Chatbot AI

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***Abstract*—This paper will talk about the fundamental aspects of an AI Chatbot. It will include results, and what we have learned.**

I. Introduction

Computers are an essential part of our life; however, they are not "intelligent". For computers or programs to be considered intelligent they must be able learn and "think" on their own. Machines that demonstrates this type of intelligence are called artificial intelligence, or AI.

One popular example of an AI is a "chatbot", an AI that can converse with an user via keyboard text inputs, inspired by Alan Turing's Turing Test where an AI's intelligence is measured by how well it mimics human responses. If most human users cannot determine if it is human or machine then the AI is considered to have "passed" the test.

Besides an academic motivation, there is also a public motivation behind perfecting the chatbot. According to the International Journal of Engineering and Innovative Technology[1], creating the chatbot AI can benefit society by providing comprehensive machine translation and thus bring the world closer.

There are two types of models to consider when creating an Chatbot AI. The most simple one and the one we chose to work with is called a Retrieval-based model. The chatbot responds only from a predefined database of responses that we created. The second model and harder one is called a generative model where the Chatbot does not rely on a database of predefined responses but is able to create its own from scratch. Another thing to consider is whether to operate in a open or close domain setting when handling conservations. In a open domain setting the user can take the conversation anywhere and the Chatbot will be able to respond appropriately. This is evidently more harder to implement that an closed domain setting where the conversation is restricted to certain goal. We have choose to implement a Retrieval-based model Chatbot AI in a closed-domain setting for our project. However, it is worth to note that the end goal of all Chatbot AI programs is to do a generative model in a open domain setting.

In this paper, we will describe our research and processes to implement the chatbot. We modified a pre-existing chatbot and taught it new words, managed its database, established its personality, and generated a response based on that personality.

II. Objective

A. Dynamic Conversation

For our chatbot, we want it to not only be able to converse with the user but also learn words and adapt its personality based on the user inputs. So in the beginning, our chatbot would not be "intelligent" but will become more knowledgeable and "person-like"as it converses. To do so, our chatbot need to be able to analyze the user inputs and extract the information it needs to make a decision. Due to time constraints this feature was not fully implemented into our working project and can be completed at a later time.

B. Personality

We also want the chatbot to adapt its personality as it converses with the user. The chatbot will start off with a "neutral" personality but will change based on how the user's response is. For example, if the user inputs "nice" messages, the chatbot's personality and response will become friendlier. If the user inputs "mean" messages, the chatbot's personality and response will become more hostile. Overall, we want our chatbot to be able to converse with the user, learn words, and have an adapting personality.

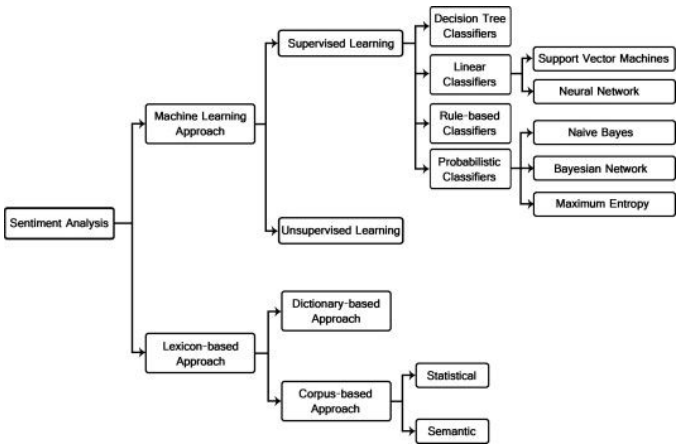
III. Methodology

Instead of building a chatbot from scratch, we took a chatbot program made by Liza Daly from Chatbot

Fundamentals 2 and added onto her code. The program itself was already able to converse with the user like a normal chatbot. It reads the input by identifying the type of words there are, such as noun, verb, pronoun, and so on. Then it takes those pinpointed “keywords” and put them into predetermined response format to generate an appropriate response.

We took inspiration from this system and used it to implement our chatbot’s word learning function. First, the user must introduce the word to the chatbot, so when the user asks it, “What is a sushi?”, it will not understand what “sushi” is and memorize the keyword in its database. When the chatbot has enough keywords in its database, the user can teach the chatbot to associate keyword with each other by using a trigger word. For example, the user would need to type, “(Trigger word), Sushi is a seafood.” to have the chatbot associate “sushi” with “seafood”, giving the keywords meaning.

The most important feature we wanted to implement into our chatbot is to give it the the ability to



change to the appropriate personality using sentiment analysis. The figure above shows the path of sentiment analysis and the machine learning approach to teach our chatbot in a supervised learning environment by using Decision Tree Classifiers.

Our approach is to have the chatbot’s personality be represented as a state on a personality spectrum. The spectrum will have Good and Hostile be at opposite ends and have the chatbot start at a Neutral personality, the middle of the spectrum. Our **cost function** is us using a Decision Tree Classifier system to analyzes the chat and shifts the chatbot toward the most appropriate personality on the spectrum. The heuristic system has a heuristic function to determine how far its current state is from the Good personality and the Hostile personality. From these heuristics, it can then choose which personality to be its “goal state” and choose the best operator to help reach it. The Decision Tree classifier has four branches that it can decide to go down based on the user input. Currently it can classify whether

1. User is engaging in normal conversation
2. User is referring to themselves in conversation
3. User is referring to the chatbot in conversation
4. Asking a general question to the chatbot

By using this Decision Tree Classifier, our chatbot is now able to respond to a variety of user conversations however it still operates in a limited space. The way we use our chatbot database of responses works is similar to how this paper[3] from Chitkara University used their chatbot database. Their database is used to generate different responses for each questions the user might have to avoid redundant answers, much like how our chatbot can answer the user in a different way depending on what it learned and its personality.

IV. Results

From the code we took, our chatbot is able to converse with the user in simple conversations. For example, if the user types, “I am a programmer” and the personality state is set to negative, the chatbot will comedically reply, “You aren’t really a programmer idiot.” Besides simple conversations, our chatbot is also capable of storing and associating words and relaying the word meaning back to the user.

If the user enters a question that asks for the definition of a certain object like, “What is an parrot?” the chatbot will not understand and reply “I don’t know what a parrot is.” When this happens, our chatbot takes note of the word “parrot” and stores it in its memory list. Now, if the users tries to trigger an association between “parrot” and “animal” by saying “Chatbot, a parrot is a animal” the chatbot will then associate those two words together and commit it to memory and confirming to the user “I understand. A parrot is a animal. When asking again what a parrot is the chatbot would already know it since it is in its memory and will respond, “A Parrot is a animal”. To change the chatbot’s personality, the user have to use

specific words. If the input contains an insulting word, the chatbot's personality will turn Hostile. For example, if the user entered, "What is sushi, stupid?" the chatbot would be more Hostile and reply, "How dare you mock me, human. Sushi is a seafood." However, when "nice" words are detected, the chatbot will shift to Good and respond more nicely. For example, if the user entered, "Hey Chatbot, sushi is a seafood" then it will reply, "Thanks friend, I understand. Sushi is a seafood."

CONCLUSION

As we worked on our chatbot, we found that developing an Chatbot AI capable of speaking like a human and learning like one as well has a lot of complicating moving parts and mechanisms. The chatbot not only have to take in messages and respond to it, the chatbot also have to analyze inputs and its context, manage its memory database, and decide what and how to generate its responses. All of these come together to give the chatbot the ability to respond, learn, and adapt as it converses. From this project, we not only learned the inner working of a chatbot but also how concepts from lecture such as heuristics apply and the origins of Artificial Intelligence as well as what it has to offer in the future. From learning these concepts, we have better understanding of what it takes to build an AI and how it works. There are a lot of things we could do to improve on this project if given adequate time and research but we feel that we were able to accomplish some of the goals we wanted to implement in our Chatbot.

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