

Detecting and Treating Depression with Automated Agent

Aditya Pingle¹, Sushilkumar Bhosale², Karan Vyas³, K. Jayamalini⁴

¹Student, Dept. of Computer Engineering, Shree L.R. Tiwari College of Engineering, Mumbai, India

²Student, Dept. of Computer Engineering, Shree L.R. Tiwari College of Engineering, Mumbai, India

³Student, Dept. of Computer Engineering, Shree L.R. Tiwari College of Engineering, Mumbai, India

⁴Professor, Dept. of Computer Engineering, Shree L.R. Tiwari College of Engineering, Mumbai, India

Abstract - Psychology professionals treat depression by asking questions on patient's day to day life and interpreting responses of their answers. In this project an automated depression-detection system is developed that models conversation between the system and an individual who does or does not have trouble with his mental health. For asking right questions, Inventory of Depression Symptomology – Self Report (IDS-SR) is used. The Android application developed in this project, monitors user for two weeks and detect signs of depression. Upon detecting signs of depression, the system provides quote, images, audios and videos to help the user with particular signs. The system uses an Artificial Neural Network (ANN) to provide proper YouTube videos from the problem user has spoken to the application. Speech-to-Text and Keywords extraction methodology is used for input to the ANN. The application also has feature of talking to the nearest medical professional via text or audio chat.

Key Words: depression, neural network, speech to text, keyword extraction, questions answering

1. INTRODUCTION

Depression is a mental health disorder characterized by persistently depressed mood or loss of interest in activities, causing significant impairment in daily life. According to the World Health Organization (WHO), mental health is a well-being state in which an individual is able to use his/her abilities, recover himself/herself from the daily routine stress, be productive, and contribute with the community. The term Mental Disorder is normally used to designate problems related to the mental health. Some examples of mental disorders are: humour disorders (e.g., depression), excessive anxiety and stress, disorders caused by drug and alcohol use (i.e., drugs addiction), personality disorders (e.g., bipolar), and delusional disorders. These mental disorders are interlaced and do not happen alone, that is, a problem normally happens associated with the presence of another one. For example, depression can come with excessive anxious and/or suicide thinking (a type of delusional disorder). Some numbers about depression are worrisome: depression already affects more than 300 million people in the world (from 2005 to 2015 that number grew 18,4%), and close to 800 thousand people die due to suicide every year, which is the second leading cause of death in people aged between 15 and 29 years[2]. Therefore, mental health problems have significantly reached a huge portion of the world population. Approximately 15.5% of the global

population is affected by mental illnesses, and those numbers are rising. Although there are many who require treatment, more than 50% of mental illnesses remain untreated. In the United States, one in five adults suffers from some form of mental illness. Every 40 seconds one person dies from suicide. There are indications that for each adult who died by suicide there may have 1 been more than 20 others attempting suicide[3]. The ramifications of this go beyond our families and cultures as mental health also has a tremendous economic impact for the cost of treatment as well as the loss of productivity[2]. Research has shown that these mental health conditions can be treated effectively. As scientists have disproved the stigmas surrounding mental health, more people have acknowledged the value of modern therapy. Insurance companies are now required to cover and treat mental health conditions[2]. Detecting and Treating Depression with Automated Agent is read and predict mood or emotion of any person by using survey/text, audio and video information which is taken when the user uses the app. This App gives mental support to depressed person where in that it will find all possible solution which is suitable for the user, which can be in the form of motivational video, motivational quotes and relaxing audio. From all possible solution this App should find the best possible solution which is useful and convenient to end users.

2. LITERATURE REVIEW

In paper "Detecting Depression with Audio/Text Sequence Modeling of Interviews"[4] published by Tuka Alhanai, Mohammad Ghassemi, James Glass utilized data of 142 individuals undergoing depression screening, and modeled the interactions with audio and text features in a Long-Short Term Memory (LSTM) neural network model to detect depression, results were comparable to methods that explicitly modeled the topics of the questions and answers which suggests that depression can be detected through sequential modeling of an interaction, with minimal information on the structure of the interview. Speech to Text Converter library will be used for text conversion.

In paper "Depression Detection using Emotion Artificial Intelligence"[5] published by Mandar Deshpande, Vignesh Rao aims to apply natural language processing on Twitter feeds for conducting emotion analysis focusing on depression. Individual tweets are classified as neutral or negative, based on a curated word-list to detect depression

tendencies. In the process of class prediction, support vector machine and Naive-Bayes classifier have been used. The results have been presented using the primary classification metrics including F1-score, accuracy and confusion matrix and speech to text convertor will be used and then Natural Language Processing will be applied for analyzing their emotions.

In paper “Monitoring system for potential users with depression using sentiment analysis”[6] published by Renata L. Rosa, Demóstenes Z. 7 Rodríguez, Gisele M. Schwartz, Ivana de Campos Ribeiro, Graça Bressan presents a monitoring solution for users with potential psychological disturbs, specially stress. The phrases extracted from social networks are filtered by mood and scored using a sentiment-analysis-metric that considers personal characteristics, such as gender and age. Sentiment analysis python library was used for the purpose of mood and mental condition analysis.

3. PROPOSED SYSTEM

Figure 1 depicts the system of the project. It consists of an Android App and a backend unit.

Using our android application the user will interact with the system. When the user creates account and login for the first time, the application will introduce itself and it will ask a set of general questions which are referred from ID-DSR survey questions. The response data will be analyzed and with the help of this data, symptoms and severity report will be prepared. The report will help to identify problem such as low energy, loss of joy, sadness, sleep disorder, feelings of guilt, suicidal ideation, concentration problems, loss of appetite, pessimism and low self-esteem faced by user. The report will be shown to the user after the ID-DSR survey. The application will also provide a media suggestion based on symptoms analyzed. The database consist of daily questions that the system will ask the user for 14 days. On a single day the questions are categorized in three parts that is morning, afternoon and evening questions. This will help in tracking the behavior of user for 14 days. If there is any sign of high depression or patient is thinking of suicidal thoughts then the app will immediately ask the user to contact a psychiatrist. All the response data is been collected from user for 14 days and a final report is generated based on processing and analyzing the data. Videos, audios and inspirational quotes are suggested to user based on the report generated. There is one more fragment where the user can say some sentences about his present feelings. The audio will be recorded by the application and using speech to text conversion the audio will be converted into text and send for processing. In backend keyword extraction will be done from that text and using Artificial Neural Network, media data will be suggested for the user. The media data will consist of motivational and symptoms related videos. Another fragment consist of chatbot system where the user can directly message depression related questions to psychiatrist. First the user need to send a request to a particular psychiatrist from mentioned list. Once the request is accepted the user can ask questions.

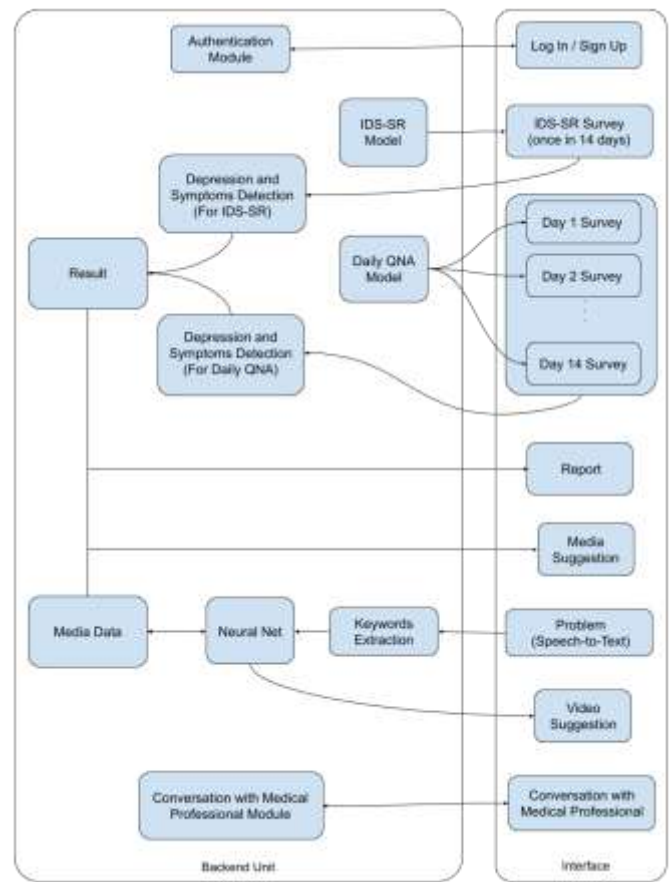


Fig. 1 Proposed System

4. METHODOLOGY

4.1. Detecting Depression and Symptoms using IDS-SR survey

For detecting depression we referred to the questions in IDS-SR[1]. We modelled those questions to get appropriate responses. Following are two documents of IDS-SR survey model. Here “value” property refers to the weight of the response user chooses for a respective question, “next” property refers to the order of the next question where -1 denotes next document of questions and property “iqid” refers to the document of actual IDS-SR question.

```
[{"_id": "5d9b76bd59b3c02d9c67528c",
  "order": "15",
  "type": "0",
  "message": "Let's talk about your mood in the past week.",
},
{
  "_id": "5d9ce57d72aca8aaa05d97c9",
  "order": "16",
  "type": "1",
  "iqid": "5d9c7968afeef9338498f483",
  "questions": [
    {
      "question": "Have you been feeling sad?",
      "options": [
        {
          "value": "0",
          "message": "No.",
        }
      ]
    }
  ]
}
```


id. Keywords column contained space separated keywords for each video.

Table -2: Neural net model specification

Layer	Output units	Activation function
Input layer	8	-
Hidden layer 1	16	Sigmoid
Hidden layer 2	16	Sigmoid
Output layer	Number of YouTube videos	Softmax

In the second part, we tokenized and stemmed each keyword and made a bag of words for all videos. We built a neural net with the model mentioned in table -2.

5. IMPLEMENTATION

We used MongoDB as our NoSQL database. We used Standard Development Kit with Android Studio for building Android Application. Python based framework Django was used for backend. For building and training model mentioned in Sec. 4.4, we used Tensorflow[8] library. The learning rate, epochs and batch size were 0.01, 600 and 2000 respectively. Adam optimizer with default parameters was used and categorical cross entropy was our loss function. Figure 2 shows model summary.

```

Model: "sequential"
Layer (type)           Output Shape           Param #
-----
dense (Dense)          (None, 8)              24168
dense_1 (Dense)        (None, 16)             144
dense_2 (Dense)        (None, 16)             272
dense_3 (Dense)        (None, 200)            3400
-----
Total params: 27,984
Trainable params: 27,984
Non-trainable params: 0
    
```

Fig. 2: Model Summary

6. RESULTS

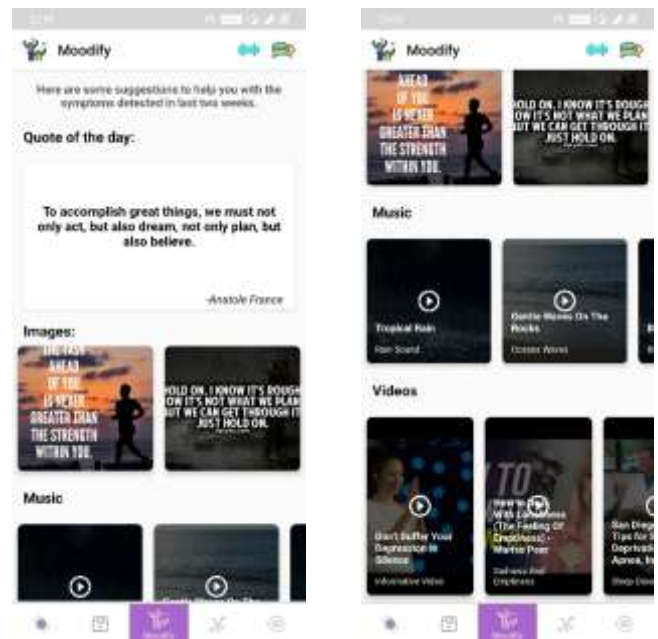


Fig. 3 Media Suggestion

We were able to monitor a user for two weeks and system was able to determine severity of depression and its symptoms. Depending on symptoms, system suggested media to use. Figure 3 shows media suggested by the application for the user.

After training the model mentioned in Sec. 5, we hit the accuracy of 0.94 with loss 0.5. Figure 4 shows epoch vs accuracy plot.

Figure 5 shows asking questions to user as an agent and the next image show a user talking to bot and getting video suggestions.

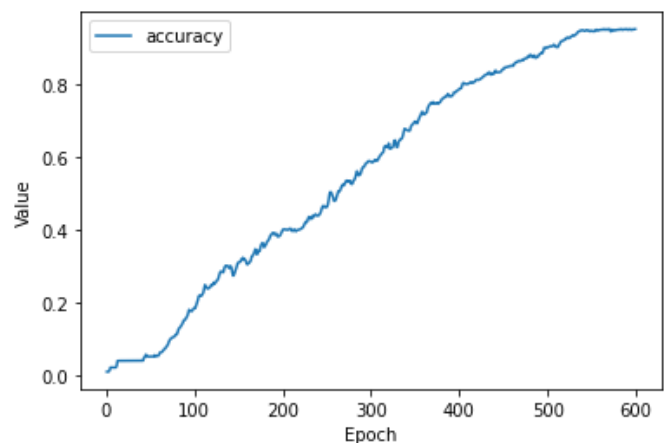


Fig. 4: Epoch vs Accuracy

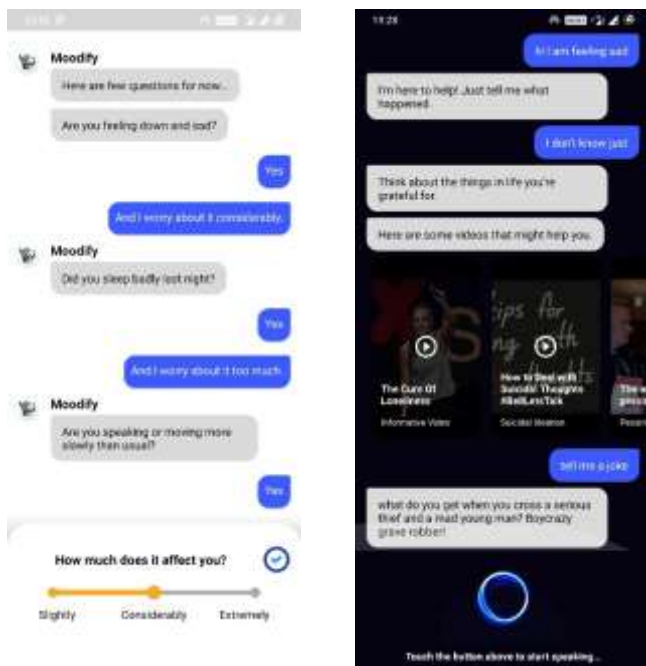


Fig. 5: QNA and Bot

7. CONCLUSIONS

IDS-SR survey asks all questions together once in two weeks and questions in QNA set are asked daily over 14 days. In this study we found that a user can test and monitor himself for his mood and depression by responding to the questions asked in the survey as well as daily QNA. Combined result of results of these two methods for two weeks can be viewed and showed to medical professional user is consulting to. A user can watch suggested videos or listen to audios suggested by the application which might be helpful to deal with particular severe symptoms. Also user can get video suggestion depending on the problem he's currently facing. For example, we tested "suicidal thoughts" as input to the neural net we trained and we got "How to Deal With Suicidal Thoughts: World Suicide Prevention Day"[10], "How I Coped with Suicidal Thoughts and Feelings"[11] and "When All Hope Is Lost Motivational Video!"[12] titled YouTube videos. If we cover wide array of problems causing depression and collect YouTube videos related to those, we could get much better results.

REFERENCES

- [1] IDS/QIDS. <http://www.ids-qids.org/>. (Mar. 2020)
- [2] Bernard Marr. The Incredible Ways Artificial Intelligence Is Now Used In Mental Health. <https://www.forbes.com/sites/bernardmarr/2019/05/03/the-incredible-ways-artificial-intelligence-is-now-used-in-mental-health/#2b19bb8dd02e>. (Mar. 2020)
- [3] WHO | Suicidal Data. https://www.who.int/mental_health/prevention/suicide/suicideprevent/en/. (Mar. 2020)
- [4] Tuka Alhanai, Mohammad Ghassemi and James Glass, "Detecting Depression with Audio/Text Sequence

Modeling of Interviews" Proc. Interspeech 2018, 1716-1720, DOI: 10.21437/Interspeech.2018-2522.

- [5] M. Deshpande and V. Rao, "Depression detection using emotion artificial intelligence," 2017 International Conference on Intelligent Sustainable Systems (ICISS), Palladam, 2017, pp. 858-862.
- [6] R. L. Rosa, D. Z. Rodríguez, G. M. Schwartz, I. de Campos Ribeiro and G. Bressan, "Monitoring system for potential users with depression using sentiment analysis," 2016 IEEE International Conference on Consumer Electronics (ICCE), Las Vegas, NV, 2016, pp. 381-382.
- [7] Jonas Depoix. youtube-transcript-api . PyPI. <https://pypi.org/project/youtube-transcript-api/>. (Mar. 2020)
- [8] Natural Language Understanding - IBM Cloud API Docs. <https://cloud.ibm.com/apidocs/natural-language-understanding/natural-language-understanding?code=python#keywords>. (Mar. 2020)
- [9] Tensorflow. <https://www.tensorflow.org/>. (Mar. 2020)
- [10] Mental Health with Sonali. How to Deal With Suicidal Thoughts: World Suicide Prevention Day. <https://www.youtube.com/watch?v=GprQaHx9Vyo>. (Mar. 2020)
- [11] Douglas Bloch. How I Coped with Suicidal Thoughts and Feelings. <https://www.youtube.com/watch?v=GJ58hvOIpp4>. (Mar. 2020)
- [12] Grow Successful. When All Hope Is Lost Motivational Video!. <https://www.youtube.com/watch?v=hfCSoSADI48>. (Mar. 2020)