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ARTIFICIAL INTELLIGENCE

CSE3013

PROJECT REPORT

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EMOTION DETECTOR AND COUNSELLOR CHATBOT

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ABSTRACT

This report comprises of an overview of the working of the project as well as the theories used in the successful running of it. A virtual human made using simple neural network learning and word vector (NLP Technique) will interact with the user. Using Cognitive Behavioral Therapy, the virtual human will advise the user and offer simple methods to improve the user's daily life. Further this code incorporates a popular algorithm of Sentiment analysis. Sentiment Analysis refers to the use of natural language processing, text analysis and computational linguistics to study the subjective states of the text presented. Using datasets freely available online, we can train models and then use Sentiment Analysis to find out if the user's response is positive, neutral or negative, and thus decide the virtual therapist's responses. Looking in to Cognitive Behaviour Theory. Cognitive behavioural therapy (CBT) is a type of psychotherapy in which negative patterns of thought about the self and the world are challenged in order to alter unwanted behaviour patterns or treat mood disorders such as depression. Using transcripts of therapy sessions, we can build the virtual human so that it can provide effective counselling.

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1. INTRODUCTION

Cyberbullying or cyber harassment is a form of bullying or harassment using electronic means. Cyberbullying and cyber harassment are also known as online bullying. It has become increasingly common, especially among teenagers, as the digital sphere has expanded and technology has advanced. Cyberbullying is when someone, typically a teenager, bullies or harasses others on the internet and in other digital spaces, particularly on social media sites. Harmful bullying behavior can include posting rumors, threats, sexual remarks, a victims' personal information, or pejorative labels (i.e. hate speech). Bullying or harassment can be identified by repeated behavior and an intent to harm. Victims of cyberbullying may experience lower self-esteem, increased suicidal ideation, and a variety of negative emotional responses including being scared, frustrated, angry, or depressed.

Teens often don't talk to their parents when things are bothering them.

Reason #1 – They don't want to overwhelm or worry you. Teens can be very intuitive, even when it seems like they aren't paying attention, and know when you're already at your limit. They don't want to add anything else to your plate, so they keep things inside or act them out in harmful ways.

Reason #2 – They don't want you to fix it. When your child was in elementary school, maybe it was okay for you to talk to their teacher or friend's parent. Now that they're in high school, no way! Not only do they think you can't fix it, but they don't want you fighting their battles.

Reason #3 – They don't want you to get mad. Teens know what kind of behavior you won't tolerate, and they don't want to be the ones to tell you they did something you won't like or agree with.

Reason #4 – You won't understand. That is the universal disconnect between parents and teens. You may even remember feeling that way about your parents.

Here, our application, can help teens to open up, and speak out about their daily distresses. Further in case of emergency situations (If according to the talk with virtual assistant the child seems suicidal), parents can be informed (This feature is to be added in later updates). The application can help prevent millions of teenage suicides and depression cases.

2. RELATED WORKS

In this paper [1], the authors propose Evebot, an innovative, sequence to sequence (Seq2seq) based, fully generative conversational system for the diagnosis of negative emotions and prevention of depression through positively suggestive responses. The system consists of an assembly of deep-learning based models, including Bi-LSTM based model for detecting negative emotions of users and obtaining psychological counselling related corpus for training the chatbot, anti-language sequence to sequence neural network, and maximum mutual information (MMI) model. As adolescents are reluctant to show their negative emotions in physical interaction, traditional methods of emotion analysis and comforting methods may not work. Therefore, this system puts emphasis on using virtual platform to detect signs of depression or anxiety, channel adolescents' stress and mood, and thus prevent the emergence of mental illness. They launched the integrated chatbot system onto an online platform for real-world campus applications. Through a one-month user study, they have observed better results in the increase in positivity than other public chatbots in the control group.

[2] The huge number of deaths caused by the novel pandemic COVID-19, which can affect anyone of any sex, age and socio-demographic status in the world, presents a serious threat for humanity and society. At this point, there are two types of citizens, those oblivious of this contagious disaster’s danger that could be one of the causes of its spread, and those who show erratic or even turbulent behavior since fear and anxiety invades our surroundings because of confinement and panic of being affected. In this paper, the authors aim at developing a smart ubiquitous chatbot, called COVID-Chatbot, for COVID-19 assistance during and after quarantine that communicates with a citizen to increase his/her consciousness towards the real danger of this outbreak. Furthermore, COVID-Chatbot is able to recognize and manage stress, during and after lockdown and quarantine period, using natural language processing (NLP). The robust messages delivered from COVID-Chatbot and its way of communication could possibly help to slow the COVID-19 spread. The proposed method is a ubiquitous healthcare service that is presented by its four interdependent modules: Information Understanding Module (IUM) in which the NLP is done, Data

Collector Module (DCM) that collect user's non-confidential information to be used later by the Action Generator Module (AGM) that generates the chatbots answers which are managed through its three submodules. And finally the Depression Detector Model (DDM) that detects anxiety in the text input through a deep learning sentiment analysis model to help AGM make the decision to deliver a reassurance message if a bad behavior is distinguished.

There are earlier studies for psychiatric counselling using chatbots. These studies [3] have not considered the user's emotional status and ethical judgment to provide interventions. This paper proposes an intelligent assistant for psychiatric counselling that understands dialogues using high-level features of natural language understanding, and multi-modal emotion recognition. A response generation model using machine learning provides suitable responses for clinical psychiatric counseling.

Some other related works include work on "Sentimental Analysis" in [4] and [5], "Cognitive Behavioral Theory" in [6] and [7], "Gensim Library" and "Word2vec Function" in [8] and [9].

3. DESIGN *DATASET PARSING*

1.6 million tweets from twitter, classified into positive (4) and negative (0), as the training data, of which 20% is used as cross-validation data. 494 tweets from twitter, classified into positive (4), neutral (2) and negative (0), as the test data. Labels adjusted to be in the range 0 to 1. Hashtags, website links and user references removed, then input tweets preprocessed by Gensim, with preprocessed tweets of length less than two removed. Vocabulary of words initialized with Gensim Dictionary and words replaced with respective position in the vocabulary plus one. Preprocessed tweets of length less than 20 were zero-padded to length 20. Those of length greater than 20 were split into tweets of length 20 and the last split part zero-padded, if necessary. Zero-padding done for supplying variable length sequences to the LSTM layer.

NEURAL NETWORK ARCHITECTURE

1. Embedding layer with zero-masking to output word vectors of 32 dimensions for each word in the vocabulary, and a zero vector for zero-padded words.
2. LSTM layer with 128-dimensional output.
3. Fully connected output layer with one neuron and sigmoid activation function.
4. Neural network uses binary cross-entropy loss function and the Adam optimizer with default parameters, but with Nesterov momentum

DECISION TREES USED FOR THE CHATBOT DIALOUGE FLOW

A **decision tree** is a decision support tool that uses a tree-like graph or model of decisions and their possible consequences, including chance event outcomes, resource costs, and utility. It is one way to display an algorithm that only contains conditional control statements.

A decision tree is a flowchart-like structure in which each internal node represents a “test” on

an attribute (e.g. whether a coin flip comes up heads or tails), each branch represents the outcome of the test, and each leaf node represents a class label (decision taken after computing all attributes). The paths from root to leaf represent classification rules.

Tree based learning algorithms are considered to be one of the best and mostly used supervised learning methods. Tree based methods empower predictive models with high accuracy, stability and ease of interpretation. In the dialogue flow, sentiment of the user is used as determining factor, and effective Cognitive Therapy is then applied, for users' maximum comfort.

4. SAMPLE CODE

The “predict” function predicts the sentiment score of each statement the user inputs.

```
def predict(text):
    preprocessed = [word[:-3] if word[-3:] == 'xxx' else word for word in
                    preprocess_string(text.lower().replace('not', 'notxxx'))]
    txt_list = [(vocab.token2id[word] + 1) for word in preprocessed
                if word in vocab.token2id.keys()]
    txt_list = [txt_list]
    max_tweet_len = 20
    if len(txt_list[0]) < max_tweet_len:
        for i in range(max_tweet_len - len(txt_list[0])):
            txt_list[0].append(0)
    elif len(txt_list[0]) > max_tweet_len:
        while len(txt_list[-1]) > max_tweet_len:
            txt_list.append(txt_list[-1][max_tweet_len:])
            txt_list[-2] = txt_list[-2][:max_tweet_len]
    prediction = 0
    for txt in txt_list:
        prediction += model.predict(np.array([txt]), batch_size=1)
    prediction /= len(txt_list)
    return prediction
```

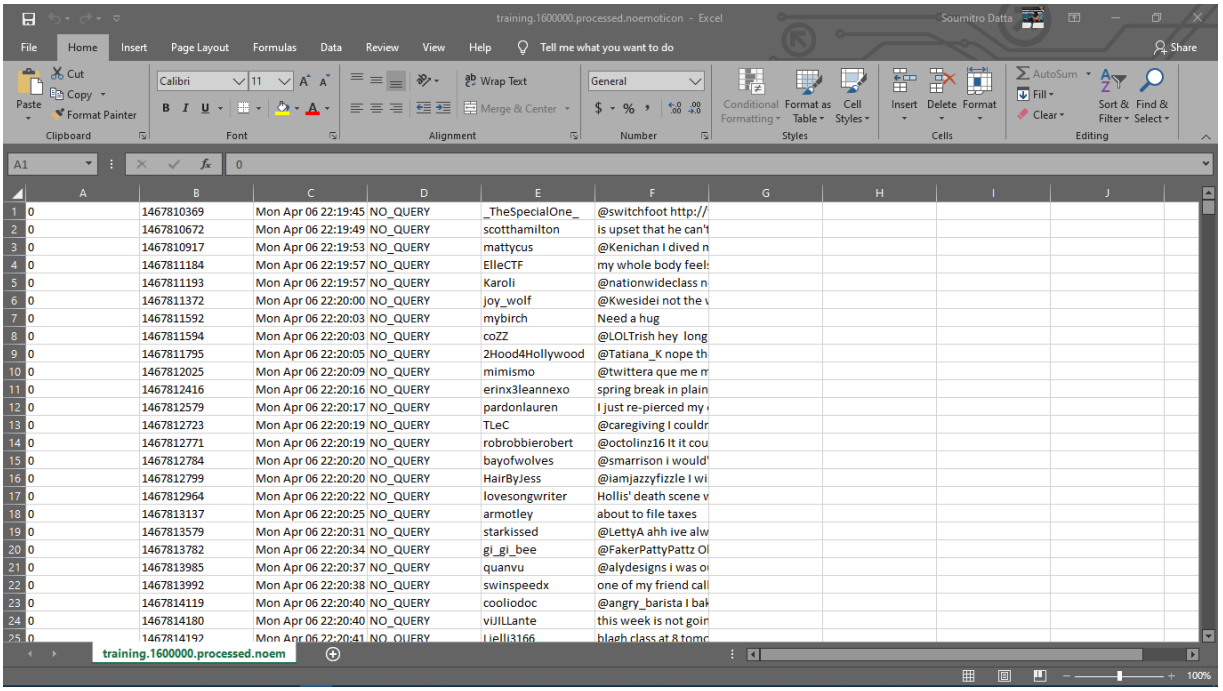
Decision Tree in dialogue is implemented line below:

```
name = name[0].upper() + name[1:]
print("Hi " + name + "! My name's Mia. Let's start with our session.")
print("Mia: How are you doing?\n")
response = input()
if (predict(response) >= 0.55):
    print('That is good. Are you usually this happy, or are there '\
                  'some worries that you want to talk about?\n')
    response = input()
    if (predict(response)>=0.7):

        response = input('You seem to be really content. Wanna sign off?\n')
        if(predict(response)>=0.7):
            print('Ok, bye ' + name + '!')
        else:
            response = input('Is there something bothering you? Would you '\
                             'share it with me?\n')
            if(predict(response)>=0.7):
                print("That's okay. It was nice talking to you. You can chat "\
                      "with me anytime you want.\n Bye" + name + "!")
            else:
                sad1()
    else:
        sad2()
else:
    sad3()
```

```
def create_word2vec(tweets):
    wv_model = Word2Vec(size=32, alpha=0.1, window=2, min_count=0, workers=8,
                        min_alpha=0.01)
    print "Created Word2Vec model\nBuilding vocabulary..."
    wv_model.build_vocab(tweets)
    print "Training..."
    wv_model.train(tweets, total_examples=wv_model.corpus_count, epochs=10)
    print "Trained"
    wv_model.save('model_word2vec')
    print "Model saved"
    return wv_model

def get_word2vec(tweets=None):
    if 'model_word2vec' in os.listdir('.'):
        response = raw_input('Word2Vec model found. Do you want to load it?'\
                             ' (Y/n): ')
        if response.lower() in ['n', 'no', 'nah', 'nono', 'nahi', 'nein']:
            if not tweets:
                tweets, labels = export()
                del labels
            return create_word2vec(tweets)
        else:
            print "Loading model..."
            wv_model = Word2Vec.load('./model_word2vec')
            print "Loaded model"
            return wv_model
    else:
        if not tweets:
            tweets, labels = export()
            del labels
```

Creation of word vectors and training of neural network happens by the code below:

5. THE DATA



1.6 M tweets were downloaded and stored as training data, further these were marked between 0-4. (0) where the tweet is negative and (4) where for the tweets that are positive. Tweet marked (2) are considered neutral, these tweets donot depict any positive or negative sentiments. Hashtags, website links and user references removed, then input tweets preprocessed by Gensim, with preprocessed tweets of length less than two removed. Vocabulary of words initialized with Gensim Dictionary and words replaced with respective position in the vocabulary plus one. Preprocessed tweets of length less than 20 were zero-padded to length 20. Those of length greater than 20 were split into tweets of length 20 and the last split part zero-padded, if necessary. Zero-padding done for supplying variable length sequences to the LSTM layer.

6. CONCLUSION AND FUTURE WORK

Over 450 million people are currently affected by mental or neurological disorders and it is estimated that one in four people will be affected by such conditions in the coming years. With the rapid advancement in technology and its application in the medical field, researchers and medical practitioners are now looking at ways in which artificial intelligence and machine learning can be leveraged to detect early symptoms and potential cure for various mental illnesses. Over the years, considerable advancements have been made in this regard and AI-powered solutions such as NLP and even chatbots have been designed to understand the human mind. We look at ways in which these solutions are helping psychiatrists and other mental health professionals deliver their job better and the potential harm associated with these technologies.

As the gap between the availability of mental health professionals and the cost of each therapy session keeps increasing, the demand for digitised healthcare solutions has increased steadfastly. Even in their low point, more and more people are picking app experience over the real therapy session. This project in later stages may prove to be a very useful tool in this case.

7. REFERENCES

[1] Yin, J., Chen, Z., Zhou, K., & Yu, C. (2019). A deep learning based chatbot for campus psychological therapy. arXiv preprint arXiv:1910.06707.

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