Development of an Python-Based Visual Chatbot for Advancing Human-Computer Interaction in Research Applications

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***Abstract*— A visual chatbot is a progressive kind of communication software that has the ability to process, apprehend and provide responses to any prompt as asked in different formats like images, Videos, and textual data. As a default chatbot is dependent on text input in order to provide a solution to a problem, the need for a chatbot that can take input in another format like visually in the form of images is created with the help of NLP and Python programming along with its different libraries. It also makes use of OpenAi in order to answer universal questions and in the form of results, it gives a solution to every problem that is asked in front of the model in any form. It can be quite effective in terms of business deals, shopping, academic fields, industrialization, etc.**

Keywords*— Machine learning (ML) Artificial Intelligence (AI), Natural Language Processing (NLP), Convolution neural network (CNN), HashiCorp Configuration Language (HCL), Natural Language Understanding (NLU)

I. INTRODUCTION

chatbots are software applications that simulate human conversation via the use of pre-programmed responses. They communicate by employing natural language. A chatbot is conversational computer software that can mimic human speech or writing. As a practical matter, chatbots are employed in conversational interfaces for tasks like customer support and data collection [1]. The designed chatbot focuses on the motive to form a "human-like" network when it communicates with students. It will permit the students to get access to beneficial instruction more commonly. It is not only a proposal as the initial way to improve connection in the university network, but also an essential origin of assistance at the time of the complete academic year [2]. A chatbot is a natural type of AI structure and a type of normal and wide-ranging depiction of radiantly HCL. The advanced chatbot consist of circumscribed present-day features, personalized synergy, and combination with other third-party applications [3]. A conversational image recognition chatbot is an application that had a drastic impact in AI which enables the users to collaborate with the help of images through common and daily life conversations. They are able to integrate image scrutiny with language clarification, by implementing processes like CNNs to illustrate visual images and NLP to react to queries and instructions in live time. This mechanism gives the user the user the opportunity to not just aspect the visual image, but also get details about them on different matters and topics related to it in detail. These chatbot are of great significance in the fields of industries like education, healthcare departments, and customer satisfaction, where fast and efficient image recognition abilities are necessary to improve user satisfaction levels and precise results [4]. The development of the chatbot includes the use of JavaScript API that can be enforced for the processes of a chatbot, and CSS to make it visually attractive. The back-end can be handled with the help of Python programming. Moreover, there are many distinctive machine language methods and processes that can be used to gather responses and commands from different users [5]. Chatbot have the abilities with which they can supply end users with instant access to data and information, personal data in real-time. With the help of conversational interaction over text or voice, chatbot provide consumers with the beneficial mode of accessing a great field of assets. It is mainly of significance for people with disabilities and language barriers because chatbot are able to take in diverse needs and penchant [6]. When taking the text-side dominated chatbot into consideration, there are two central paths for the sake of obtaining responses in a chatbot. The classical method is to utilize hard-coded templates and processes to form chatbot. With the introduction of deep learning, a more efficient new method was discovered. The large neural networks are competent on big quantities of data to understand the method of creating more efficient, precise, and correct reactions from the model [7]. The continuous development of the investigation of chatbot has a notable integrative characteristic, dominating areas of language, philosophy, sociology, psychology, and HCL [8]. As soon as the back-end obtains the requirement of the end-user, it makes utilization of the NLU part to gather important data and information by the data has been fed and created a depiction of its actual meaning that can be utilized thereafter in the process [9]. Chatbot can contribute to custom-made shopping satisfaction in both forms of offline and online modes. On the other hand, the central objective

which is the human language complexity and the cogency of chatbot becomes the problems to be solved [10].

II. LITERATURE REVIEW

Among the distinct methods to create a chatbot, the pattern recognition objective is to develop a computer structure that can act like homo-sapiens and their conversation. The pattern recognition is dependent on classical catalyst return type bricks, where the end screen customer types a message and the model provides a response based on the input supplied by the end user [11]. Many AI-dependent utilitarian potentials are used as a service for Natural language processing, members have the opportunity to candidly provide their data on the data gathering screen, which is then processed and replied to based upon adequate response [12]. Language modeling is taken into consideration by the AI programs to develop the response to the input provided by the end user. It can give important data that is in raw form with the help of reserved search [13]. There soon will be a time when chatbot will be considered the first preference in the Employment fields and businesses for communicating with separate clients and parties and immediately solving all the problems faced. Moreover, the sudden trend of the popularity of chatbot has significantly affected the major advancement that includes the growth of message services and AI. chatbot are particularly task-effective and can copy a humanized form of conversation for education, business, etc [14]. They are designed in such a way that by taking the support of NLP for performing live conversation, along with the objective to provide consultation and shielding. There is no denying the fact that the use of AI in online shopping has become one of the most common methods now in finding products as well as customer service [15]. Chatgpt exercises an alternative of the Gpt model that has been instructed to answer the queries by making use of a large dataset and it also develops answers in the form of textual data with the help of NLP [16]. The central category of chatbot is basically examined and observed to be work-specific, which also concludes that these colloquial agents are designed with the purpose of assisting the end users in order to find a solution to a particular problem or issue. Data also stated that chatbot are also built in order to continue a green condition of communication with humans and to develop a kind of bond with them [17]. The normalized text will be the prompt given to the software and it should be capable of providing the output that is adequately sensible and correct as a response to the prompt asked of the program. This procedure runs in a loop and returns output as the text of voice speech [18]. Advanced chatbot that are mechanized by NLP are able to access greater communication synergy with the end user and accommodate back-to-back queries, or the communication method of the chatbot can be transformed to entertain the main objective [19]. The thesis on the low rate of responses of the communication models proposes the need that the lagged response has a major consequence on the factor of in what way a chatbot is recognized and that getting output on the spot takes away the feeling of natural communication in a human being and in order to dodge this issue, the modernized chatbot are not designed to display outputs after some particular time also known as a lagged response to mimic a normal person replying even after knowing the answer even immediately [20]. In the field of healthcare sectors, at the organization where the data of end users is Handled, it becomes necessary to take care of its privacy. chatbot take the help of raw data to gather information and learn and make outcomes based on them whereas the end users do not have any how the data provided by them is hidden securely. It raises alarm on the factor of the personal space of people when their data is shared and considering it, it is important to apprehend how the data is contained and shared by the communication agents [21]. The chatbot encourages the end-consumers to contribute their thoughts on it with the medium like suggestions, ratings, etc that build the pillars for steady development in the model. The suggestions provided become one of the major reasons that cultivates ML model data training and reaction time criteria which eventually increases the efficiency of the chatbot [22]. There is always a possibility to add functions that were previously not in the current model with the inclusion of a drawback in it. The complete process that includes the training of the model, civilizing it, and testing it has to be done. The addition of the latest functions every time in the current model will lead to the degrading of the performance and efficiency of the chatbot [23]. The communication between a chatbot and a human being has to be centered around emotions and affections taking mindset and actions into consideration. chatbot have to be built in such a way that these points are taken good care of when executed. It can easily be performed if a greater amount of datasets that are directly related to monotones, personas, and emotions is taken [24]. The procedure to create output begins with giving some prompt to the chatbot through text, video, or audio, then the NLU comes into action and reads and understands the prompt through ML and algorithms to find out the objective of the end user and to collect information of greater good that is required. The data extracted is stored and the dialog managers then come to the choice depending upon the present condition also taking the policies into consideration. In the end, the NLG part comes into play which develops a perfect output on behalf of the system or program and displays it to the end user [25]. Different research models have been studied which are depicted in Table 1.

TABLE I. SURVEY OF RESEARCH MODELS

Reference no.	***RESEARCH PAPER***	***RESEARCH GAP***
[11]	2019	The model was not able to perform in terms of real-world applications. It made use of AIML for its work but suffered in terms of performance comparatively to other models it aimed at.
[12]	2020	The model has to compromise with the privacy and security concerns in terms of the working of the model. It did not have any performance matrix for judging the efficiency of the model.
[13]	2023	As it took ChatGPT as its base, it was not able to complete research and analysis of the drawbacks and limitations faced by ChatGPT itself.

[14]	2022	The model had restricted access to data and content which affects its efficiency on an overall basis. It also was not standing in the field of emotional recognition and was not able to cover the gap in human-human conversation.
[15]	2022	The contextual memory that holds the output scope is lacking in this model. Unwanted content and data are not optimized and reasonably affect the accuracy of the outputs of the model.
[16]	2023	This model never came into action on real-world applications therefore has not been tested on a global basis. It pays no attention to the multi-modal capabilities.
[17]	2021	The inconsistent and limited study about the user's expectations led to less feature exploration of the models researched.
[18]	2015	The collection of data was not done in this model which led to no prior knowledge about the features users required now.
[19]	2021	The model was limited to specific task applications and was not able to perform generalized tasks.
[20]	2023	There was a lack of analysis of the data taken into consideration for the collection of data and working of other models. Its design is not user-friendly and has no flexibility based on devices.
[21]	2022	There was Limited focus on privacy and security that affects the user's trust. The training and testing of the model were not done properly which affected the accuracy of the model I real-world applications.
[22]	2023	The precision of the model was comparatively low due to the use of old machine-learning models. It was not able to support different languages. Security concerns were another factor that the model lacked.
[23]	2019	The issues lie in the deployment of the chatbot that deals with data privacy, and security concerns. It was also not adaptable to the changes in the technologies coming into trends and is used more nowadays.
[24]	2021	The model was not user-friendly. It should be flexible for users of every age, and gender. It also lacks in establishing the normalized matrix of performance in different applications and industries.
[25]	2024	The model mainly focused on emotional support and not mental health. It is not customized based on people of different age gaps. The security and privacy concerns remain intact in it also.

The table above depicts distinct research models made earlier on the similar obejctive along with the contraints they had to suffer with. The above table states that the main constraints which were commmon in most of the models were flexibility, privacy and security concerns of the end users data, and the fall back in analysying the data that become the reason for the not up to mark performance of their respective models.

III. PROPOSED MODEL

The invention aims to create an AI-based chatbot for the detection and recognition of images and videos. The major goal of the research is the integration of computer vision with machine learning. The language used for the development of the chatbot is Python. Various libraries of Python are used such as TensorFlow, Tkiner, pillow, OpenCV, threading, and Numpy.TensorFlow deep learning library which uses data graphs for building machine learning algorithms. Tkiner library aims to build a graphical user interface for the chatbot. OpenCV library has been used for image and video processing. NumPy library has been used for the mathematical computation of the images and the videos. Pillow is another Python library that has been used for image processing. Threading has been used for the responsiveness of the chatbot. Modules used in the invention are ImageTk and FileDialog. File dialog is a module under Tkiner used for choosing the files and ImageTk is a module of Pillow responsible for the displaying of the images in the graphical user interface. OpenAi API has been used for the chatbot to answer all the questions of the user. Here are some different processes used in the development of the model.

A. Pre-processing :

When the user provides input as an image, text, or video pre-processing is done. The data needs to be processed and go through various steps to make the chatbot understand its logic.

B. DATA CLEANING:

In the case of text, it refers to cleaning whitespaces, converting them into lower cases for the chatbot to understand, and deleting the extra spaces.

C. FRAGMENTATION:

It includes breaking the phrase into smaller and smaller text.

D. STEMMING :

Conversion of words into their root or original form is called stemming.

E. NORMALIZATION :

Normalization here refers to the correction of the grammar or the spell check which makes it easy for the chatbot to interact.

F. APPLICATION PROGRAMMING INTERFACE:

It is a set of instructions of protocols that enables the software to communicate or interact with each other.

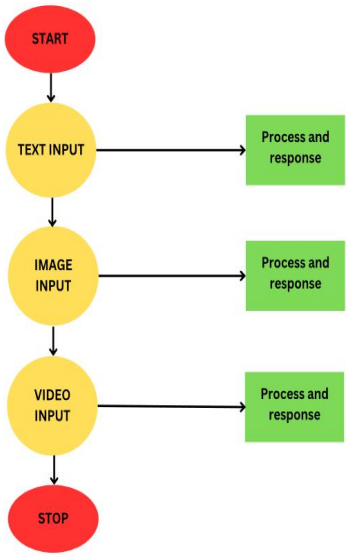

Fig. 1. Working of visual chatbot

Figure 1. shows the working of the visual chatbot. When the user makes an input either the input will be text, video, or image. There will be three conditions. Firstly if the input is in the form of text the chatbot will retrieve the data from the API process and will provide the output. Secondly, if the input is video the chatbot will pre-process the video and display the results. Thirdly if the input is in the form of an image the chatbot will pre-process the image and display the results. All the data related to the text, image, or video will be fetched from the open API.

IV. IMPLEMENTATION AND RESULTS

Fig. 2. Buttons of chatbot

Figure. 2. represents the buttons for recognizing a video or an image. The user can click on these buttons for recognize images or videos

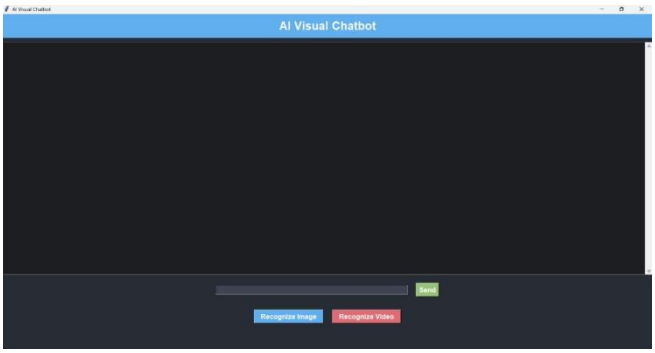

Fig. 3. chatbot Interface

Figure 3. represents the interface of the chatbot with which the user can interact. It represents the options for the user to interact with the chatbot.

V. CONCLUSION AND FUTURE WORK

A major change in technology for communication has been introduced in the paper as a visual chatbot. To develop the model, different programming languages and methods have been used like Python, its libraries, and OpenAi. ImageTk and Filedialog are the modules used for its development. The chatbot returns statements and answers as output called responses in return for the prompt provided to it. All the restrictions of the previous research paper have been taken into consideration in this model and made an error-free, smooth-functioning, flexible model for use in real-life applications. The Future works involve the use of voice commands, and online streaming of video as output in the model.

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