



# INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

## AI Chatbot for Mental Health : PTSD Assessment

M. Mukesh Reddy \*<sup>1</sup>, M. Thulasi Reddy\*<sup>2</sup>, Y. Niteesh Kumar\*<sup>3</sup>

\*<sup>123</sup>Student, Department of Computer Science and Engineering,

Kalasalingam Academy of Research and Education, Krishnan Kovil – 626126, Virudhunagar, Tamil Nadu, India.

Dr. N.C.Brintha#<sup>1</sup>

#<sup>1</sup>Assistant Professor , Department Of Computer Science and Engineering,

Kalasalingam Academy of Research and Education, Krishnan Kovil – 626126, Virudhunagar, Tamil Nadu, India.

**Abstract:** PTSD effects many people throughout the globe and can be easily be triggered if a person experiences a traumatic events in the past. So, sometimes this trauma doesn't subside and becomes a serious disorder. Common Symptoms includes like panic attacks, anxiety, negative feelings, thoughts, and etc. Especially, in poor places where medical healthcare facilities are scarce, like unstable areas or low income countries and undeveloped areas, war and conflict regions, posttraumatic stress disorder can be very serious threat to those people because there won't be enough healthcare doctors and specialists to access the risk and treat in time. Due to this, there is a serious need to provide more support by use of technology with posttraumatic stress disorder patients. By nature of their occupation, initial responders and military veterans also are a lot of at risk of numerous mental diseases like posttraumatic stress disorder. Almost 30% of those people who work in military are prone to posttraumatic stress disorder and later it is known by analyzing data revealed that, majority of them all are diagnosed with posttraumatic stress disorder. And there's a serious lack of proper infrastructure to help those in need. So, in quest of solving this problem we asked ourselves how can we help those people who are in dire need of proper support? How can we with the help of technology and software can reach out to them? Important task in our hands now would be to identify those people. So now, We created this project as an web application in order to provide assistance to those vulnerable victims with posttraumatic stress disorder throughout the world. Our goal can become a reality with the help of NLP based AI Chatbot deployed on a website or any messaging platform to communicate with posttraumatic stress disorder and evaluate the condition. An NLP based AI chatbot can

respond the required information to those people who wants an immediate need of help.

**Keywords—***Machine Learning, Logistic Regression, Python, MLflow, Natural Language Processing, Visualization, Accuracy Models, Authentication, Javascript, Google Cloud Server, Regression, Neural Networks(key words)*

### INTRODUCTION

Nowadays, the most vulnerable people mostly are children, elderly people, military veterans. These people who are prone to posttraumatic stress disorder and later it is known by analyzing data revealed that, majority of them all are diagnosed with posttraumatic stress disorder. And there's a serious lack of proper infrastructure to help those in need. Now we can solve this problem by creating a chatbot which works based on recognizing the language and expressions of users and responding them. This chatbot software targets the most vulnerable people in the society like children, people who live in low resources societies, elderly people, people who had traumas and breakdowns. Then it identifies their problems and provide the necessary help they need. This only requires basic understanding of using technology and easily accessible to all those who seek support. Users can then interact and respond with the chatbot. With our project , we created a Natural Language Processing (NLP) based chatbot as an web application in order to provide assistance to those vulnerable victims with posttraumatic stress disorder throughout the world. Our goal can become a reality with the help of NLP based AI Chatbot deployed on a website or any messaging platform to communicate with posttraumatic stress disorder and evaluate the condition.

When a user visits the website and interact with the chatbot, our chatbot responds appropriately by guessing their intentions, emotions from its training. Then next, when such person if shows any signs of immediate risk or danger, such as suicidal thoughts, our Chatbot has been trained to immediately provide healthcare numbers.

Many people suffering with posttraumatic stress disorder suffer from various issues like PTSD, depression, anxiety, loneliness, suicidal thoughts, etc. However, the shame and frustration will not let these people to come out of their closed shell in order to get the required support they need. So, people who suffer from posttraumatic stress disorder typically shut themselves from their own family members and friends and avoid proper channels of communication. Our AI chatbot will aim to spot any anomalies or irregularities in given user expressions, sometimes this can be a technically difficult challenge for an AI-based software system. Our chatbot will use cloud technology to run the backend, also we are going to use a system where we can grant remote admin access to friends and family of chatbot, so they can also help in providing the required support for the PTSD patients or any mental health related people who will use our application.

This final web application sing AI Chatbot can provide additional support by conversing with the users and provide specific use case support who are suffering from post traumatic stress disorder.

The objectives of this work are:

- (1) To design and implement a Natural Language Processing based interactive chatbot that can provide support to the vulnerable people suffering from PTSD.
- (2) To design a user-friendly interface which will allow the users themselves to analyze and evaluate their condition.

## 2 . LITERATURE SURVEY

2.1 MLFlow : MIFlow is a framework which consists of various modules , which can be used to oversee your model during running and training, , loading the model in project code, for storing various models and creating a pipeline. There is another feature called mlflow projects, through which we can create pipelines for our project. We can also run our model using this feature on any cloud environment, by using specific template.

2.2 Natural Language Processing(NLP): NLP is nothing but another category of artificial intelligence, which is used to understand and analyze the human language. It consists of various python libraries which can be used to classify our datasets in project and thus it can help us to interpret the required datasets. It is consisting of lots of open-source toolkits, which can be very useful in field of linguistics and machine learning.

The major focus of our research is to focus on detecting and analyzing the patterns pertaining to user conversations, and their intent. These expressions are

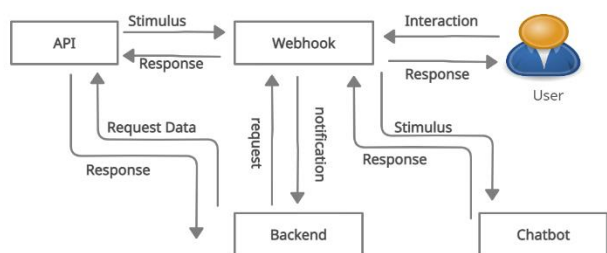
recognized by leveraging the machine learning algorithms at both classification and regression. We prefer classification, as we focus on a two-way classification and immediate trigger action. Classification techniques including logistic regression, decision tree learning, support vector machines, neural networks are widely used in the process. In order to focus on the effectiveness of the algorithm, we maintain huge set of logs from the websites for analysis with the machine learning algorithms. Since the problem also maps on time-space trade off, there is a need to concentrate on the efficiency of the model. It is obvious the decision tree learning works well with outliers but not efficient with the time. Logistic regression is also heavily biased by the threshold value. Losing control on the threshold will make the entire mechanism to fail. Neural networks being well advanced, but requires a good number of data initially. Data requirement during earlier stages of analysis are usually not satisfied. Hence, we prefer support vector machines with kernel for effective classification of access patterns in public websites for information extraction or scrapping.

## 3.SIMILAR WORKS

There is a chatbot called Cognitive woe chatbot which particularly uses a technique called cognitive behavioral therapy (CBT) to provide help to people who suffer from mental illness called cognitive dissonance disorder. So this software can be helpful to treat it by differentiating the thoughts into positive and negative ones. But the main issue of this methodology comes from the fact that it is very difficult to predict the pattern of user thoughts. Also accurate results are very low. Chatbot performs a series of steps in order for the treatment of this disorder, which can be very challenging. This chatbot then enquires the end-users to help them identify their negative thoughts and slowly start working by helping them to analyze them. This process can be really helpful in the long run and proven for helping them critically analyze their thoughts and differentiating positive and negative ones. There is another chatbot to use CBT technique in order to treat any depression or challenging mental health issues stemming from negative thoughts. This works on a basic principle of triggering the certain memories with users and helping them analyze those critically, at the end it can help them to solve their mentalhealth issue. Broadly speaking, these functions in the chatbot are performed individually like categorical analysis, behavioral analysis and various other factors like personality. But sadly, this requires extensive budget and still can't be used commercially viable for everyone out there.

## 4. PROPOSED METHOD

### SYSTEM BLOCK DIAGRAM



**Fig-1:** Block Diagram

### ALGORITHM

Step 1: The end-user speaks directly or type an expression.

Step 2: This chatbot sends the user expressions from the website to backend google dialogflow in a direct intent request message.

Step 3: Chatbot forwards a intent detection reply message to our software. This sent response is having details about the matched intent, their actions, and the variables, and the reply outlined for the target intent.

Step 4: This chatbot executes steps as we required, like querying database or calling external APIs.

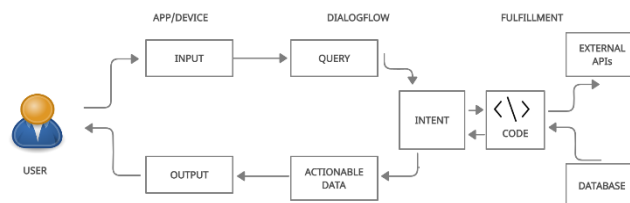
Step5: Then this chatbot sends a response to the user.

Step 6: Then finally visiting user either reads the text or listen the given response.

Our chatbot is based on the Natural Language Processing framework with which we used to build this PTSD chatbot. This web app reads the input and analyzes a conversational response and finds its intent, which is a specific path of conversation around which the chatbot can send a response. Understanding of a concept is created by design of entities which store related concepts and terminology, and then can be integrated into a message which respond dynamically. It is hosted on Google Storage Cloud Platform.

We use API interaction tools in order to get response from end-user and to forward it to backend software to analyze it with our training data and then NLP chatbot will converse with the user by displaying the conversational appropriate response. We must also directly interact with Chatbot's API for each conversation to send the end-user expressions and receive required intent matches. The following figure explains the processing flow of our chatbot during its interaction with the APIs.

## 5. SYSTEM METHODOLOGY

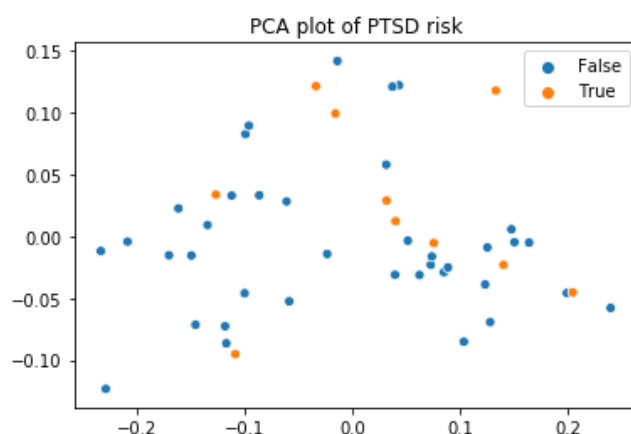


**Fig-2:** System Design

Our chatbot is based on the Natural Language Processing framework with which we used to build this PTSD chatbot. This web app reads the input and analyzes a conversational response and finds its intent, which is a specific path of conversation around which the chatbot can send a response. Understanding of a concept is created by design of entities which store related concepts and terminology, and then can be integrated into a message which respond dynamically. It is hosted on Google Storage Cloud Platform.

This chatbot is built by user friendly software. The language used is Python. The strongest feature of Frontline is not only how we have trained the chatbot but also how we can continue to train it. One of the future training aspects that we hope to improve upon is Knowledge Training. This feature, as part of Google Dialogflow, allows a user to train the AI not just on intent and response queries but by FAQs and knowledge based articles. The various methods and steps including identifying the different expressions, intent and analyzing which among them are defined or not. So, if it is not defined, then user will have limited interaction, so we train the model again.

**Visualization:** On the required data, we performed Principal Component Analysis, which is one of a statistical method. It uses an orthogonal transformation to convert a set of observations of various correlated variables into a set of values of linearly uncorrelated variables called principal components. And we have used it to lessen the dimensions of the dataset in order to be able to visualize data.



**Fig-3:** PCA plot

**The Classifiers:** We have to use logistical method of regression because it is a very simple model and the dataset is extremely small which is likely to overfit if passed to a complicated model. SVM is suitable for its ability to work with high dimensional data and set the following 15 hyperparameters for the classifiers and these are the ones that seemed to yield the best results.

```
LogisticRegression(random_state=0,
C=1,solver='liblinear',class_weight="balanced")

LinearSVC(C=1,class_weight="balanced")
```

**Fig-4:** Logistic Regression

We have used both recall score and accuracy score to get a better evaluation of the models. The score here was very important because the model should be able to correctly predict all positive PTSD symptoms, however false alarms would render the model useless as it would be too overly sensitive.

Algorithm	Metric	FOLD 1	FOLD 2	FOLD 3	FOLD 4	FOLD 5
Logistic Regression	General Accuracy	0.40	0.40	0.60	0.67	0.67
	Recall Score	1.00	0.50	0.50	1.00	1.00
Linear SVM	General Accuracy	0.40	0.40	0.60	0.44	0.78
	Recall Score	1.00	0.50	0.0	0.00	0.50

**Fig-5:** Accuracy of Evaluation Model

We have used MLflow during model development in order to log a model training run. We would, for instance log into an accuracy metric and then model generated can also, be associated with this run. This process here is very efficient such that this software uses scoring modules and the Sklearn model input (pandas framework) as a specifications for the Rest API. Sklearn was also used as an example in here as it has bindings for Spark, Keras, Tensorflow, ONNX, Pytorch, etc. It just normally infers with the input from the model packaging format, and offloads the data to scoring function.

**Webhook Request:** During the API call, if any intent is configured and if the fulfillment matches, then our chatbot sends POST webhook request to our backend software. This request contains a javascript object with information about the matched intent.

It is vital for us to continue NLP chatbot training in order to improve it's level of accuracy, fixing infrequent errors & to get the feedback so we can reduce the fallbacks. It uses NLP framework and ML to enhance itself. It always learn based on user input, conversations & training from various datasets.

Conversation	Requests	No match	Date	
anyone there	6	6	Today	🟢
hi	5	4	Today	🟢
hi	4	2	Today	🟢
hi	1	0	Today	🟢

**Fig-6:** Training

If given intent is mismatched, then it is corrected or set to default. We gather this required data in various sessions. So, we collect enough expressions from end-users for purpose of gaining insights and adding training of the intent.

In this case of MLflow software, process of ULMF, it applies discriminative learning method rates throughout the different cycles of learning.

```
learn = language_model_learner(data_lm, AWD_LSTM, drop_mult=0.5)
learn.fit_one_cycle(1, 1e-2)
```

epoch	train_loss	valid_loss	accuracy	time
0	3.878264	3.527228	0.283194	00:04

```
[ ] learn.unfreeze()
learn.fit_one_cycle(5, slice(1e-4,1e-2))
```

epoch	train_loss	valid_loss	accuracy	time
0	3.537875	3.367251	0.300177	00:06
1	3.369558	3.294099	0.303339	00:06
2	3.184345	3.280420	0.309170	00:06
3	2.993809	3.297564	0.306594	00:06
4	2.841509	3.298448	0.308333	00:06

**Fig-7:** ULMF Process

**Entities:** The basic term entity is used in this context and in the Dialogflow Console to describe the general concept of entities.

- First start the Dialog flow software.
- Select the required appropriate agent
- Now, select Entities in the sidebar option menu.
- Finally select the option for custom entities defined for the agent or the system tab for system entities used by our agent.

Dialogflow Essentials US - PTSD [SAVE]

Define synonyms
  Regex entity
  Allow automated expansion
  Fuzzy matching

sad	sad
not feeling well	not feeling well
anxiety	anxiety
illness	illness
depression	depression

Click here to edit entry

+ Add a row

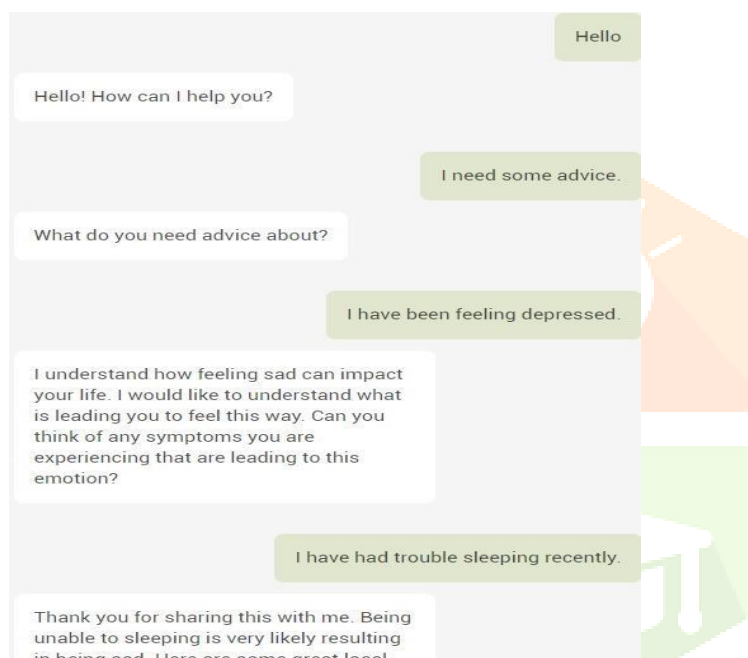
**Fig-8:** Creating Entities

The Events are identified simply by using their name. Certain Platform-specific events have specific names, but we can use custom events for anything. In order to

configure an intent so that it is triggered when certain events are invoked:

- First we start by going to the console workplace.
- Then we choose a suitable agent.
- Now choose Intents in the custom leftmost side option.
- Finalize an intent.
- Then expand the required Events in section.
- Finally enter one or more event names.

**Results:** Below is the screenshot of user conversation with the AI chatbot in our, asking doubts regarding his mental health issues to chatbot. Based on user input, chatbot will suggest required support to the user.



**Fig-9:** User conversation with chatbot

**Objectives fulfilled:** We have thereby defined intents by analyzing patient data and responded with appropriate response with help of pre-defined intent. We are using NLP to make our Machine Learning project & perform the risk assessment by using backend. We have used various classification techniques and regression for analyzing risk and evaluating final assessment of PTSD using in NLP. We built an Integrated chatbot using help of APIs. Used NLP Chatbot to build a friendly conversational user interface that can respond to questions & provide support about the PTSD. We have build an API, called a webhook using python, which allows chatbot to get information from external data sources. Then finally we have Integrated our chatbot backend model with a front end website to create a user friendly text-based chatting web application. And we have also completed all task integrations using NLP and machine-learning and implemented the AI chatbot with the frontend website. Tested for

accuracy & trained the model. Further deployment of chatbot is done in Google Cloud platform in website.

By using Logistic regressions and various ML techniques and training, we got 90% accuracy. Further training of larger datasets will help us to achieve more accuracy in PTSD assessment.

## 6. CONCLUSION

It was concluded that the AI based PTSD chatbot was very accurate, and the accuracy range will be increased as the no of training samples increase. We built an NLP based chatbot that perfectly serves our purpose for anyone who requires professional support. Trained the chatbot for accuracy and analyzed the user expressions and emotions and successfully test run is done. So now, with this NLP based interactive chatbot project as an web application, we can provide assistance to those who are vulnerable victims with posttraumatic stress disorder throughout the world.

**Future Scope:** This AI based PTSD assessment chatbot can further help to identify and provide support to patients, and has lots of scope and uses in medical field in future.

## 7. REFERENCES

- [1] Peter. Jackson. Introduction of Expert Systems. Wesley-Addison Longman Publishing Co., Inc., 1998.
- [2] M. Buco, N. Ayachitula, Y. Diao, S. Maheswaran, R. Pavuluri, L. Shwartz, C. Ward, "IT services and management automation - A hybrid methodology to integrate and orchestrate collaborative from human centric and automation centric workflows," IEEE International Conference on Services Computing (SCC), Salt Lake City, 2007, pp. 574-581.
- [3] M. P. Singh, "An Ontology for Commitments in Multiagent Systems", Artificial Intelligence and Law 7(1), 97-113, 1999.
- [4] P. R. Telang and M. P. Singh, "Specifying and Verifying Cross-Organizational Business Models: An Agent-Oriented Approach", IEEE Transactions on Services Computing, volume 5, number 3, pp. 305-318, 2012.
- [5] A. Perini, P. Bresciani, P. Giorgini, F. Giunchiglia, J. Mylopoulos: Tropos: A software methodology which is agent-oriented. Multi-Agent Systems and Autonomous Agents, volume 7, number 3, pp. 203-236, 2004.
- [6] Viraj Amila, Building your own ML chatbot by using Deep Learning, Github sourcecode, [https://github.com/amilavm/Chatbot\\_Keras](https://github.com/amilavm/Chatbot_Keras).
- [7] Peter King, Medium, 2019. <https://medium.com/omdena/ai-and-machine-learning-in-healthdesigning-a-chatbot-for-ptsd-assessment-fd014a669db>.

[8] Business Model Prossessing and Notation (BMPN), version 3.0 beta.

[9]P. R. Telang, J. Xiao, K. Kalia, M. Vukovic, “A unique methodology based driven processes to transform people to chatbot services”, International Conference on Services and Computing (ICSOC), Malaga, 2018, pp. 545—5.

