ELEKX - Adding Mental Health Perspective to a Chatbot

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Abstract.

Typically, mental health professionals such as therapists treat mental disorders. Nevertheless, there is a universal human resource shortfall to provide such mental health services. Because of the scarcity and cost concerns, the Artificial Intelligence (AI) industry has taken matters into their own hands. The development of AI systems capable of producing human- like responses is currently a very popular research domain. Creating a virtual psychotherapist AI is one step closer to realizing the dream of human-like bot. In this work, a metal health bot for responding to users via text, i.e., a chatbot named "ELEKX" is proposed. The name Elekx is derived from the Greek word Elex which means man's defender or warrior. This chatbot allows patients to converse in the language they are most comfortable with from anywhere. This chatbot has been built using dialog flow to understand the mental health of a patient and engage them in a conversation by understanding their problems, suggesting remedies and seeking to lower their anxiety, stress and depression. The developed chatbot ELEKX is capable of aiding users in their day-to-day affairs and detecting any signs of negative change in mental health, and, if required, for alerting the concerned healthcare workers and immediate family members. Elekx is having an omnichannel messaging support and it provides sentimental analysis to our conversation.

Keywords. Artificial Intelligence, Assistance, Design-Based Research, Emotional Health, Values.

1. INTRODUCTION

A chatbot is a computer programme that communicates with people in real time utilising verbal medium, textual, facial, and bodily language [1]. Chatbot is also known as chatterbot, dialogue system, virtual agent, machine conversation system, and Conversational User Interface (CUI). A chatbot's basic goal is mimicking of a human conversation. Chatbots are generally driven by text, along with pictures and integrated widgets, thereby making it easier to initiate a conversation with a bot. Intelligent chatbots employ Artificial Intelligence (AI) for comprehending the purpose and circumstance of a user text and replying back. Un-intelligent or rule based chatbots produce a conversation based on certain established rules such as decision trees [2]. Over the past few years, chatbot usage in health care has increased. Chatbots for healthcare are popular for supporting the patients, their families, and the health care workers [3] by offering specialised cognition, therapeutic aid, and behavioural changes (such as Wysa, that offers cognitive behaviour therapy) [4], or assistance with disease management (such as Babylon Health, which offers digital health consults) [5].

Pharmacotherapy or psychotherapy are typically used to address mental health issues [6]. The demand for mental health experts, however, is greater than the supply in many countries.

According to global estimates, there are nine psychiatrists available for every 100,000 individuals in rich nations [7] and one psychiatrist for every 10,000,000 individuals in underdeveloped nations [8]. The WHO estimates that roughly 45% of individuals in industrialised nations and 15% of individuals in developing nations bear accession to mental health care [9]. When individuals with mental health illnesses are not treated, suicide thoughts and fatality rates might rise [10].

The chatbots are generally comprised of four primary modules: a text interpreting module, a conversation manager, a response generation module, and, a database which stores many kinds of data required for the training and operation of chatbot. A chatbot architecture and the connections among its constituents is shown in Figure 1. There are still technological restrictions even if AI can realise and aid in the creation of chatbots. The inability of current systems to recall earlier talks might result in improper answers [12]. To solve this problem, information about the patient's mental state must be gathered and preserved for further encounters with chatbot. Due to a lackof understanding or emotional intelligence, a chatbot reply may frustrate or be insufficient for a user [12]. Existing mental health chatbots have general abilities, a tendency to repeat themselves, and interactions that frequently resemble those found in self-help books [13].

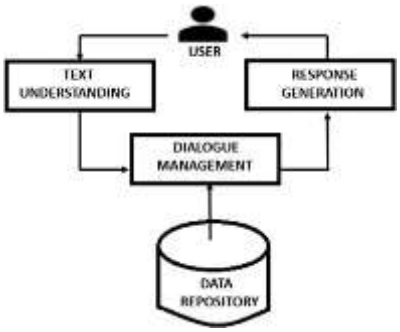

Figure 1. Chatbot architecture [11]

The problem here is that the technological constraints of the created mental health chatbots are not thoroughly studied in the present research. Evaluations primarily rate user experience and usefulness [14, 15]. The app stores are filled with mental health chatbots, but many of them lack evidence-based practises or, at the very least, do not have practises that are supported by pertinent research [16]. Mental health chatbots should rely on clinical data in order to be trustworthy and useful, which means integrating therapeutic procedures that are already in use in clinical practise and have proven helpful. Additionally, there is less research regarding the therapeutic value of mental health chatbots [16, 17]. Chatbots must maintain the privacy and confidentiality of user data regarding their mental health due to the sensitivity of such information [18]. Contrary to doctor-patient interactions, where patient privacy and confidentiality are guaranteed, chatbots frequently overlook these factors. Users

cannot interact anonymously with the majority of chatbots, notably those found on social networking networks [18].

2. BACKGROUND

A technique for putting word segmentation into practise was described by Mohammed Javed et al. in [19]. This algorithm's authors suggested calculating the character spaces within the sentences. All different kinds of gaps between characters should be included in the character spacing. They consist of word gaps, punctuation, and letter gaps. The method is based on the quantity of blank space or characters between each sentence unit. To get the mean average between the characters in the sentence, the character spacing are first computed [20].

People have used a variety of design and development methods for chatbots ever since they were first developed. Modern approaches for dialogue creation and management are more and more utilising machine and deep learning techniques [20–22]. This is due to the growing acceptance of machine learning and artificial intelligence techniques in a variety of applications. For people who have a little psychological disability, there is a smartphone application called SERMO [23]. It helps emotional control and uses techniques from Cognitive Behaviour Therapy (CBT). The programme is a conversational agent that prompts users to submit their feelings and ideas about commonplace occurrences that are established on Albert Ellis' theory of situation, emotions and thoughts. The theory takes the stance that inputs are assessed, whether intentionally or unintentionally, and that these assessments result in certain emotions and actions [24]. For people who feel embarrassed in revealing their mental health difficulties to a health care practitioner owing to stigmatisation, chatbots are also appropriate for offering mental health therapy. Lucas and colleagues found that veterans who used a chatbot revealed greater Post-Traumatic Stress Disorder (PTSD) symptoms than those who used anonymised or non-anonymised variants of a self-administered questionnaire [25]. Because they lack the high-quality human engagement that face-to-face interactions with health care professionals give, most computerised therapies are characterised by higher dropout rates as well as low adherence, even if they can be successful in ameliorating mental health [25, 26]. Through their intuitive, human-like, and enjoyable user interactions, chatbots can develop into a potential replacement for those treatments and increase users' adherence [27]. The fact that AI algorithms are often trained with massive data sets presents another significant challenge for the creation of chatbots for mental health. Another issue is that training with data of other fields can inject information into the system which could increase the risks of patient damage. Other methods that use lesser data for training or employ transfer learning are being developed. Furthermore, when the training data are poorly sampled or data are unavailable for particular sub-groups, trained models might become biased towards specific demographic groupings. The problem here is that the technological constraints of the created mental health chatbots are not well studied in the existing research [28, 29]. Evaluations primarily rate user experience and usability [28, 29].

Chatbots can't communicate human emotions or attend to all of a patient's demands. They could be useful for less difficult activities like data gathering or administrative and organisational chores, but whenever in-depth patient knowledge is required, they may falter [29]. It is necessary to improve their capacity to comprehend user input and respond properly. The accuracy of identifying emergency situations and developing a suitable

response after an emergency situation has been identified is a significant difficulty. Another unresolved issue is the customization or personalization of chatbots for specific users [30]. A number of patients, doctors, insurance companies, researchers, tech firms, and programme officials from the US National Institute of Mental Health established a unanimous statement on requirements for mental health mobile apps [31].

3. ELEKX - THE PROPOSED CHATBOT

The following are some advantages of the proposed ELEKX:

● With the help of ELEKX, users will be easily able to deal with day-to-day stress, depression, and anxiety.

● The user's data and progress about the user's mental health conditions will be stored and analysed.

● The user's mood can be enhanced and cheered up using a positive approach, humour, and CBT (Cognitive Behavioural Therapy).

● CBT will be used in the form of suggestions to help users lessen the effects of daily stress, depression, and various other mental health problems.

4. EXPERIMENTAL SETUP

For the implementation of ELEKX, Google Colaboratory online platform has been used here. Google Colaboratory, which is particularly well suited to machine learning, data analysis, and teaching, enables anybody to develop and run arbitrary Python code through the web. The dataset is then downloaded from Kaggle's Mental

Health FAQ [32]. This data set comprises of 98 questions and answers regarding mental health. There are three columns in it: Question ID, Questions, and Answers. Since NLP (Natural Language Processing) enables chatbots to learn and imitate the patterns and styles of human speech, ELEKX uses NLP. It links user input to an intent in order to categorise the message for the best potential predetermined response For this model, regularization is employed to control the model complexity which will make our model prone to overfitting, and the best model is retained for final comparisons based on training and validation accuracy and loss. We have used dropout regularization in our chatbot.

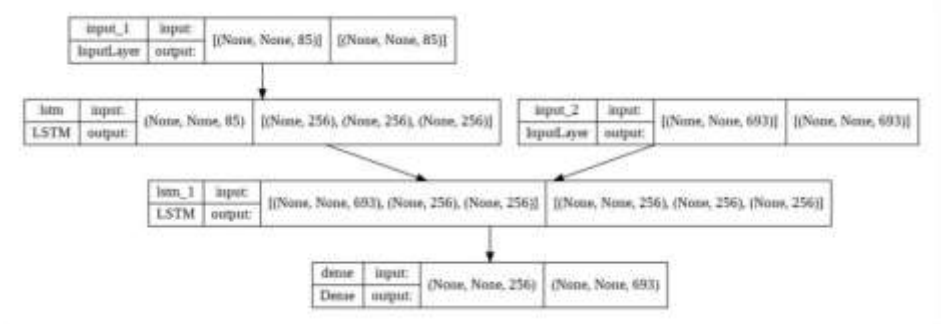

Figure 2. Complex model plot of ELEKX based on LSTM

Here, The Convolutional Neural Network (CNN) design appears to produce the greatest outcomes. Three layers make up the model: a CNN layer, an embedding layer, and a fully linked layer.

Figure 2 portrays the training as well as validation accuracies of the proposed chatbot. An encoder-decoder model is trained on the used data set. A seq2seq model, known as the encoder-decoder model, employs LSTM (Long Short-Term Memory) to generate text from the training corpus. Figure 3 depicts the training losses of the model.

Here, the model's training accuracy demonstrates how well it can categorise the two photos while being trained on the training dataset, whereas the model's validation accuracy demonstrates how well it can categorise the images on the validation dataset. It predicts a word from the user's input, and then it uses that word's probability or likelihood of occurring to forecast each of the subsequent words.Figure 4 shows the demonstration of ELEKX. It can be seen that ELEKX has run successfully after implementing the code in the software. It can provide quick solution of questions regarding mental health for its users.

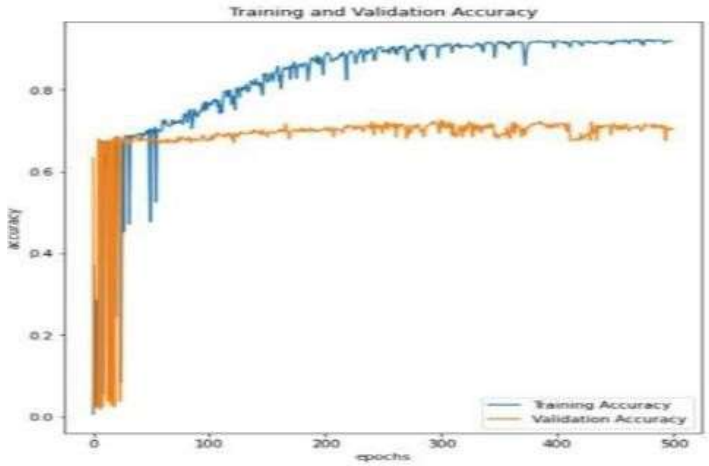

Figure 3. Training as well as validation losses

5. CONCLUSION

It is observed that the field of internal health assistants and chatbots in psychology and psychotherapy operations is expanding. The application of cutting-edge natural language technologies in conjunction with psychotherapy can result in tools that can, to a large extent, fill gaps in the delivery of internal care. ELEKX has been developed as a friendly chatbot so that users can feel at ease when they are counting on it for solutions regarding their mental health.

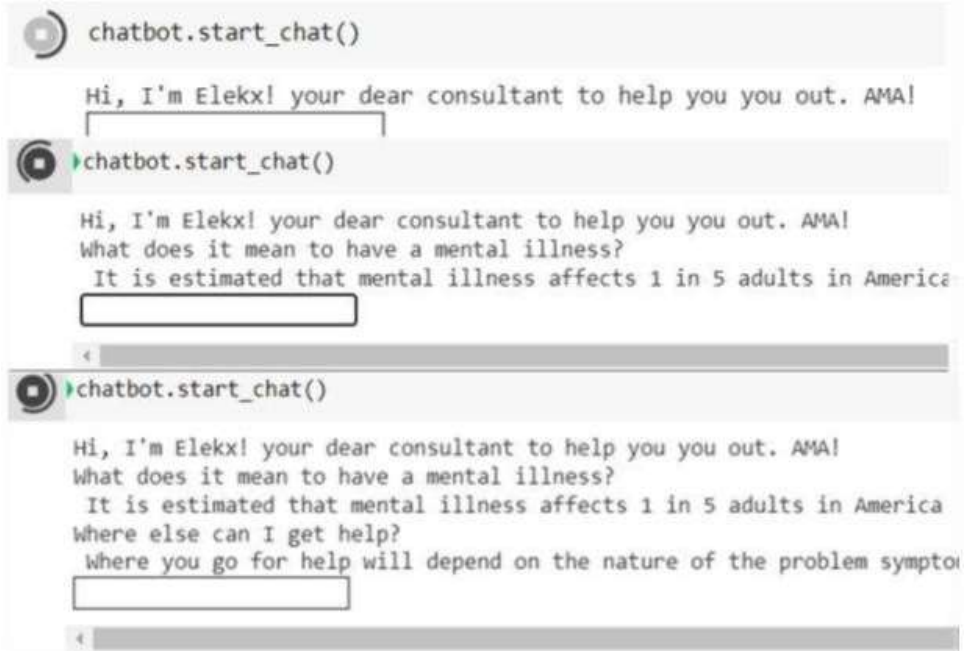

Figure 4 Working demonstration of ELEKX

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