

Chatbot for Monitoring Mental Health

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Abstract - Mental health indicates the degree of psychological prosperity. When a person faces an unbalanced mental health, it results in mental disorder. In India, the number of cases regarding the mental disorder is increasing every year, and there is a shortage in the mental healthcare professionals. In such situations, technologies like Artificial Intelligence helps to fill the gap. In recent days, many industries have started to adopt the chatbot for answering user's question with the help of chat interfaces. With the latest development in technologies, it has become easy to develop a chatbot application, but the application itself is a complex system. It is a challenge to achieve the efficiency, effectiveness and also to satisfy the users while developing a chatbot. Because of chatbot's popularity and user-friendly features, it has taken the place of humans. In this paper, we analyze the performance of the chatbot which will ask a series of question on the basis of Depression Anxiety Stress Scales (DASS), and take user to next level, which is recording answers to another set of questions, if necessary. Finally, the mental health of the user will be analyzed by the chatbot.

Key Words: chatbot, mental health, DASS, audio, video

1. INTRODUCTION

As indicated by the World Health Organization (WHO), emotional well-being or mental health is a prosperity state in which an individual can utilize his/her capacities, recuperate himself/herself from the day by day schedule pressure, be beneficial, and contribute to the society. Ten to fifteen percent of working age populace experience depression, with discouragement being one of the most common mental issue. India is very near to mental health epidemic. As per a review directed by the National Institute of Mental Health and Neurosciences expressed a general weighted pervasiveness for any grimness related to psychological wellness at 13.7%. The general treatment hole for mental disorder extended from 70% to 92% across different clutters [1]. According to the standards of developed nations, the perfect number of specialists, analysts, mental social laborers, and emotional wellness medical attendants is 1/10,000. Be that as it may, the present figures in India are as per the following: therapists – 0.2/100,000, clinicians – 0.03/100,000, mental social laborers – 0.03/100,000, and emotional well-being medical attendants – 0.05/100,000 populace [2]. Thinking about the lack of mental experts, it will take different creative strategies to connect this huge hole.

Artificial Intelligence gives the incomparable capacity to a computer, to impersonate the human perspective of thinking and behaving. Chatbots are nothing but such sort of computer programs that uses common dialects to interact with the clients. This innovation began in the 1960's to check whether the chatbot framework could trick users that they were real humans.

Considering the shortage in mental health professionals, number of innovative ideas have been considered to bridge the gap. Numerous digital interfaces have emerged as feasible alternatives for narrowing this gap and making psychiatric diagnosis and treatment accessible and affordable. The taint associated with the psychiatric disorders make people to not seek any help. Young adults or college students might hesitate or even the lack of time make it difficult to seek the treatment by a therapist or to fulfil their mental health needs. With the enhancement of Artificial Intelligence (AI), there's a drastic change in many fields which also includes psychiatry. AI has helped in developing many applications in the field of psychiatry that includes prediction of suicide and preventing it, identification of a particular drug which best suits a particular patient and many more.

A chatbot is an application which utilizes AI to initiate a conversation which can be done on different platforms, for example, messaging or voice chat. Few of the chatbots are completely automated while some utilize the human interface. Chatbots have already gained popularity in customer service. They can address the most elementary issues of customer 24X7 every single day, comparatively at a lesser cost when compared to a customer service agent. It's no big surprise Gartner predicts twenty-five percent of customer care and support operations will utilize some kind of chatbot by 2020. 2020 will likewise be the year, as per another predictions of Gartner, that eighty-five percent of all customer care interactions will be dealt by a chatbot. The chatbots have the ability to provide support, therapy and companionship which helps the therapist by reducing their burden. It appears as an option for individuals who have issue with affordability and accessibility both regarding time and distance. Nonetheless, a few concerns are being brought up in this issue. The foremost concern is privacy. Other concerns are monitoring, lack of standardization, overdependence on the bots and chances of missing severe mental issues.

2. Literature Review

Chatbot technology has been explored for quite a while, which was likewise utilized in numerous areas. The literature review of chatbot technology and its application are given as follows.

A. Types of chatbot.

A chatbot is an application which utilizes AI to initiate a conversation which can be done on different platforms, for example, messaging or voice chat. There are 2 kinds of the chatbot, i.e., Rule-Based chatbot and AI-Based chatbot.

Rule-based methodology is the best approach to create chatbot by determining conditions or rules to the chatbot. At the point when a client poses a few inquiries without giving any conditions, the chatbot won't comprehend that question. Therefore, this kind of chatbot isn't reasonable for the conversation application.

Artificial intelligence based or intent based methodology is the strategy based on the human capacity to learn by themselves and gather effective information. To do this, the chatbot is trained on the basis of natural language processing (NLP) using data sets, which are conversational dialogs, in order to extract the combination of conversation which includes context, intent and entity [3]. There are numerous cutting-edge devices that can be utilized for this purpose, for example, IBM Watson [4], Api.ai or Dialogflow and Wit.ai [5].

Generally, the premise of implementation chatbot requires templates that matches with the user's inputs and generate a suitable answer. Right now, there are numerous approaches to build a chatbot without coding which makes it easy, convenient and simple to develop a chatbot.

B. Related work

There are numerous works related to studying, developing and publishing about this topic. The popular idea for chatbot was introduced by Weizenbaum, which was called as Eliza [6]. This work portrayed conversation by utilizing regular language among human and machine, which is a feasible solution to build the chatbot.

Generally, to help people who have a psychological issue is performed through face to face meetings with specific mental health experts, typically psychologists and psychiatrists, in a frequency that can enhance as indicated by the assessment of the case, constantly from once every month to 3 times each week. Be that as it may, as there is increase in the quantity of individuals with some sort of mental issue, it is fundamental to confront the challenge of decreasing or, in any event, decelerating the growth of that number. One of the solutions proposed is the utilization of various patient assistance techniques provided through cell phones and applications. Such strategies can be utilized to

gather mental health data [7], to provoke people to react to questions concerning what they are doing (or have done) and what they are experiencing (or experienced) in their daily schedule [8], [9], to remotely perform intervention related to mental health [10], and to give access to mental health assets, for example, to initiate communication channels with mental health experts [11]. Such arrangements are developed in the context of the research area known as Mobile Health (mHealth) [12]

3. System Implementation

In this section, implementation process of the system is described. The system is divided into four modules, namely,

1. Chatbot module
2. DASS module
3. Emotion detection with webcam module
4. Speech to text module

3.1 Chatbot module.

Automated responses for a user's input can be easily generated using ChatterBot which is a Python library. ChatterBot utilizes few selected machine learning algorithms and produces various kind of responses. This makes it simple for developers to create chat bots which automate the conversations with user. The structure of ChatterBot is with the end goal that it permits the bot to be trained in numerous languages. On this, the algorithms of machine learning make it simpler for the bot to enhance on its own utilizing the input from the user.

The accuracy of the chatbot will be increased with the increased responses. The program chooses the nearest reaction that matches from the nearest identical statement which matches with the input, then it picks the response from a set of statements for that response.

The chatbot is developed using slack. The application should be used by the user once or twice in a week. He/she must answer some questions based on DASS (Depression Anxiety Stress Scale) which will be asked by the chatbot. Based on the DASS results, if required, the user uses the webcam and mic to record answers to another set of questions. Once the result from the video and mic is determined, the chatbot gives some suggestions based on their mental condition.

3.2 DASS Module

As per the general description of DASS, "The DASS is a set of three self-report scales intended to assess the negative states of mind of depression, tension and stress" [13]. The DASS was built not only as another set of scales to estimate mental states that are defined conventionally, but also to improve the process of understanding, defining and measuring the pervasive and clinically compelling mental states normally

expressed as anxiety, depression and stress. The DASS should subsequently meet the prerequisites of both scientist-professional clinicians and researchers.

The DASS contains 42-item self-report instrument intended to quantify the three related negative emotional conditions namely anxiety, tension/stress and depression. The DASS-21 has 21 items for people who are under time pressure. Then that score will be multiplied by two in order to compare the result with the standard DASS.

In this application, DASS-21 is implemented. Based on the score from DASS evaluation, mental state of the user like depression, anxiety and stress will be identified along with the levels like normal, mild, moderate, severe and extremely severe. Based on this result, the user will be taken to the next part of the application. If the DASS score is not normal, then the application will take the user to video module and the user is supposed to answer another set of questions based on his/her daily routine, work life and family life. Emotion of the user will be identified from the audio and video and finally a conclusion will be drawn about the mental health of the user.

Table-1: Depression Anxiety Stress Scale

Level	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely severe	28+	20+	34+

3.3 Emotion detection with webcam module.

Emotions play a crucial role in portraying a human’s state of mind that helps in identifying any emotional trait that could result in a long-term problem like depression, insomnia and anxiety and find the solution at the earliest. Thus, being able to assess the other person’s emotion or express and communicate one’s own feelings is very essential.

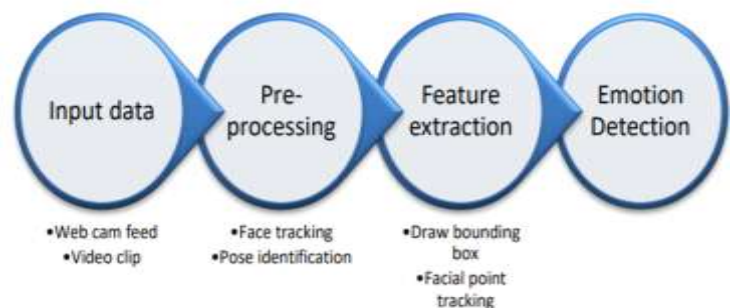
The current module recognizes human faces and their corresponding emotion from a digital image frame from a video source or webcam. The project is an implementation of machine learning based on the computer’s ability to train on given dataset and classify human emotions based on the employed dataset. We used OpenCV to pre-process the digital image. The emotions are complicated forms of human feelings. It is not easy to classify them into clear divisions, but there are a few that are broadly classified as – sadness, happiness, anger, disgust, fear and surprise. The module aims at being able to detect these emotions.

Steps in emotion detection module:

- It involves training the computer on the selected dataset, so that the computer learns the characteristics that determine a particular expression or emotion.
- It recognizes different objects and classifies and specifically selects only the human faces.
- The input is given frame by frame from a video or webcam feed.
- It then classifies human emotions based on the dataset and the characteristics that the program learns every time the project is executed.

To answer the questions asked by the chatbot, user make use of webcam and mic. Webcam record the expression of the user while he is answering the questions. The recorded video will be divided into frames of photos using OpenCV. Emotion of each photo will be determined which is then stored in an array. The most probable emotion will be considered as the final emotion of the video.

Figure 1: Architectural diagram of emotion recognition system



3.4 Speech to text module

Based on the result of DASS, the user is taken to video module. The video recorded is further divided into emotion recognition module and speech to text module. In Speech to text module, the audio recorded will be converted into text. There are few libraries and methods accessible in Python for recording audio. One such library is PyAudio. Since the OpenCV doesn’t record any audio, we need this library to record the answers of users.

Once the audio is recorded, it must be converted into text. Google Speech-to-Text allows developers to transform audio to text by applying robust neural network techniques with the help of an easy-to-use API. It processes both pre-recorded audio and real-time streaming using machine learning technology provided by Google. By using this API, the voice from the audio is converted into words. A dataset

of words which will be frequently used by the people with low mental stability will be considered. Then it will be compared with the converted words to check how many such words will the user use frequently while answering the question asked by the chatbot. Then by considering both the final emotion and the number of predefined words spoken by the user, the application determines the mental health of the user.

4. CONCLUSIONS

Mental health stability incorporates psychological, emotional and social prosperity of an individual.. It is important in every stage of life since it affects the way one thinks, feels and acts. It is considered as healthy to visit a therapist occasionally to keep a person's mental health stable. Many people suffer from mental illness, but fail to notice it, as they are too busy to visit a therapist. Chatbot for Monitoring Mental health is mainly developed to keep track of the mental health of the people. User can use this once or twice in a week, as per the user's requirement. Chatbot will first ask a set of questions based on DASS-21. The application then processes the answers and then take the user to the next level, where the user can record answers for another set of question regarding his/her daily routine, work-life and family using webcam and mic, if the DASS score is not normal. So, the developed chatbot can be used by anyone. It hardly takes 5-10 minutes to answer those questions, which will then be processed by the chatbot. If the user's mental health is severe or extremely severe based on the DASS score and results from video analysis, then the chatbot will suggest the user to visit a psychiatrist as soon as possible. If the result is mild or moderate, then the chatbot will suggest some activities to perform by the user to take care of his/her mental health. By using this, it saves time for the user and also helps user to keep track of their mental health.

REFERENCES

- [1] Gururaj G, Varghese M, Benegal V, Rao GN, Pathak K, Singh LK, et al. Bengaluru: National Institute of Mental Health and Neurosciences; 2016. National Mental Health Survey of India, 2015-16
- [2] Math SB, Gowda GS, Basavaraju V, Manjunatha N, Kumar CN, Enara A, et al. Cost estimation for the implementation of the mental healthcare act 2017. *Indian J Psychiatry*. 2019;61:S650-9
- [3] E. Pratt, "A Primer Artificial Intelligence and Chatbots in Technical Communication – A Primer," pp. 2-9, 2017.
- [4] Thomas Watson, "IBM WATSON," 2011. [Online]. Available: <https://www.ibm.com/watson/>. [Accessed: 20-Aug-2011].
- [5] wit.ai, "wit.ai," 2018. [Online]. Available: <https://wit.ai/>.
- [6] J. Weizenbaum, "ELIZA---a computer program for the study of natural language communication between man and machine," *Commun. ACM*, vol. 9, no. 1, pp. 36-45, 1966.
- [7] A. Rocha, M. R. Henriques, J. C. Lopes, R. Camacho, M. Klein, G. Modena, P. V. de Ven, E. McGovern, E. Tousset, T. Gauthier, and L. Warmerdam, "Ict4depression: Service oriented architecture applied to the treatment of depression," in 2012 25th IEEE International Symposium on Computer-Based Medical Systems (CBMS), June 2012, pp. 1-6.
- [8] A. S. Teles, A. Rocha, F. J. Silva, J. C. Lopes, D. OSullivan, P. V. d. Ven, and M. Endler, "Towards situation-aware mobile applications in mental health," in 2016 IEEE 29th International Symposium on ComputerBased Medical Systems (CBMS), 2016, pp. 349-354.
- [9] A. Soares Teles, A. Rocha, F. Jos da Silva e Silva, J. Correia Lopes, D. OSullivan, P. Van de Ven, and M. Endler, "Enriching mental health mobile assessment and intervention with situation awareness," *Sensors*, vol. 17, no. 1 - 127, 2017.
- [10] K. E. Heron and J. M. Smyth, "Ecological momentary interventions: Incorporating mobile technology into psychosocial and health behaviour treatments," *British Journal of Health Psychology*, vol. 15, no. 1, pp. 1- 39, 2010.
- [11] A. Teles, D. Pinheiro, J. Goncalves, R. Batista, F. Silva, V. Pinheiro, E. Haeusler, and M. Endler, "Mobilehealthnet: A middleware for mobile social networks in m-health," in *Proceedings of the 3rd International Conference on Wireless Mobile Communication and Healthcare*, ser. *MobiHealth '12*, 2012.
- [12] S. Kumar, W. Nilsen, M. Pavel, and M. Srivastava, "Mobile health: Revolutionizing healthcare through transdisciplinary research," *Computer*, vol. 46, no. 1, pp. 28-35, 2013.
- [13] Overview of the DASS and its uses. Available online : <http://www2.psy.unsw.edu.au/dass/over.htm>