimize customer-business interactions and increase conversion rates. It focuses on the challenges of adopting chatbots, such as their personalization, efficiency, and their role in open innovation. The built chatbot automatically answered 85% of the most frequently asked questions. Customer service response times reduced by 20% increase in online sales.

In addition, the authors in [15] suggest a knowledge-based intelligent conversational agent system architecture to support customer services in e-commerce. The proposal provides instant, personalized answers to customer queries, reducing waiting times and improving overall satisfaction. The proposed chatbot recommends products to customers, offering more personalized shopping experience and increasing the chances of a sale. Furthermore, the proposed work automates repetitive customer service tasks, such as frequent questions and support processes freeing up time for higher value-added tasks. Customers benefit from faster, more personalized assistance, enhancing their online shopping experience.

The proposal presented in [16] presents an e-commerce website integrated with a recommendation system, chatbot, and reverse image search to enhance the user experience. The problem addressed is that of efficient product search on e-commerce sites, by enabling users to find similar products via image search and to receive personalized recommendations. The authors have developed a system architecture combining recommendation algorithms-based user preferences, a chatbot to answer customer questions, and a reverse image search engine to enable users to find products by uploading an image. The developed system has improved customer satisfaction by offering more precise recommendations and faster product searches via image.

An interesting proposal presented by [17] which aims to improve customer satisfaction, optimize operations and increase customer service efficiency. The proposal explores the

integration of chatbots in e-commerce to improve customer experience and increase sales. The paper uses web crawling, NLP and Information Retrieval (IR).

Furthermore, the authors in [18] introduce BOON, a neural search engine for cross-information retrieval between text and images. The challenge is to create a search engine capable of understanding complex queries combining images and text to provide relevant results. The authors use a neural network based on visual transformers and language models to process textual and visual data together. The BOON model has been trained on large databases containing text and images to improve the accuracy of search results. BOON performed better than traditional search engines, providing more accurate results for queries involving images and text.

The authors in [19] present a conditional generative chatbot using a Transformer model, to generate coherent and contextually adapted responses in conversations. The problem addressed is the need to improve the generation of responses in chatbots so that they are relevant and consistent over the long term in a conversation. The paper proposed a combination of Conditional Wasserstein Generative Adversarial Networks (cWGAN) with a Transformer model. The generator is a complete Transformer model that produces responses. The discriminator uses only the Transformer's encoder to evaluate the reality or "falsity" of the generated responses. The proposed model showed promising results in terms of generating more consistent responses, outperforming traditional chatbot models.

The main problem addressed in the paper [20] is the lack of immediate human assistance in e-commerce. This gap can lead to customer dissatisfaction and lower online conversions. The proposed work aims to improve user experience, increase sales and understand customer intentions. The proposed chatbot seeks to fill this gap by providing a fluid user experience close to human interaction. The proposal understands user queries using artificial intelligence to detect customer intentions and identify key information in their messages and finally, the requests are routed to the appropriate modules to generate relevant responses. The proposal uses the AIML (AI Markup Language) for natural language processing and deep neural networks (DNN) to enhance the accuracy and relevance of responses.

Related works comprise retrieval-based models, generative models, and hybrid approaches. Retrieval-based chatbots use ML or DL to select the most appropriate response from a predefined set. They are efficient, consistent, and safe but limited to existing responses and unable to generate novel replies. Generative models that use DL architecture, such as transformers (e.g. BERT) and large language models, can produce new, contextually relevant responses and handle complex, open-domain conversations.

However, they require large amounts of training data, advanced computing resources, and precise tuning to avoid producing incorrect or inaccurate results. Hybrid models combine both techniques, using retrieval for precision and generation for flexibility, offering a more balanced and adaptive conversational experience, but at the cost of increased system complexity.

In a nutshell, a variety of used chatbot approaches have been presented. However, the selection of the most appropriate approach is contingent on the client's requirements and the prevailing technical constraints. AI-based solutions (e.g. Transformers) have proved superior customization capabilities; nevertheless, they can be costly and complex to implement.
Hybrid approaches seem to offer a satisfactory compromise, integrating the benefits of multiple techniques to deliver precise recommendations and natural interactions.
Taking advantage of the related work, we propose a new AI chatbot using ML algorithms. In the next section, we will present our proposal in detail.

4. PROPOSED APPROACH

Building an efficient e-commerce application based on an AI chatbot is a big deal and involves different technologies. However, how can we choose the best technique to ensure the functionality of the chatbot while avoiding the challenges posed by the different methodologies available?
To answer this question, we propose a new model based on ML and NLP, as shown in Figure 1, which includes different components.

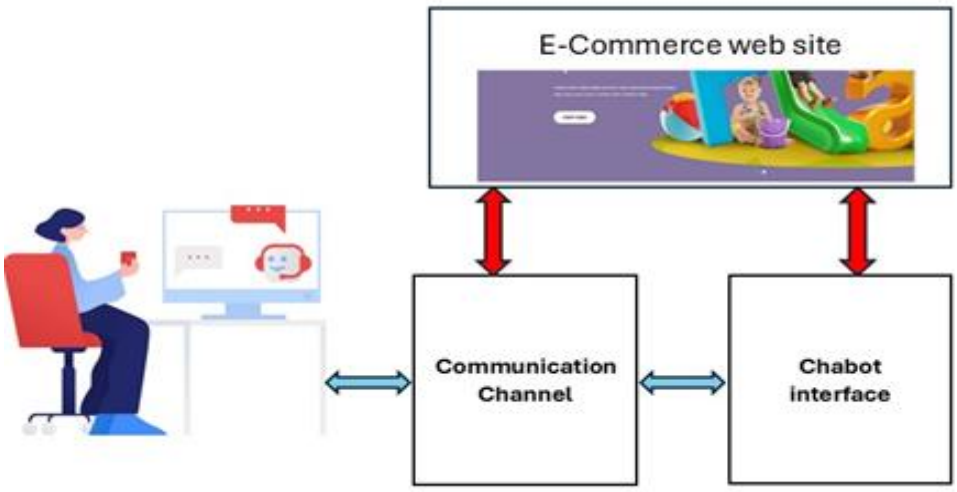

Fig.1. System architecture

The proposal includes two components:

- The first component is the e-commerce application hosted on a remote server, this application is hybrid, it will be Explorer on a desktop or on a smartphone.
- The second component is the AI chatbot hosted on the same server.

When you know your chatbot use case, its type, and channels, you are ready to select the platform to build your chatbot.

Our proposal improves the business benefits, it makes customers' experience more effective and personalized, which increases providing answers and helps in improving the satisfaction level of the customer experience.

Dealing with customers is very time-consuming and we need people to always be available, which improves the cost of doing business; however, a well-developed chatbot makes it easy to communicate with customers in their homes. It acts as a personal shopper, helping customers find what they need.

The process to generate response as illustrated in figure 2 involves various phases:

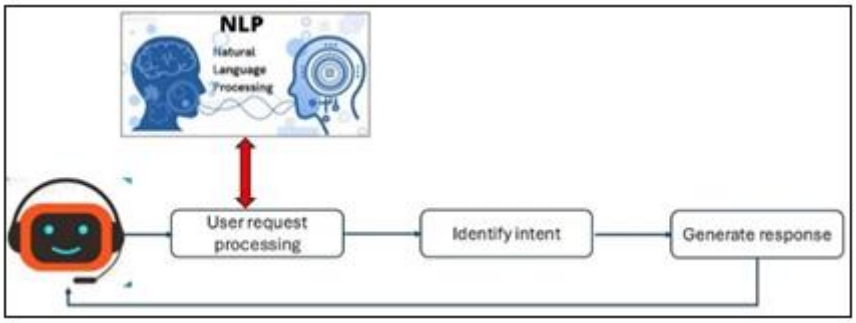

Fig.2. Chatbot system management

A. User request retrieval:

At the beginning, the chatbot greets us with a welcome message and waits for our response. The user, therefore, formulates his request in the form of text. The query is checked against the other queries in the question/answer repository prepared in advance. If the request matches a query in the repository, the system sends a response directly to the client. Otherwise, the request is then processed with BERT (following step).

B. **User request processing**:

In this phase the customer sends a message, generally a text, to the bot. This message is processed with BERT (Bidirectional Encoder Representations from Transformers) [21] which is a DL algorithm for text processing. We note that we have prepared registered questions and responses in the database serving as interaction models to provide quick response to the user.

The use of BERT transformed text processing by enabling models to deeply understand contextual nuances.

BERT's architecture considers both the left and right context of a word simultaneously, making it highly effective for tasks such as sentiment analysis, question answering, named entity recognition and text summarization.

By leveraging its pre-trained language understanding, BERT can be fine-tuned to specific datasets for domain-specific applications such as medical text analysis or legal document

processing. Its versatility and contextual understanding have set new standards in many NLP tasks, improving both accuracy and efficiency.

In this step, the user request processing using BERT involves different phases to deeply understand the context and the meaning. Here's how it typically, these phases work:

- **Tokenization:** The user's request is first broken into tokens (words) and converted into embeddings that BERT can understand.
- **Contextual Encoding:** Unlike traditional models, BERT reads the entire sentence bidirectionally, capturing the full context of each word based on its surroundings. This allows it to understand nuances like intent, entities, and sentiment.
- **Feature Extraction:** The output of BERT is a set of high-dimensional vectors representing each token with contextual meaning. The vector often represents the overall sentence meaning. This step is accompanied by a selection of the best features. For this, we use the bioinspired Grey Wolf Optimization (GWO) algorithm [22]. GWO, a nature-inspired metaheuristic optimization algorithm that mimics the leadership hierarchy and hunting strategy of grey wolves in nature. It is widely used to optimize complex problems, including tuning ML and DL models.
- **Intent Detection :** This vector is fed into a classifier to determine the user's intent (for example buy a dress). In this phase, the bot tries to understand incoming messages automatically based on a database history which involves frequent messages with their responses. The bot scans the text and matches it with predefined rules or AI-based algorithms to pick the best response. The classification of customers' potential intentions is done by classifiers. One customer might want to check the status of an order, while another might want to check the vouchers she has, which are two different types of queries.
- **Response Generation :** Based on the detected intent and entities, the chatbot either retrieves a suitable response (retrieval-based) or uses another model to generate a reply (generative approach). The bot sends a response within seconds, and the SMS bot sends the perfect response back, making things fast and convenient for customers. To generate responses, chatbots use two different ways. It uses history database where all the messages are stored, that means if the message is equivalent (in term of meaning) to a message before sent, the response is generated automatically from the predefined database. Else, the bot generates a new response on the fly which will be stored in the history database for further use.

For commercial applications, responses tend to be pre-defined to ensure that customers receive a consistent service, and that the bot does not respond in unintended ways that could lead to public relations failures.

In essence, BERT enhances a chatbot’s ability to understand user input by providing rich, context-aware text representations, crucial for accurate intent detection and natural interaction.

Preliminary results have shown an improvement in accuracy over the classic BERT approach with feature reduction. However, the response time is a little longer.
The novelty of our approach is twofold. First, we use a prepared database of request/response to quickly deal with user requests. Second, we enhance BERT with GWO aiming for a high-performance intent classification or dialogue act recognition in a chatbot.

5. CONCLUSION

In this paper, we introduced chatbot technology, its types, and its impact in e-commerce and we give details about the AI chatbots. Furthermore, we propose a new approach related to an e-commerce application based on AI chatbot to improve e-commerce benefits.
Our approach involves using BERT with GWO to enhance performance. In our future work, we intend to enhance our proposal and reduce request time processing.
Finally, we deduce that a selection of a technique or methodology cannot be made prior to a thorough examination of the functional requirements of the chatbot in question. This is since each technique possesses inherent limitations and advantages, necessitating the maximization of these benefits.

6. ACKNOWLEDGEMENTS

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