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Chatbot in Artificial Intelligence

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Abstract: ***This paper discloses a virtual conversational method and system to relieve the psychological stress of adolescents. It also aims at providing some positive information through continuous dialogue answers in order to guide adolescents to think and face difficulties with a positive and optimistic attitude and the agenda of reliving the psychological pressure of the adolescents can be achieved. Conventional face-to-face stress detection and relief methods do not work when confronted with those adolescents who are reluctant to express their negative emotions to the people in real life. In this paper, we would like to present an adolescent- oriented intelligent conversational chatting system called "HappySoul", which acts as a virtual friend who can assist to encourage, understand, comfort, and guide stressful adolescents to pour out their bad and negative feelings, thereby releasing the stress. Chatbots, or conversational interfaces, present a new way for adolescents to interact with computer systems. This chatbot will allow a user to simply ask questions in the same way that they would address a human. The technology at the core of the proposed chatbot is natural language processing ("NLP"), RNN and client server architecture with the help of Android GUI.***

Keywords: Chatbot, NLP, RNN, stress, conversation, adolescents, students

I. INTRODUCTION

Chat bots or Virtual Assistants have been designed to simplify the interaction between computers and humans and have hit the market. A chat bot is a software that uses artificial intelligence (AI) that can converse (or chat) with a user in natural language via virtual chat rooms, websites, mobile apps and messaging applications or through the telephone. Chatbots are often referred to as one of the most promising and advanced form of interaction between machines and humans. Although, from a technological perspective, a chatbot can only represent the evolution of a Question Answering system based on Natural Language Processing (NLP). Generating responses to user queries in human like natural language is one of the most common examples of Natural Language Processing leveraging in various enterprises' end-use applications. Chatbot applications slick interactions between services and people, improving customer experience. Simultaneously, chatbots offer companies various opportunities to enhance the customer's loyalty and ensure operational efficiency by minimizing the surplus cost of customer service. Chatbot solutions have to effectively perform both of the tasks for successful execution. Human support plays a vital role here:

Irrespective of the kind of approach and the platform, human intervention plays a crucial role in training, optimising and configuring the chatbot system. There are two different tasks which form the basis of a chatbot:

1) *User Request Analysis:* This is the primary task that a chatbot performs. In this task, it analyses the user's request and identifies the user intent in order to extract relevant entities.
   This ability of identifying the user's intent and extracting data and relevant entities present in the user's request is the first and basic condition and the most crucial step at the core of a chatbot: If you fail to correctly acknowledge the user's request, you will fail to provide the correct answer.
2) *Returning the Response:* First the user's intent is identified and once that is done, the chatbot can provide the most appropriate response for the user's query. The answer can be:

- A predefined and generic text.
- A text retrieved from a knowledge database containing different answers.
- A contextualized piece of information that is user data oriented.
- Data which is stored in enterprise systems.
- The result of an action that the chatbot has performed by interacting with backend applications.

A render question helps the chatbot to correctly understand the user's request. Chatbot can be developed by the use of different approaches and tools. Depending on the application you want to address, some specific chat bot technologies are more suitable than others. In order to achieve the desired responses, the fusion of different AI forms such as machine learning, semantic understanding, and natural language processing may be the best option.

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A. Motivation

Chatbots play a key role as human- computer interfaces. It's a software that simulates typed conversation, with the agenda of temporarily luring the human into thinking they were talking to another human. Chatbot, basically acts as a conversational agent that can talk to any user in given field using the Natural Language Processing.

According to World Health Organization (WHO), stress is the major cause of mental disorder throughout the world, posing threats to over 300 million each year globally. With a rapid increase in the need for additional assistance, the bot aims to create an environment that is less automated and more conversational. Thus to overcome this stress, the chatbot provides insights and provides positive responses through cognitive- behavioural therapy.

B. Literature Survey

1) *Endurance:* A Companion for Dementia Patients : Many people suffering with dementia retain much of their conversational abilities as their illness progresses. However, the shame and frustration that many dementia sufferers experience often make routine, everyday talks with even close family members challenging. That's why Russian technology company Endurance developed its companion chat bot. Many people with Alzheimer's disease struggle with short-term memory loss. As such, the chatbot aims to identify deviations in conversational branches that may indicate a problem with immediate recollection – quite an ambitious technical challenge for an NLP-based system. In addition, since the chatbot is a cloud- based solution, physicians and family members can review communication logs taken from the bot to identify potential degradation of memory function and communicative obstacles that could signify deterioration of the patient's condition. Interestingly, the as-yet unnamed conversational agent is currently an open- source project, meaning that anyone can contribute to the development of the bot's codebase. The project is still in its earlier stages, but has great potential to help scientists, researchers, and care teams better understand how Alzheimer's disease affects the brain. A Russian version of the bot is already available, and an English version is expected at some point this year.
2) *Casper:* Helping Insomniacs Get through the Night: If you suffer from insomnia, you'll know that the feeling of almost suffocating loneliness – the idea that everyone else in the world is resting peacefully while your own mind betrays you with worries and doubts – is among the worst parts of not being able to sleep. Enter Casper's amazingly named Insomnobot 3000 (which truly is one of the most tongue- incheek, retro-futuristic names for a chatbot I've ever come across), a conversational agent that aims to give insomniacs someone to talk to while the rest of the world rests easy. At this point, Insomnobot 3000 is a little rudimentary. The responses offered by the agent aren't quite right. But I'm not sure whether chatting with a bot would help me sleep, but at least it'd stop me from scrolling through the never-ending horrors of my Twitter timeline at 4 a.m.
3) *UNICEF:* Helping Marginalized Communities Be Heard : So far, with the exception of Endurance's dementia companion bot, the chatbots we've looked at have mostly been little more than cool novelties. International child advocacy nonprofit UNICEF, however, is using chatbots to help people living in developing nations speak out about the most urgent needs in their communities. The bot, called U-Report, focuses on large- scale data gathering via polls – this isn't a bot for the talkative. U-Report regularly sends out prepared polls on a range of urgent social issues, and users (known as "U- Reporters") can respond with their input. UNICEF then uses this feedback as the basis for potential policy recommendations. In one particularly striking example of how this rather limited bot has made a major impact, U- Report sent a poll to users in Liberia about whether teachers were coercing students into sex in exchange for better grades. Approximately 86% of the 13,000 Liberian children U-Report polled responded that their teachers were engaged in this despicable practice, which resulted in a collaborative project between UNICEF and Liberia's Minister of Education to put an end to it.
4) *Med What:* Making Medical Diagnoses Faster : If you're the kind of person who has WebMD bookmarked, it might be worth checking out Med What.

   This chatbot aims to make medical diagnoses faster, easier, and more transparent for both patients and physicians – think of it like an intelligent version of WebMD that you can talk to. MedWhat is powered by a sophisticated machine learning system that offers increasingly accurate responses to user questions based on behaviours that it "learns" by interacting with human beings.

   In addition to the ever- growing range of medical questions fielded by MedWhat, the bot also draws upon vast volumes of medical research and peer-reviewed scientific papers to expand upon its already considerable wealth of medical expertise. In many ways, MedWhat is much closer to a virtual assistant (like Google Now) rather than a conversational agent. It also represents an exciting field of chatbot development that pairs intelligent NLP systems with machine learning technology to offer users an accurate and responsive experience.

5) *ALICE:* The Bot That Launched a Thousand… Other Bots : No list of innovative Chatbots would be complete without mentioning ALICE, one of the very first bots to go online – and one that's held up incredibly well despite being developed and launched more than 20 years ago. ALICE – which stands for Artificial Linguistic Internet Computer Entity, an acronym that could have been lifted straight out of an episode of The X- Files – was developed and launched by creator Dr. Richard Wallace way back in the dark days of the early Internet in 1995. (As you can see in the image above, the website's aesthetic remains virtually unchanged since that time, a powerful reminder of how far web design has come.) Despite the fact that ALICE relies on such an old codebase, the bot offers users a remarkably accurate conversational experience. Of course, no bot is perfect, especially one that's old enough to legally drink in the U.S. if only it had a physical form. ALICE, like many contemporary bots, struggles with the nuances of some questions and returns a mixture of inadvertently postmodern answers and statements that suggest ALICE has greater selfawareness for which we might give the agent credit. For all its drawbacks, none of today's chatbots would have been possible without the groundbreaking work of Dr. Wallace. Also, Wallace's bot served as the inspiration for the companion operating system in Spike Jonze's 2013 science- fiction romance movie, Her.

II. PROPOSED METHODOLOGY

The proposed model of our chatbot works as a client server based android application. An android mobile application will be used to serve as the front end and the bot will learn to respond on the server.

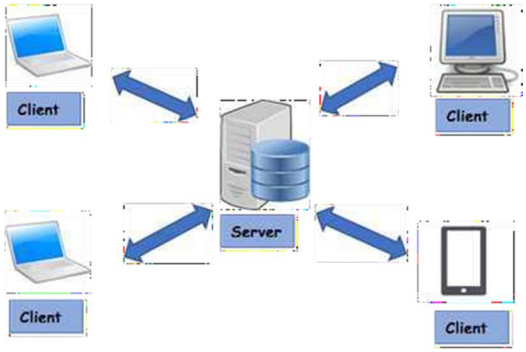


Fig. 1 Client Server Architecture

A. Android Application

Our android application will aim at getting the inputs from the user and displaying the generated output. The user will have to signup if he/she doesn't have any login credentials or else he/she will navigate to login page. The details would consist of the name of the user, its contact number and email address. The bot will use the name provided to address him/her during the conversation. For security and authentication reasons contact number and email address will be used.



Fig. 2 Chat Screen

Above is the example of the android application that is intended to be built. The bot will be responding in the similar fashion based on the mood of the user. On successful login, a chat window will appear. A greeting message will be displayed from the bot's side to indicate that it is active. The user can then enjoy talking to this virtual companion.

B. Server

The real processing of data takes place on the server. The inputs that is taken from the user is sent to the server for processing using the Recurrent Neural Network (RNN) and the output is generated. A Recurrent Neural Network is a deep learning model specifically used to handle the sequences. The responsibility of an internal state is to take into consideration and proper handling of dependency between successive inputs. Provided that its properties are given, this model is most suitable for different NLP tasks, and exactly in the text generation context it can be explored using basic concepts of Tensorflow and Theano and then moving to Keras for training the final model. For our chatbot, a sequence to sequence (Seq2Seq) model of RNN will be used. Sequence to sequence (Seq2Seq) model consists of 2 main components, an encoder RNN and a decoder RNN. The encoder's task is to encapsulate the information of the input text into a fixed representation. The decoder's task is to take that representation, and generate a variable length text that best responds to it.

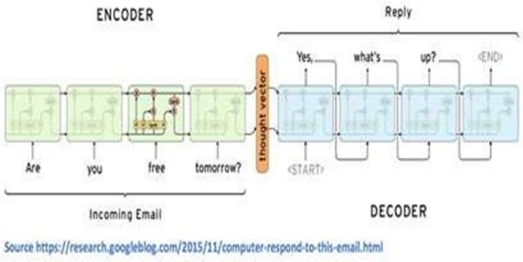


Fig.3 Encoder and Decoder

RNN contains many hidden state vectors, wherein each represent information from the previous time steps. The final hidden state vector of the RNN encoder can be considered as an accurate representation of the whole input text, by this logic. The another RNN that is the decoder, takes in the final hidden state vector of the encoder, to predict the words of output reply. The first cell's job is to take in the vector representation v, and decide which word in its vocabulary is the most appropriate for the output response. The second cell will be a function of the vector representation v and the output of the previous cell both.

$$p(y_1,\ldots,y_{T'}|x_1,\ldots,x_T) = \prod_{t=1}^{T'} p(y_t|v,y_1,\ldots,y_{t-1})$$

$Y_0,\ldots,Y_{T'}$ = Output Sequence
$X_0,\ldots,X_T$ = Input Sequence
v = Vector Representation

Fig.4 Vector Representation

Tensor flow will be helpful in doing it. We need a large number of conversation logs for sequence to sequence models. This encoder decoder network must be able to understand the type of responses (decoder outputs) that are expected for every query (encoder inputs). Some common datasets are the the Ubuntu corpus, Microsoft's Social Media Conversation Corpus, and Cornell Movie Dialog Corpus.

C. Architecture Diagram

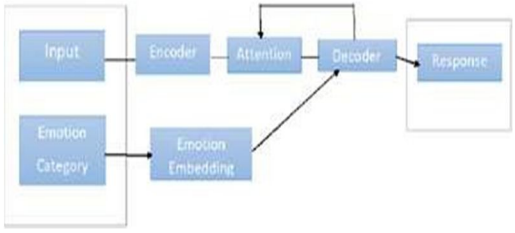


Fig5. Architecture Diagram

The basic structure of chatbot is very similar with a sequence to sequence model. The architecture consists of Recurrent neural network of GRU cells with attention mechanism. But it contains three different mechanisms which can be used for generating response with specific emotion. The following are the characteristics of the system :

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1) Emotion Category Embedding: Representing different emotion category as an embedded vector. This vector will be learned during training by being feed to the decoder. The emotion embed remains static and would not change in the flow.
2) The architecture is a regular end to end sequence model, where the GRU is been used to be the basic cell and based on that we build our decoder using Recurrent Neural Network.
3) We build our encoder using bi-directional LSTM and concatenate the cell state and hidden state to be the input of decoder.
4) The attention mechanism is also integrated to our system. Attention mechanism is the technique where in we extract the essential characteristics of the sentences.
5) Gated Recurrent Unit (GRU) aims to solve the vanishing gradient problem which comes with a standard recurrent neural network. It can also be considered as a variation on the LSTM because both are designed similarly and, in some cases, produce equally.

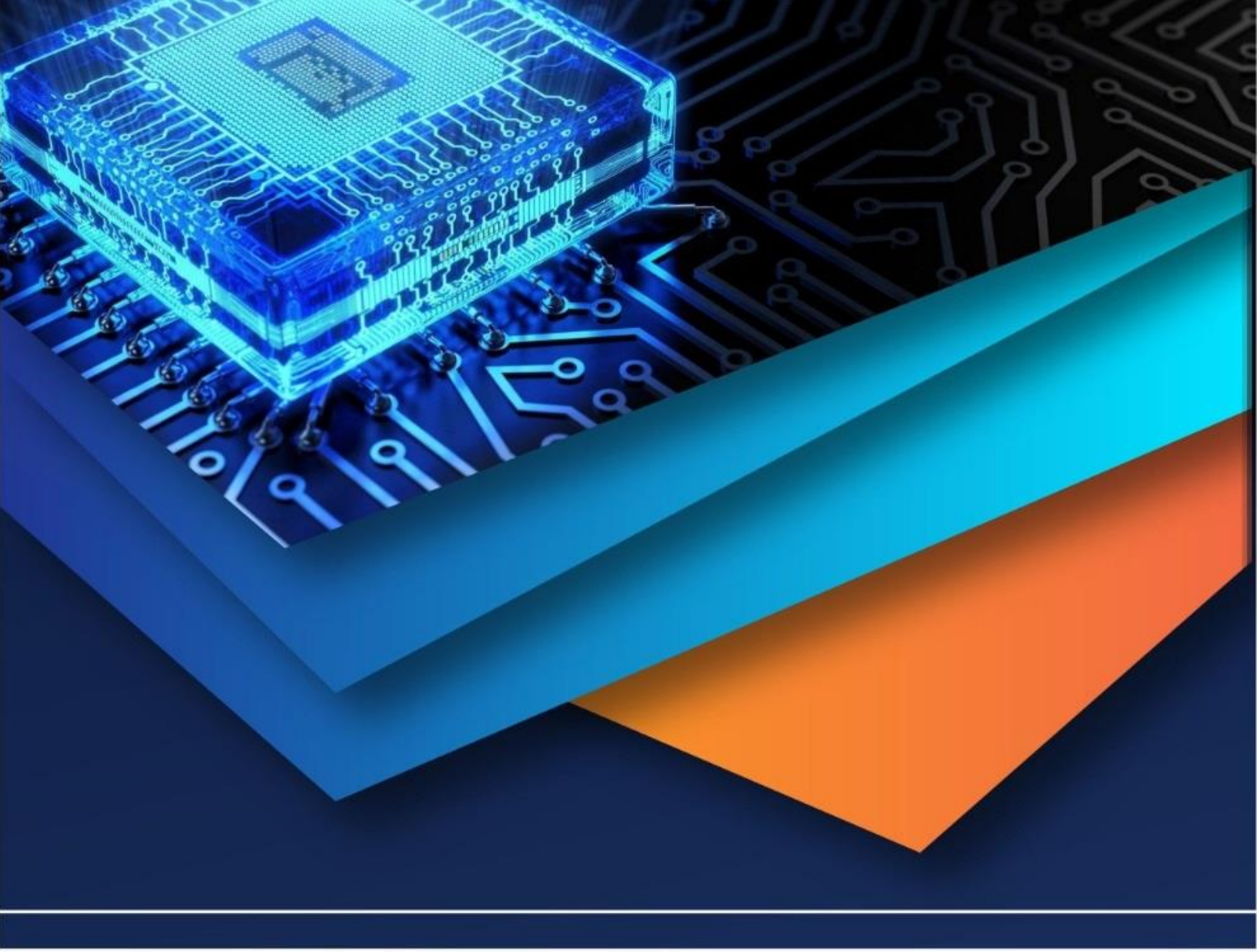
III. CONCLUSION

Chatbots have been on the rise since a couple of years and have already faced a wide adoption. They are bringing a new way for businesses to communicate with the world and most importantly with their customers and with the rise of emerging technologies and Artificial Intelligence (AI). Proving their usability in the field of customer support, the chatbots can also be extended to help users mentally like a companion. Our chatbot, HappySoul, is one such approach. It helps the adolescent users to talk freely about their mental conditions without being hesitant about it. It proves to be a great help towards society as mental health is a topic of grave concern especially in the youngsters. The future scope of this project would involve analyzing the different kinds of emotional disturbances faced by the teenagers and their causes. This would help to evolve happier generations. The concept of RNN can be used for implementation of a conversational chat bot.

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