Mental Healthcare Chatbot

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Abstract- Chatbots are a way for people to communicate with computer systems. A conversation with a chatbot is similar to having a conversation with a human being. Keeping that in mind, we have chosen to create a chatbot that deals with mental health issues like depression, anxiety, etc. As most people are not comfortable talking about it to other people, a chatbot might help provide some suggestions on how to deal with mental health issues. The core technology that will be used to create such a chatbot will be Natural Language Processing (NLP). Natural language processing consists of a vast range of manifold tasks such as textual entailment, question and answering, semantic similarity assessment. The capacity to learn efficiently from raw text is critical to reduce the dependency on supervised learning in natural language processing (NLP). The chatbot's data will be stored in a database. The chatbot will identify user inputs and accordingly make a decision in the form of a response.

Keywords- Chatbot, Mental Health, Contextual, Bag of Words, Neural Networks

I. INTRODUCTION

This template is designed to help you in preparing your manuscript in expected format. The guidelines include complete descriptions of the fonts, spacing and related information for creating your proceedings manuscripts. Please follow them properly. Mental health is a raging issue in current times that requires much attention. It refers to the emotional and behavioral well-being of an individual. An individual's mental health is just as important as one's physical health, it affects a person's ability to think, work, and has an equal effect on physical well-being. One of the core issues that people find difficult when it comes to dealing with mental health issues is the reluctance to talk about it. In this regard, a chatbot will provide a platform to initiate a conversation to address one's issue. A chatbot is a software application that simulates human conversation using Artificial Intelligence and Natural Language Processing. It is a smart system that processes the user input to give appropriate responses, maintaining the conversational flow. A chatbot in the domain of mental health will use intuitive technology to deal with a prevalent and growing issue. A user communicates with our chatbot to solve its problems through an application or website. The chatbot is developed using NLP and deep learning. NLP is a branch of an AI due to which humans can communicate with machines and computers can interpret & manipulate human language.

Mental wellness is a vital part of quotidian life and impacts all aspects of life. However, there is lack of awareness and acknowledgement of mental health issues which leads to undealt problems that become worse overtime. It can be physically and emotionally harmful and can make us feel vulnerable to the opinions and judgments of others. Even in the 21st century, many people who face mild/severe mental health issues impart a feeling of diffidence in communicating these issues. Also, some people are not able to afford psychiatrist fees and other treatment due to which they are not able to get rid of their mental health problems. A mental health chatbot will serve as a platform to initiate dialogue pertaining to mental health and aid in easing mental distress. It will deliver an encouraging and therapeutic responses to aid users so, at times when they feel low, chatbot engages them with conversation. Some chatbots can actively engage users that are on their site or have downloaded an app while Some chatbots engage passively, replying only when users reach out. Mental health chatbots can work as a friendly ear. An app or area to express worries, concerns, intruding thoughts or captivate in 'therapeutic' small talk. Developers can use this conversational input to know the mood of the user and acknowledge with insight.

The basic aim is to provide users with a service to express their mental health problems using a conversational model, to develop a chatbot that assist in alleviating user's mental health by providing refined responses and attempt to achieve the following objectives.

- The user should feel better after having a conversation with the chatbot.
- The user should get a better sense of the reason behind their distress.
- Providing a platform to users to express their concerns using a conversational model since some individuals are disinclined to convey their problems with their family or friends due to the risk of being censured.

II. LITERATUREREVIEW

Before we move further into the pivot let's take a look into previously established work in the same domain.

There are several approaches for developing chatbots. Jianfeng Gao, Michel Galley and Liong Li evaluate different approcahes which can be considered while building a chatbot in their paper 'Neural Approaches to Conversational AI Question Answering, Task-Oriented Dialogues and Social Chatbots'[1].

Jack Cahn's thesis 'CHATBOT: Architecture, Design and Development' provide great insights into a chatbots architecture and designing strategies [2]. In order to assure a chatbot's role in improving mental health Aditya NrusimhaVaidyam and Hannah Wisniewski's study convincingly states the positive impact of chatbots as a part of appeasing mental health issues [8]. In this paper we are using a conversational AI to mitigate a pervasive issue backed by strong foundations.
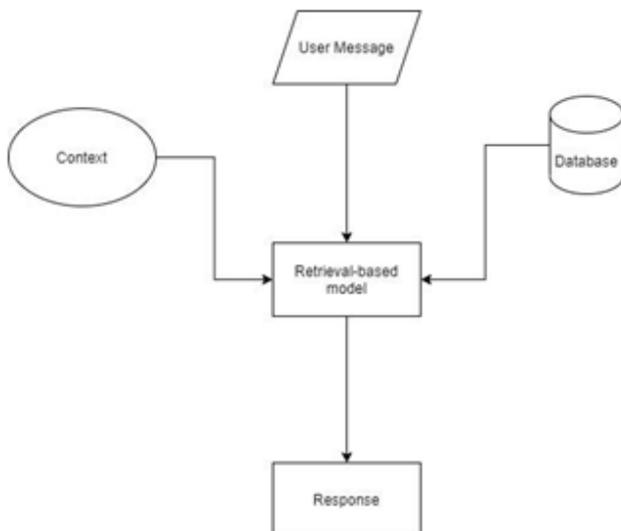
III. PROPOSEDSYSTEM

Fig.1. Proposed System

In the proposed system the bot will greet the user and initiate a conversation. Eventually the bot will start asking the user their problems/challenges. The primary focus of the bot is to save the time that the user takes to have an explicit conversation about his mental inabilities. The bot achieves this goal by providing response suggestions which will make for convenient conversations with the bot and also avoid any erroneous conversation between the user and the bot. This profitably helps in minimizing errors and improve adherence to the conversation flow. There are three prime features that

the bot exhibits; Exercises, Gratitude, and Mood Tracker. The user can carry forward the conversation with the bot or choose any of the above-mentioned features to have a specific communication aligned to his concern. The conversation between the bot and the user is saved in the form of data in the database. As the word gratitude itself means thankfulness, the user can mention situations/actions that they are thankful for, in life. The bot will save such experiences under a proper date and time. Speaking of mood tracker, the user can very easily record their current mood under a proper date and time. This information is saved in the database. Thirdly, exercises are activities that the user can practice to progressively feel better and lighter. Amidst the conversation, the bot will always work on the goal to have a friendly conversation with the user while making sure the user feels rejuvenated about the situation, they are in. We approach this chatbot by transforming intent definitions to a neural network. The mechanism of the bot functions in a way that it matches the user input with the data in the existing database. The bot will then set the context of the input and successfully provide a response from the database, making the conversation pretty much simpler. The advantage of using context is that the user can start the conversation from where heleft.

IV. IMPLEMENTATION

4.1 AGILEDEVELOPMENT

Agile is one of the most commonly used project management methodologies today. Agile methodology uses "sprints", or short development cycles, to provide with a rapid development strategy without much need of documentation. We need to build, check, correct, rebuild, test continuously and every time we make changes, we need to go through these steps to verify the results of our work. The goal of Agile is to increase productivity in software development. It involves dividing a project into several phases or sprints. Each sprint is to be planned, designed, built, tested, reviewed, and deployed one by one instead of waiting until the entire project is finished and deploying as a whole. The usual waterfall methodology involves ascertaining the requirements in advance of time with testing and documentation in the final stages after development is finished, wherein there is more chances of bugs to be found and solving them becomes expensive. Agile methodology provides improvement techniques that are effective and profitable for portable applicationsadvancement.

4.2 DATA

There are different ways of dealing with different emotions. Keeping this in mind different conversation flows

are created for every emotion that the bot helps dealing with. So, our data that we used to train the model has a standard format indifferent to the emotion. It consists of intent definitions, every intent has a tag, pattern, response, context, and filter. The tag is analogous to a label used in text classification. Patterns are the responses that the user might provide. Patterns are used to train the model, responses is the bot response that it will provide once the tag is matched, and context is an auxiliary element that is used to distinguish between to different tags having similar patterns. The context set is used to set the context and filter is used to verify the context. Apart from this data we also have created a dictionary for our buttons. It consists of a context that is set and the patterns that is present in the actual database.

4.3 TEXTPROCESSING

One of the most frequently used exercises in ML applications is Text Processing. Retrieving Information, Extraction of Information, Question and Answering (Chatbot), Machine Translation are some examples of such applications. These applications process a great deal of text to perform classification and metamorphose text into something an algorithm can understand is a complex task. Here are the steps contained in TextPre-processing.

Step I: Tokenization — In this step it converts sentences to words.
Step II: In this step removal of needless punctuation and tags takesplace.
Step III: Removing stop words — I this step removal recurring words such as "the", "is", "on" etc. that do not have specific semantic takesplace.
Step IV: Stemming — In this step words are curtailed to a root by removing inflection through dropping unessential characters, usually a suffix.
Step V: Lemmatization — Another step or approach to eliminate inflection by regulating the part of speech and utilizing detailed database of the language.

Hence, stemming & lemmatization help alleviate words like 'looks', 'looking' to a common base form or root word 'look'. We can use NLTK and Beautiful soup for text pre- processing. In this project we have used NLTK Module. The Natural Language Toolkit is one of the most famous and frequently used NLP libraries, useful for all kinds of tasks such as tokenization, stemming, tagging, parsing, and beyond.

4.4 BAG-OF-WORDSMODEL

The model that we have used to modify data is **Bag-of- words Model**. In natural language processing and

information retrieval (IR) bag-of-words model is used for simplifying representation. In bag-of-words model, a text (like a sentence or a document) is illustrated as the bag (multiset) of its words, without taking into account of the grammar and even word order but keeping multiplicity [5]. Here, the major idea is to quantify each extracted key point into one of visual words, and then each image is represented by a histogram of the visual words. So, for generating the visual words generally a clustering algorithm (e.g., K-means) is used for this purpose. In the text corpus called vocabulary the list of unique words is made. In this method, we peek at the histogram of the words within the text, i.e. considering each word count as afeature.[5]

Example Implementation

1) Jordan likes to read. Max likes to read aswell.
2) Jordan is an excellent basketballplayer.

Each sentence gives out a list of words as follows
1.["Jordan","likes","to","read","Max","likes","to","read","as ", "well"]
2. ["Jordan","is","an","excellent","basketball","player"]

Representation of these bag of words as a JSON object is as follows,

BoW1 = {"Jordan": 1,"likes": 2,"to": 2,"read": 2,"Max": 1,"as": 1"well": 1}

BoW2 =   {"Jordan":   1,"is": 1,"an": 1,"excellent": 1,"basketball": 1,"player":1}

Data introduced for the first time into the neural network from the source is called the input. Its objective is to provide network data to form a choice or prediction on the knowledge that is introduced into it. In usual cases, the neural network model embraces real-valued inputs, which should be fed into a neuron in the input layer. Training sets are inputs for which you already know the correct outputs. This are commonly used to assist the neural network in training and memorizing the outcome for a given input set. Any neural network produces an output in the form of a forecast or judgement based on the data it receives. This result falls into the category of a set of real values or a set of Boolean decisions. The output value is produced by only of the neurons in the outputlayer.

The data that we have created will be used to train the neural network for text classification of the patterns. The data in the JSON file contains patterns. Patterns are the input from the user. The input is first passed through text pre-processing

and fed into the neural network to convert it into Binary Vectors. The user input is then matched with the patterns in the dataset using text classification to give appropriate bot response. For all unsuccessful bot responses, the bot asks the user to give the appropriate information, the bot absorbs the data and retrains to improve accuracy.

V. RESULT ANALYSIS

The final outcome of the process is as follows.

- The model of the mental healthcare chatbot was trained with 1000 epochs and achieved 74% of accuracy and loss of0.4
- Achieved the desired conversational flow.
- Achieved generation of response suggestions achieved.
- Successful implementation of gratitude journal and mood tracker.

Table.2. Result Analysis

Elements	Training Step: 10999	Training Step: 11000
Total Loss	0.45834	0.44431
Time	0.070s	0.077s
Epoch	1000	1000
Loss	0.45894	0.44431
Accuracy	0.7489	0.7490
Iteration	160/168	168/168

VI. LIMITATIONS

Making a bot completely based on ML and expecting it to be a human imitation is not yet achievable. The problem with such type of bots is that it will inevitably make a wrong decision. The technology is yet not that advance and achieving seamless conversations sounds unrealistic. Hopefully with the advancements in NLP the bot will be able to respond to ambiguity. Humans can feel whereas the bot cannot. Emotion is something very critical for the users of this bot and being able to identify these emotions is vital. Since it is a retrieval based chatbot it won't produce responses on its own and not able to identify user emotions. Lack of data makes it vulnerable to errors caused due to out of context questions.

VII. FUTURESCOPE

The chatbot will learn on its own by training on new unknown data and will frame responses on its own keeping in mind the emotion of the user. These emotionally accurate statements can be a game changer which we hope to achieve in future. Furthermore, the chatbot will be able to integrate with social media apps and speech recognition software.

VIII. CONCLUSION

The proposed Mental Health Chatbot uses a context-based response database to train and build a conversational model by using various deep learning techniques which can automatically respond to a user, similar to a human conversation. In the presented system we are missing features that can handle flow breaks for digressing conversations. Another area which requires focus in future is in-depth automatic updation of the intent database so that a chatbot with refined responses can be built.

IX. ACKNOWLEDGEMENT

REFERENCES

[1] Jianfeng Gao Microsoft Research jfgao@microsoft.com, Michel Galley Microsoft Researchmgalley @ microsoft.com, Lihong Li Google Brain lihong@google.com, "Neural Approaches to Conversational AI Question Answering, Task-Oriented Dialogues and Social Chatbots".

[2] Jack Cahn, Thesis Advisor: Dr. Boon Thau Loo, Engineering Advisor: Dr. Jean Gallier, "CHATBOT: Architecture, Design, &Development".

[3] Aishwarya Gupta Department of Computer Science Dayananda Sagar College of Engineering Bangalore, India, Divya Hathwar Department of Computer Science Dayananda Sagar College of Engineering Bangalore, India, Anupama Vijayakumar Assistant Professor Department of Computer Science Dayananda Sagar College of Engineering, "Introduction to AIChatbots".

[4] Fuzhen Zhuang, Zhiyuan Qi, Keyu Duan, Dongbo Xi, Yongchun Zhu, Hengshu Zhu, Senior Member, IEEE, Hui Xiong, Fellow, IEEE, and Qing He, "A Comprehensive survey on TransferLearning".

[5] M. Dahiya Dept. of Computer Science, Maharaja Surajmal Institute, Janakpuri, India, "A Tool of Conversation: Chatbot".

[6] AM Rahman, Abdullah Al Mamun, Alma Islam, "Programming challenges of Chatbot: Current and Future Prospective", IEEE1, International Islamic University Chittagong2".

[7] Mark J. Berger,Department of Computer Science,StanfordUniversity,Stanford, CA 94305, "Large

Scale Multi-label Text Classification with Semantic Word Vectors".

[8] Vaidyam, Aditya & Wisniewski, Hannah &Halamka, John & Keshavan, Matcheri&Torous, John. (2019). Chatbots and Conversational Agents in Mental Health: A Review of the Psychiatric Landscape. The Canadian Journal of Psychiatry.   64. 070674371982897.10.1177/0706743719828977.