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Image classifying AI Chatbot

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ABSTRACT

We have built the bot by using HTML and CSS for a simple front-end display and JavaScript for the application tier. The neural network is constructed using Brain.js, a GPU accelerated library for handling neural networks in JavaScript. Brain.js consists of multiple neural network implementations mainly to foster the ability of different neural nets to perform different tasks well. The object detection feature is built using ML5.js. Training of the bot by exposure to both specific and generic questions would be crucial. Also, whenever a user isn't satisfied with the answer given by the bot, he can raise an issue, and the answer for that question would be answered correctly in future updates. The bot also learns with each question the user asks, thereby making it better and better with each iteration. The bot also has an image classifier feature for detecting objects.

Keywords: Chatbot, Image Recognizer, Object Detection, Web Development, Artificial Intelligence, Machine Learning, Computer Vision, Human-Computer interaction

1. INTRODUCTION

Artificial intelligence (AI) refers to the simulation of human intelligence in machines which can be programmed to think like human beings and mimic their actions. The ideal function of artificial intelligence is its ability to rationalize and make moves that have the best risk of reaching a particular purpose.

A Chatbot ^{[1][2][7]} can be defined as an AI-based computer program that simulates human conversations. They are also known as digital assistants. Bots interpret and process the user requests and give applicable answers ^[6]. They work by analyzing and identifying the purpose of a user's request. After that, the responses are delivered to the users. Chatbots increase efficiency and bring cost savings to businesses while providing a simple and enhanced customer experience. There are specific names such as a clever bot, Conversational bot, Chatterbot, Talbot, Interactive agent, Conversational AI, and Conversational interface.

2. RELATED WORKS

In the article Intelligent behavior Shown by chatbots by Vibhor Sharma, Monika Goyal, Drishti Malik, Chatbots ^[10] are described as software agents used to interact between a computer and a human in natural language. As people use language to communicate with each other, chat conversations use natural language processing to communicate with human users. The primary purpose of their creation was to resemble a person in the way they made the stated communication, to try to make the user think they were writing to the person. In that paper, they analyzed some existing chatbot systems namely ELIZA and ALICE, and then concluded that it is easier to build bots using ALICE because of its simple pattern matching techniques than building one for ELIZA since it is based on rules. Finally, they discussed their proposed system. In particular, the proposed program was the implementation of the ALICE chatbot program as a domain-based discussion tool which was a student information system that assists users with a variety of questions related to students and universities.

The article Survey on Chatbot Design Techniques in Speech Conversation Systems by Sameera A. Abdul-Kader and Dr. John Woods ^[9] talks mainly about Natural Language Processing (NLP) techniques such as NLTK in which Python can be applied to analyze speech, and intelligent responses can be found by designing an engine to provide appropriate human-like responses. This form of program is referred to as a Chatbot, which is the focal point of this paper. The paper discusses the similarities and variations in the strategies and examines mainly the Loebner prize-winning Chatbots.

3. ARCHITECTURE

The bot is planned to be built using HTML and CSS for a front-end display and JavaScript for the application tier. The neural network is constructed using Brain.js, a GPU accelerated library for handling neural networks in JavaScript. Brain.js offers a wide

range of neural networks in which different neural networks can be trained to do unique things well. Learns patterns and relationships between inputs and outputs to create learning assumptions when working on related issues [8].

Training of the bot by exposure to both specific and generic questions would be crucial. Also, whenever a user isn't satisfied with the answer given by the bot, he can raise an issue, and the answer for that question would be answered correctly in future updates. The bot also learns with each question the user asks, thereby making it better and better with each iteration.

On the other hand, Image Classification is one of the most common applications of machine learning and hence, has been integrated with the chatbot for expanding its usage. In this project, we would use ML5.js which is a machine learning library for the web.

4. WORKFLOW

There are two main functionalities of the bot application which can be used by the user. One is having a conversation with the bot and the other is the image recognition feature. In the conversation module, the user begins the conversation by giving a statement or a question as input. Input can be given in the form of text or voice. The bot receives the request and processes it. It tries to identify the intent of the user and provides the appropriate response. If the user is satisfied with the response he can give the next request, if not he can improve the current response of the bot by giving what should be a better response. The bot stores this new response from the user so that the next time the same request is given, it can give the appropriate response. This is represented in figure 1 shown below.

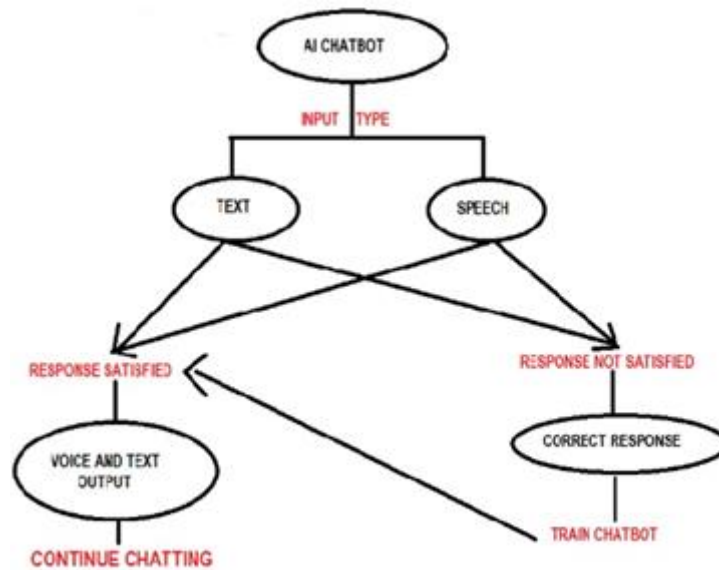


Figure 1 Overall Architecture

The image classifier feature is used for recognizing an object. Input can be given in two ways - by uploading the image as a file from the device's storage or by simply dragging and dropping it into the upload dialog. Upon uploading the image, one can search for results. The workflow is given in figure 2.

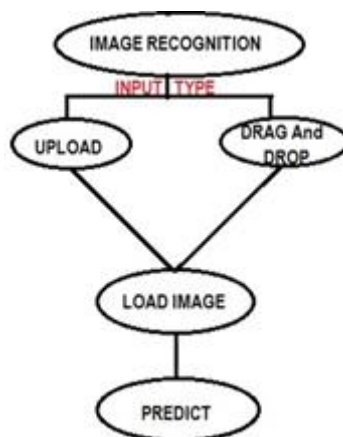


Figure 2 Image Recognition Architecture

The list of modules implemented and technologies used will be discussed in the following sections.

4. MODULES IMPLEMENTED IN THE APPLICATION

4.1 Voice Recognition Module

Synthesizes the given voice input and converts it to text format for further operations. This is done using speech recognition APIs and libraries. The user first grants permission for capturing the voice and then it is received and displayed. Once the user is satisfied with the displayed text format, he sends it to the chatbot for receiving a reply.

4.2 Message Classifier

Here the message is classified as to whether it can fetch the answer from previous related questions or if the NN can answer based on its learning. For the question that has been previously asked, the answer is just fetched and provided. In case of any new question, the answer is provided based on how the NN is trained. Initially, it gives default answers.



Figure 3 Interaction with Chatbot

4.3 String to Binary for Data collection

Upon receiving the input from the user, the next step is data processing or converting the input to an appropriate format for the neural network. The input for the neural net should be in binary format. So, we have to convert it to binary format before any further processing.

4.4 Neural Network

A neural network is a series of algorithms that endeavors to recognize underlying relationships in a set of data through a process that mimics the way the human brain operates. The binary data that was processed in the previous step is sent to the neural network, where it is either processed for learning or for producing the required output.

4.5 Image Recognizer

Here, the user shares an image, the bot does an image search and produces the required results. It is carried out using ML5.js [5], which is available online. This library has various recognition and detection algorithms embedded in it, which makes image recognition efficient. figure 4



Figure 4 Image Recognizer Results

4.6 Text to Speech

This module is created to make WebApp more like a human. Making the app speak just like a human would enhance the intractability between the two. The text output produced as a result of the neural network is delivered in a vocal format to the user.

4.7 Learner Module - For correcting the response

Different users require different kinds of responses. So, the learner module gets trained as per the user's responses. Whenever the user is not satisfied with the output, the user can type in the expected results.

4.8 ML5.js

TensorFlow.js is a toolkit for coping with GPU-elevated mathematical operations and reminiscence management for gadget mastering algorithms. ML5.js provides an open-source, pleasant high-level interface to TensorFlow.js. ML5 aims to make machine learning accessible to a wide range of audiences like artists, creative coders, and students. It is a JavaScript machine learning tool built on top of deeplearn.js with examples.

5. TECH STACK

5.1 HTML

Hypertext Markup Language (HTML) is the standard language for marking texts designed to be displayed in a web browser. It can be aided by technologies such as Cascading Style Sheets (CSS) and writing languages such as JavaScript. Web browsers download

HTML documents from a web server or local storage and display them on web multimedia pages. HTML specifies the layout of a web page by topic and includes the document's visual cues at first.

5.2 CSS

CSS is a style sheet language for describing the display of a page written in markup languages like HTML. CSS is a World Wide Web basic technology, alongside HTML and JavaScript. CSS is designed to enhance the look and feel of contents such as text, colors, and fonts. This segmentation can improve content access, enable more flexibility and control in the presentation of presentation features. Another advantage is that it helps more web pages to share formatting by specifying appropriate CSS in a separate CSS file that reduces complexity. Also, it causes CSS files saved to speed up the page between pages that share this file and its formatting.

5.3 JavaScript

JavaScript, often abbreviated as JS, is the programming language that complies with ECMAScript specifications. It has curly-bracket syntax, dynamic typing, model-based orientation, and first-class functions. Combined with HTML and CSS, JavaScript is one of the basic technologies of the World Wide Web. JavaScript enables interactive web pages and is an integral part of web applications. Most websites use it for customer-side activity, and all major web browsers have a JavaScript engine dedicated to doing so.

5.4 AJAX

Ajax (short for "Asynchronous JavaScript and XML") is a collection of client-side web development techniques for creating asynchronous online applications. With Ajax, web applications can send and retrieve data from a server by syncing (background) without disrupting the display and behavior of an existing page. By removing the data transfer layer from the presentation layer, Ajax allows web pages and, by extension, web applications to dynamically change the content without the need to reload the entire page. In exercise, JSON is often used instead of XML in contemporary structures.

6. PERFORMANCE ANALYSIS

When the AI Chatbot WebApp was moved to the deployment phase, its final performance lived up to the expectation on which the app was built. The feedback after conducting the end-user testing was satisfactory. The user experience was found to be pleasant and smooth. Despite such efficacy and fluidity in performance, some challenges might arise nescience of the end-users.

6.1 Challenges

The lack of availability of proper data-set reduced the competence of the AI Chat-bot. The Bot was trained using a Generic data set which resulted in a limited performance of the bot. This problem is faced by both sections of the application. The image classifier does the job of identifying what the image is. The result obtained is very generic. The classifier does not tell the model, version, or some other relevant information about the image. When it comes to the chatting side, due to the scarce availability of input and output text, the bot does not produce or seldom produces appropriate answers for questions that were never asked before. Chatbot testing is another major problem where most of the difficulty lies. Chatbots continue to thrive because of their advancement in native language models. Therefore, you must test and use the chatbot to check its accuracy.

6.2 Future Scope

Using appropriate data collection and web scraping methods, the amount of data available in the form of images would increase. This would in turn result in improved accuracy of the bot. Another update that was planned was, using intents and entities to make the bot do specialized tasks such as checking the mail, writing a blog on behalf of the user.

The expected benefits of chatbots often fail because of their robotic language, inconsistency, and difficulty in understanding the purpose and diversity of the language. Experts say that restricted customer communications and negotiations disrupt technological success. The user experience requires a consistent, clear, and focused personality that mimics human communication and makes them feel comfortable. So, making conversations non-artificial and the way the user will feel comfortable is necessary.

Bots need to be further developed to improve their NLP and script removal capabilities. In companies with a lot of options, products, or services, users will naturally slow down, forget and interrupt. Chatbots will need to demonstrate the nuances of conversations, personal memory, and development to be a legitimate place for clients who say - despite language barriers - can show patience, ingenuity, understanding, and flexibility.

7. CONCLUSION

It can be widely seen now that many organizations use chatbots for customer assistance or other purposes. The usage of such conversational chatbots is only expected to grow as more and more websites and apps employ this as it cuts costs for the organization and also minimizes human interaction. Also, the response time is considerably higher. For example, let's say we have a query on the usage of a digital app. If we enter the 'support' section and ask our query, the chatbot will immediately greet us and ask for our problem. In the case of a human, the response time might vary depending upon the state of the employee. Also, in such a way it might require an employee to sit all day in front of the screen for a prompt response. This can be eliminated with chatbots. Also, they can provide 24*7 service as well.

These days, consumers expect to be able to find the information they want online quickly and easily. And when a business can't provide that kind of experience, they get frustrated. Chatbots are ready to alleviate this frustration by providing the real-time, desired way consumers want it. In today's world, chatbots or smart assistants with artificial intelligence are dramatically changing businesses. There are a variety of chatbot chat platforms available in various businesses, such as e-commerce, retail, banking,

entertainment, tourism, health care, and so on. Hence it can be concluded that chatbot is a key AI innovation that will continue to impact businesses for the years to come.

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