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Virtual Therapist for Psychological Healthcare

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ABSTRACT

Nowadays Stress has been a quite common ailment in people. We believe that when technology is used to build understanding, it can help humanity in creative and effective ways. That idea lives at the core of our paper in an easily accessible app to help users. The paper elaborates plan to develop a virtual assistant (a.k.a. chatbot) that would act as a therapist to the masses. We propose to use Machine Learning and NLP together with web front-end technologies. As per availability of data, Experiments show that the proposed methods achieve high accuracy in patient action understanding, error identification and task recommendation. The proposed virtual PT system has the potential of enabling on-demand virtual care and significantly reducing cost for both patients and health care providers.

KEYWORDS: *chatbot, machine learning, virtual assistant, stress, natural language processing*

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I. INTRODUCTION

As indicated by the World Health Organization (WHO), the variety of mental issues incorporates wretchedness, bipolar emotional issue, schizophrenia and different psychoses, dementia, scholarly incapacities, and formative issues including chemical imbalance. These conditions show in various manners, for example, irregular contemplations, insights, feelings, conduct, and associations with others. Depression alone influences in excess of 300 million individuals as per the WHO [1,2] .

Besides, an individual determined to have any type of psychological instability is probably going to require treatment and treatment for quite a while. Adding to the way that there aren't sufficient specialists, treatment for psychological instability is regularly costly. In metros like Mumbai and Delhi, private professionals charge anyplace from Rs 1,500 to Rs 3,000 for every meeting. Frequently patients need to see specialists consistently, and throughout some undefined time frame, looking for treatment turns into a costly undertaking, motivation behind why numerous individuals cease treatment, mid-way.

Virtual therapy is a type of telemedicine. It includes any treatment that a person seeks through an electronic device.

Some examples of virtual therapy include:

1. Talking to a practitioner via videoconferencing software
2. Using an app to access therapy.
3. Phone- and email-based therapies, such as when a physical therapist suggests specific exercises via email.
4. The use of online devices to assess clients or patients remotely — for instance, when a speech therapist uses online tools to measure progress.

In other words, patients are increasingly drawn to the concept of healthcare services that come to them, rather than vice versa. And, providing as it does a means to consult doctors, nurses or other healthcare professionals from home, virtual healthcare offers just that. Virtual healthcare also better enables specialists to monitor situations or procedures from remote locations. Patient monitoring at home has also been shown to be useful for treating patients with chronic conditions like diabetes and hypertension, where rehospitalisation's too often occur due to lack of communications or transparency about the patient's condition [3,4].

Virtual physical therapy offers traditional care but in an online or phone-based setting. A physical therapist might discuss recent symptoms, recommend exercises, or administer screenings. In some cases, a therapist might ask a client to perform exercises and then use a camera to evaluate their form and progress.

Some physical therapy apps complement therapy by offering additional exercises or allowing a client to track their progress between sessions. A person can use these apps alongside virtual or in- person therapy [5,6].

Benefits and disadvantages of Virtual Therapy:

A client or healthcare professional considering virtual therapy should evaluate the pros and cons:

Benefits

Virtual therapy is relatively new, and researchers have not thoroughly tested every type of treatment. However, preliminary research suggests that it could be effective.

For example, a 2020 study of virtual physical therapy following knee surgery found that virtual therapy offered similar benefits to in-person treatment. It also significantly lowered costs.

The authors of a 2017 systematic review also suggested that tele mental health services provide a quality of care and outcomes like those of traditional mental healthcare.

Some other benefits of virtual therapy include:
Increased access to care: People who have physical disabilities, are geographically isolated, or do not have time to drive to therapy can access treatment with virtual options.

More privacy: Well-managed virtual therapy means that a person can get care in the privacy of their own home, without having to sit in a waiting room or interact with other clients.

Cost savings: Virtual therapy may cost less. The overheads may be lower for the therapist, particularly if they switch to an exclusively online model of care.

Client satisfaction: Most research on satisfaction following virtual therapy suggests that clients are at least as satisfied with it as they are with traditional care. For some people, seeking virtual care may be less stressful, greatly increasing satisfaction.

Disadvantages
Some drawbacks of virtual therapy include:
Data concerns: If a therapist chooses the wrong platform or does not encrypt therapy sessions, a third party might violate a client's privacy. If a client seeks care on a public network or leaves their computer unlocked, their colleagues or housemates may be able to view their sessions.

Relationship concerns: Depending on the modality the client chooses; it may be harder to form a trusting relationship with the therapist. For instance, email-based therapy removes body language and voice tone cues, potentially causing communication issues.

Technological limitations: Slow networks, low quality video, and chat delays can make therapy more difficult.

Technological expertise and philosophy: People who are not comfortable with technology may feel less comfortable with or more anxious about virtual treatment.

II. LITERATURE SURVEY

A. Social Survey

Since the time the pandemic hit India morethan five months back, trailed by a phenomenal lockdown, feelings of anxiety have been on the ascent with 43 percent Indians experiencing discouragement, as indicated by another investigation. Directed by GOQii, a shrewd tech- empowered preventive medical services stage, the examination studied more than 10,000 Indians to see how they have been adapting to the new ordinary [7,8].

According to the study 26% (1 in 3) of respondents were suffering from mild depression, 11% (1 in 9) were feeling moderately depressed and, 6% (1 in 15) were facing severe symptoms of depression. (Figure-1)

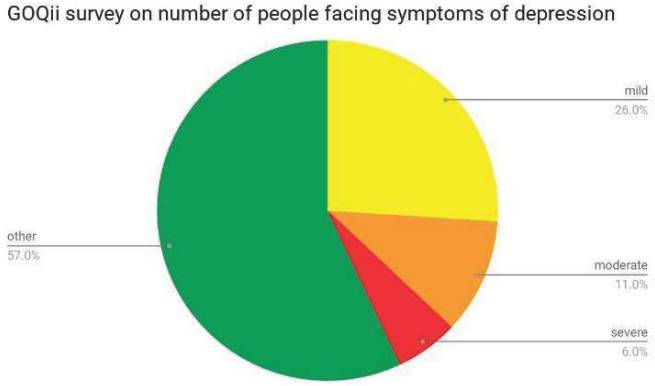

Figure-1: Survey of no. of people facing symptoms of depression.

B. Data Survey

In general, most questions have only a few responses with 75% of questions having two or fewer total responses. However, many questions have a lot of therapist engagement. The most commented-on question is "Do I have too many issues for counseling?". It's nice to see such wonderful participation from therapists on questions like this (Figure-2).

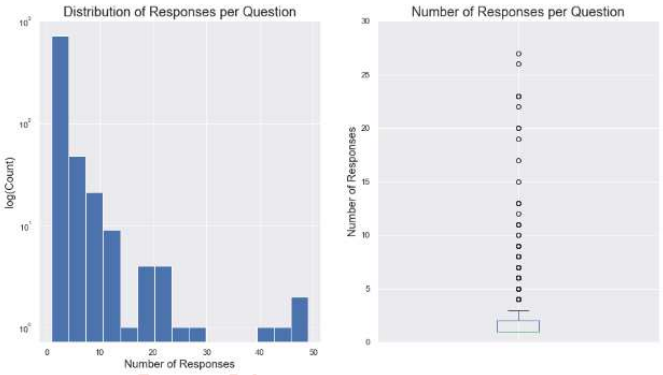

Figure-2: Distribution of responses per question

We can also observe some interesting trends in the topics. If we plot the number of questions by topic, we see that most questions are about depression, relationships, and intimacy (Figure-3).

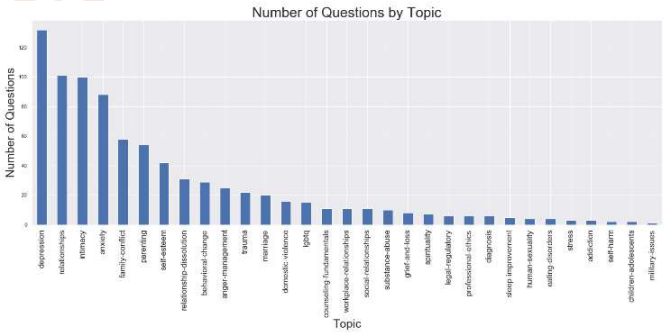

Figure -3: Number of questions by Topic

When we plot the number of responses by topic, we find out that counseling-fundamentals jumped 12 places to take the number three spot in the number of responses (Figure -4).

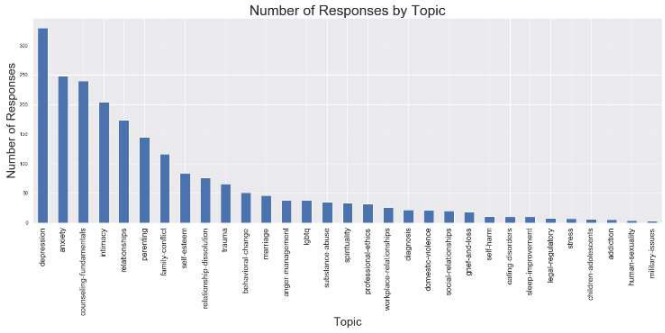

Figure-4: Number of responses by topic

In general, most questions are pretty short. The therapists seem to be providing much longer responses. The average question length is 54 words, but the average response is 170 words long (Figure-5).

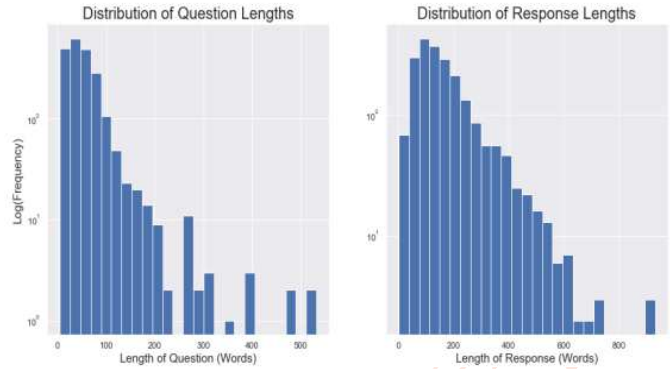

Figure-5: distribution of question and response length.

It might also be interesting to see how well BERT features divide the space so we created some simple UMAP 2D embeddings. We don't see a strong separation between the classes in general. However, different groups of topics do appear closer together in some cases and further apart in others. Take workplace relationships (purple) for example, it's very close to relationship-dissolution (black), but completely separate from counselling fundamentals (bright green) (Figure-6).

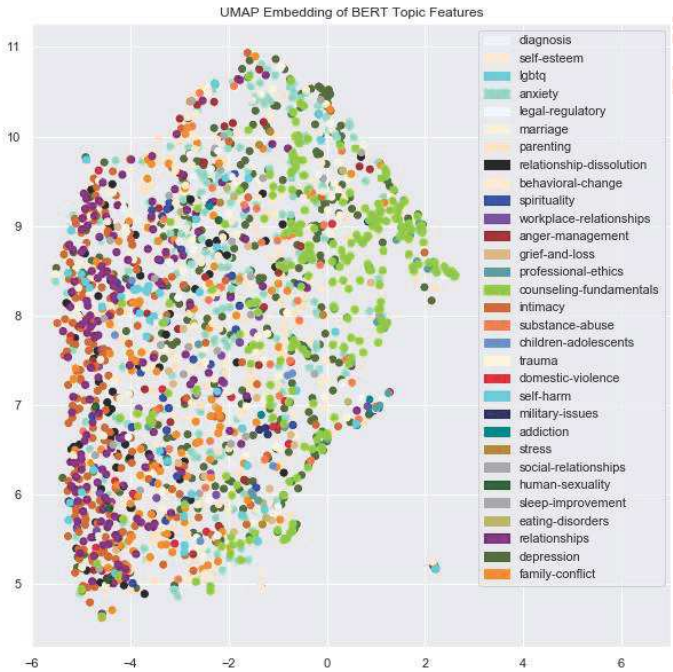

Figure-6: Workspace relationships

III. OBJECTIVES AND SCOPE

Our problem statement is to build a chatbot that will provide support and guidance to the user of our application. The main mode of communication between the user and the chatbot will be through a text-based widget responsible for chatting. Our main motive behind this project is to bring mental healthcare to the masses [9,10].

1. Help users make decisions and clarify their feelings to solve problems.
2. Provide support and guidance, while helping the user make effective decisions within the overall structure of support.
3. Maintain the level of confidentiality of the user's data.
4. Suggest visiting a psychiatrist, who is also a medical practitioner and can prescribe medication, if it is determined that medication is necessary for a user's treatment.
5. Be a cost-effective alternative to a psychologist.
6. Dynamically train the model based on the new questions from the user.

IV. METHODOLOGY

For the dataset, we will be web-scraping an expert community forum of counsellors and users. This provides us with data of questions and answers between a user and a counsellor. We have decided to go with 'Counsel Chat' as our expert community. It is a platform to help counsellors build their reputation and make meaningful contact with potential clients. On the site, therapists respond to questions posed by clients, and users can like responses that they find most helpful. It's a nice idea and lends itself to some interesting data [9,10].

Since we all know that raw web-scraped data is not ready for use in Machine Learning models and similar applications, we need to pre-process the data. This will include steps such as cleaning the data, tokenization and finally training the model. In the cleaning step, we will need to firstly perform feature selection. This includes removal of the features in the dataset that are not related to our project. Then, we need to verify if the dataset contains non-allowed characters such as emojis and other non-textual data. This non-allowed data needs to be removed from the dataset prior to training.

When we train a deep-learning based dialog agent, in an end-to-end fashion, we face a major issue. The issue being that dialog datasets are small and it's hard to learn enough about language and common-sense from them to be able to generate fluent and relevant responses. To tackle this issue, we'll take another path that gathered tremendous interest over the last months: "Transfer Learning". The idea behind this approach is quite simple:

1. Start by pretraining a language model on an exceptionally large corpus of text to be able to generate long stretches of contiguous coherent text,
2. Then fine-tune this language model to adapt it to our end-task.

A. Algorithm

Our language model is prepared with a solitary info: a grouping of words. However, our model should utilize a few kinds of settings to create a yield succession: one or a few persona sentences, the historical backdrop of the discourse with in any event the last expression from the client, the badge of the yield succession that have just been created since we produce the yield arrangement word by word.

A basic answer is simply to link the setting portions in a solitary grouping, putting the answer toward the end. We would then be able to produce a fruition of the answer token

by token by proceeding with the succession. First, we'll add special tokens to our vocabulary for delimiters and segment indicators. These tokens were not part of our model's pretraining so we will need to create and train new embeddings for them.

Adding special tokens and new embeddings to the vocabulary/model is quite simple withpytorch- pretrained-BERT classes. These special-tokens methods respectively add our five special tokens to the vocabulary of the tokenizer and create five additional embeddings in the model.

Now we have all we need to build our input sequence from the persona, history, and beginning of reply contexts.

B. Tokenizer

The tokenizer will take care of splitting an input string in tokens (words/sub-words) and convert these tokens in the correct numerical indices of the model vocabulary. Tokenization is performed on the corpus to obtain tokens. The following tokens are then used to prepare a vocabulary.

C. Transformer

These models are called decoder or causal models which means that they use the left context to predict the next word. A language model will just be a model that takes as input a sequence of tokens and generates probability distribution over the vocabulary for the next token following the input sequence.

D. Decoder

Greedy-decoding is the simplest way to generate a sentence: at each time step, we select the most likely next token according to the model until we reach end-of-sequence tokens. One risk with greedy decoding is that a highly probable token may be hiding after a low-probability token and be missed. We need to mitigate this issue.

Currently, the most promising candidate for the decoder is top-k sampling. The general principle of this method is to sample from the next-token distribution after having filtered this distribution to keep only the top 'k' tokens with a cumulative probability just above a threshold.

V. CONCLUSION

In this paper, we propose a machine learning- based virtual physical therapist (VPT) system development for enabling personalized remote training for patients having common Psychological diseases. Different physical therapy tasks with multiple difficulty levels are selected to help patients with VPD to improve balance and mobility. For enabling automated task recommendation, a machine learning-based process model has been trained from real patient and VPT data for providing accurate, personalized, and timely task update recommendation for patients with VPD, so that emulating a real VPT's behavior. Real patient data can be collected in the clinic to train the models. As per availability of data, Experiments show that the proposed methods achieve high accuracy in patient action understanding, error identification and task recommendation. The proposed virtual PT system has the potential of enabling on-demand virtual care and significantly reducing cost for both patients and health care providers.

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