

Reducing Human Loneliness during Pandemic using Deep Learning-based Chatbot

Abstract

Now that individuals are spending more time in the virtual world as a result of the Covid19 pandemic, psychologists have discovered that 8 out of 10 people feel lonely sitting at home even while doing work for not getting to see their peers or close ones - which is specifically seen in older teens or young adults. The authors of this paper devised an innovative method for dealing with people's loneliness by utilising a deep learning chatbot. Chatbot development has grown in popularity, and numerous conversational chatbots have been developed to replace traditional chatbots. A chatbot is a piece of computer software that communicates with humans and anticipates their needs. The chatbot responds to the user's inquiry and can occasionally do actions as well.

Keywords - overcoming loneliness, Chatbot, Deep Learning, Natural Language Processing(NLP)

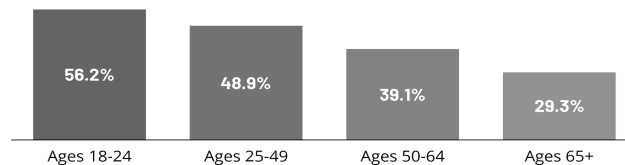
1. Introduction

As the COVID-19 pandemic spreads around the world, posing a serious threat to population health and economic growth, it is causing widespread concern, fear, and stress, resulting in a state of disorganised psychological well-being, all of which are natural and normal reactions to the changing and uncertain situation in which everyone finds themselves. Several studies have found a significant incidence of psychological distress, which has been linked to a negative perception of the pandemic's severity as well as containment methods such as lockdown, forced facemask wear, social isolation, and so on. Residents have found the reactions at national levels, which are frequently accompanied by lock-down enforcement, to be difficult. The psychological components of this must be investigated concurrently, with a focus on the COVID reaction and the adaptive response to lock-down, particularly in the Indian environment, where morbidity tends to exceed available resources, and a solution to this problem must be discovered.

Researchers believe that older teenagers and young adults are particularly vulnerable because they commonly shift from their hereditary families to their chosen families, resulting in a lack of vital ties to individuals who might serve as critical guardrails against loneliness. Students at college may struggle to fit in and experience homesickness, while those who are not enrolled in school may feel isolated from vital social groups or communities. Young people routinely make important decisions about their job and personal lives, as well as their relationships, according to the researchers, which can contribute to their stress and sense of isolation.

The problem isn't only in India; it's all throughout the world. According to a recent American study, 36% of respondents to a national poll of around 950 Americans stated they felt lonely frequently, almost all the time, or all the time in the preceding 4 weeks, compared to 25% who claimed they had major troubles in the two months before the epidemic. The fact that 61 percent of individuals aged 18 to 25 reported high levels is perhaps the most remarkable. Psychologists are concerned that the coronavirus pandemic is causing a loneliness epidemic, claiming that feelings of social isolation are on the rise and that older teenagers and young adults are the most impacted.

**Younger Adults are More Likely to Report Symptoms
of Anxiety and/or Depressive Disorder
During the COVID-19 Pandemic**

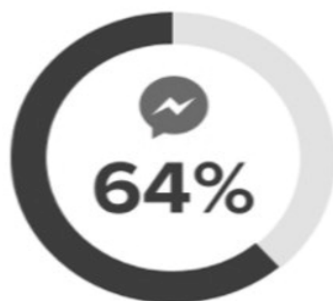


As a result, this issue must be dealt with as quickly as possible. The authors of this paper suggest a deep learning-based solution to this problem: a chatbot that would provide company to a person for 24 hours a day with conversational maturity.

2. Literature Survey

Chatbots are conversational interfaces that offer a new and intelligent way of interacting with computers. To get a query answered by a software, a search engine is used and certain forms are filled out. The chatbot, on the other hand, allows any user to ask a question in the same way that a person asks another person. Chatbots are becoming increasingly popular on web-sites. Natural Language Processing(NLP) is the chatbot's technology. Chatbots have been around for more than 50 years in the NLP field. The ELIZA chatbot was the first well-known chatbot in the NLP field, having been built in 1966. It was a psychotherapy bot that acted as if it were a real psychotherapist. Many technological advancements have recently been achieved that have improved the accuracy and usefulness of Natural Language Processing (NLP). This advancement in NLP is significant for many research purposes, and it could lead to improved chatbot accuracy and efficacy. Chatbots have a bright future ahead of them and can be found on almost every website and online platform.

**People are more likely to choose Chatbots
over other solution**

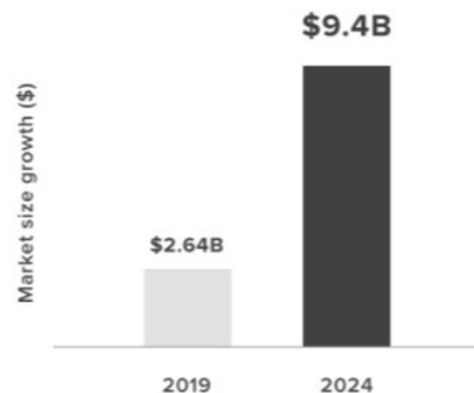


of Facebook users in Brazil, India, the UK, and the US say they like to send chats to a business over Facebook Messenger because it is the platform businesses are most likely to get back in touch with them



According to a recent survey, 44% of consumers in the United States prefer chatbots to traditional customer service alternatives. And 61% of those polled claimed they communicate with a chatbot at least once a month since they respond quickly to their questions and save precious time of the customer. It is not only the most cost-effective alternative for businesses, but also the most technically compatible solution for simultaneously treating the concerns of millions of consumers. This is due to the fact that chatbots may communicate with a huge number of customers at once using a messaging app. Companies might use it as a data collection tool, collecting and analysing enormous amounts of data at the same time

The chatbot market size is projected to grow from \$2.6B in 2019 to \$9.4B by 2024 at a compound annual growth rate (CAGR) of 29.7%



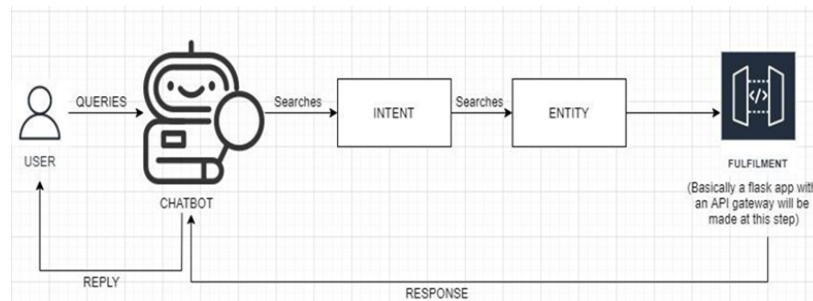
It could also be used for other commercial purposes. Nowadays, practically every chatbot is focused on a certain business objective, but there are still a handful that people can use as talking buddies when they are lonely or when they are alone and have no one with whom to share their feelings. Due to these problems, people develop anxiety and despair. As a result, there must be a solution to this dilemma, leading to the writing of this research paper.

3. Our Propositions

Intelligent chatbot solutions can be implemented using a number of powerful bot development frameworks, tools, and platforms. The authors of this paper advocated that instead of adopting any bot development framework or platform, they should create a simple, intelligent end-to-end domain-specific chatbot from the ground up using deep learning with Keras to deal with the loneliness of the people.

The work has been divided into various components.

- Intent Defining
- Data Preparation
- Model Training
- Model Testing with real-time query
- Creating the front-end and integrating it with the backend



3.1 Intent Defining

"Intent" refers to the intention of a user communicating with a chatbot, or the intention behind each message received by the chatbot from a specific user. Depending on the domain of the chatbot solution, these intentions may differ from one to the next. As a result, it's critical to give the chatbot with appropriate intentions that are relevant to its domain. The chatbot uses a domain knowledge base to answer questions and performs a range of additional tasks. In order to continue interacting with the user, the chatbot must first understand what the user is saying or planning to do. As a result, the chatbot must be able to decipher the intentions underlying user communications (in order to determine the user's intent).

A few simple intents and messages that correlate to those intentions have been produced, and replies have been mapped to each intent type. Those are stored in several json files.

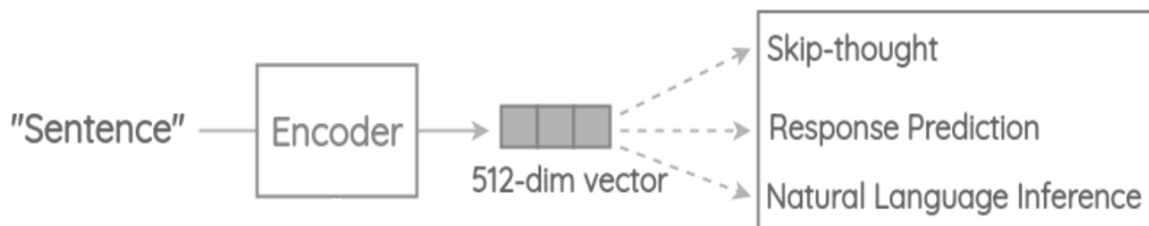
```
{
  "intents": [
    {
      "tag": "greetings",
      "patterns": ["Hi", "Hey", "Heya", "Hello", "Hola"],
      "responses": ["Hello", "Hi", "Hi there"]
    },
    {
      "tag": "goodbye",
      "patterns": ["Bye", "See you later", "Goodbye"],
      "responses": ["See you later", "Have a nice day", "Bye! Come back again"]
    },
    {
      "tag": "thanks",
      "patterns": ["Thanks", "Thank you", "That's helpful", "Thanks for the help"],
      "responses": ["Happy to help!", "Any time!", "My pleasure", "You're most welcome!"]
    },
    {
      "tag": "name",
      "patterns": ["What is your name", "What's your name?"],
      "responses": ["PersonX", "PersonX is my name"]
    },
    {
      "tag": "help",
      "patterns": ["Could you help me?", "Give me a hand please", "Can you help?", "What can you do for me?", "I need a support", "I need a help", "Support me please"],
      "responses": ["Tell me how can I assist you", "Tell me your problem to assist you", "Yes Sure, How can I support you"]
    }
  ]
}
```

being alive mean_	09-12-2021 04:21	JSON File
being alive mean_usersays_en	09-12-2021 04:21	JSON File
Boredom - no	09-12-2021 04:21	JSON File
Boredom - no_usersays_en	09-12-2021 04:21	JSON File
Boredom - yes	09-12-2021 04:21	JSON File
Boredom - yes_usersays_en	09-12-2021 04:21	JSON File
Boredom	09-12-2021 04:21	JSON File
Boredom_usersays_en	09-12-2021 04:21	JSON File
Coffee Date	09-12-2021 04:21	JSON File
Coffee Date_usersays_en	09-12-2021 04:21	JSON File
Date	09-12-2021 04:21	JSON File
Date_usersays_en	09-12-2021 04:21	JSON File
Default Fallback Intent	09-12-2021 04:21	JSON File
Default Welcome Intent	09-12-2021 04:21	JSON File
Default Welcome Intent_usersays_en	09-12-2021 04:21	JSON File
Die	09-12-2021 04:21	JSON File
Die_usersays_en	09-12-2021 04:21	JSON File
Eat	09-12-2021 04:21	JSON File
Eat_usersays_en	09-12-2021 04:21	JSON File
Favourite food	09-12-2021 04:21	JSON File
Favourite food_usersays_en	09-12-2021 04:21	JSON File
Free Version	09-12-2021 04:21	JSON File
Free Version_usersays_en	09-12-2021 04:21	JSON File
GamePlay	09-12-2021 04:21	JSON File
GamePlay_usersays_en	09-12-2021 04:21	JSON File
Hair Color	09-12-2021 04:21	JSON File
Hair Color_usersays_en	09-12-2021 04:21	JSON File
Happy to hear	09-12-2021 04:21	JSON File
Happy to hear_usersays_en	09-12-2021 04:21	JSON File
I have no friends - no	09-12-2021 04:21	JSON File
I have no friends - no_usersays_en	09-12-2021 04:21	JSON File

3.2 Data Preparation

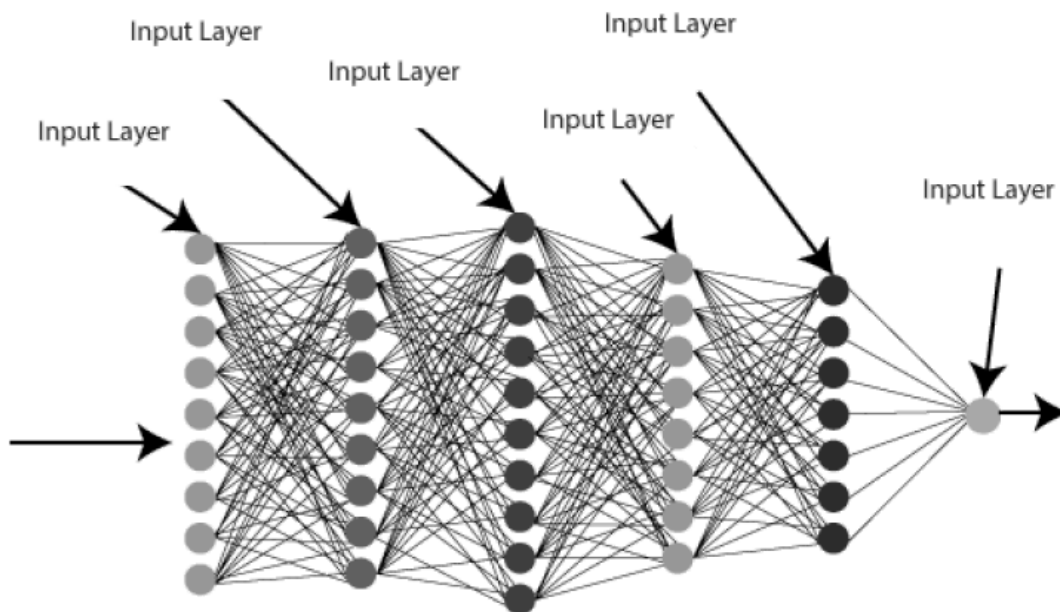
Because this is a simple chatbot, there is no need to gather or download any significant datasets. To train the model, a unique dataset is developed. Before this dataset can be trained, the intentions must be understood. The needed data is taken from the json file that has been loaded in the previous step. The data is then split into two parts: one contains all of the training data (which are example messages for each intent category), and the other contains all of the target labels that match to each training data.

LabelEncoder is used to transform the target labels into a format that the model can comprehend. The user-built Tokenizer class vectorizes the text data corpus. By default, this class eliminates all punctuation, converting the texts into space-separated word sequences, which are then divided into token lists. They'll be indexed or vectorized after that. Another option is introduced to handle words that are out of vocabulary words (tokens) at the moment of inference. Another user-created method is included to ensure that all of the training text sequences have the same size.



3.3 Model Training

The suggested model's neural network architecture is then specified, with Keras' "Sequential" model class being employed. Softmax was employed as the activation function.

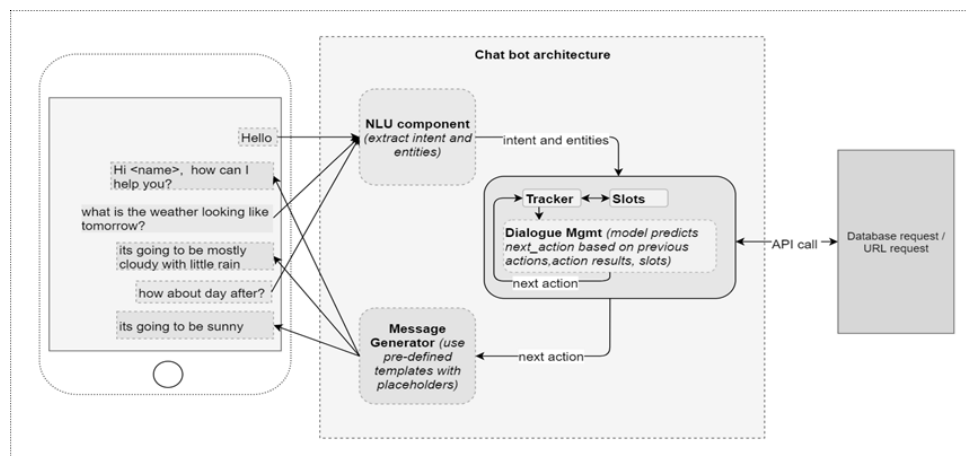


Keras Neural Network Sequential Model

The model has trained via extensive training. It is preferable to dump all needed files after training so that they may be used during inference. So that the trained model, the fitted tokenizer and the encoder object are all saved.

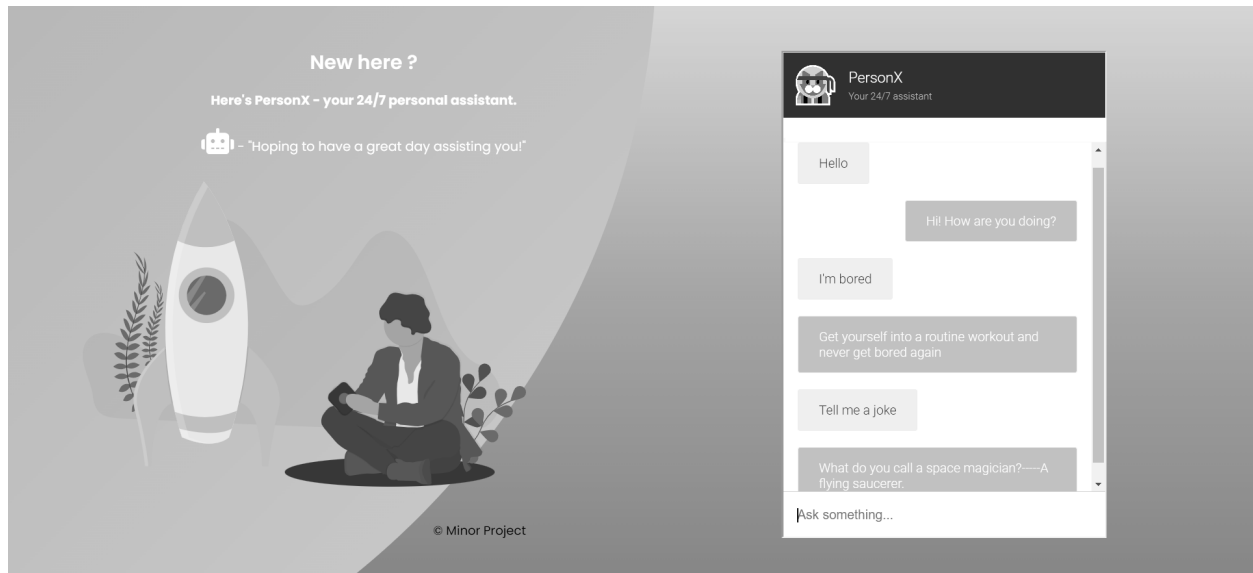
3.4 Model Testing with real-time query

When a new user message is received, the chatbot computes the similarity of the new text sequence to the training data. Taking into account the confidence scores obtained for each category, it assigns the user message to the intent with the greatest confidence level.



3.5. Creating the backend and front-end and integrating it with the backend

Now that the Deep Learning component has been done, the front-end is built with HTML, CSS, and Bootstrap, while the backend is built with Flask. As a result, the end-to-end project is now completed and is given the shape of a web application.



4. Conclusion

This is a chore that will be mechanised for 24 hours a day, eliminating people's loneliness and providing them with a talking agent to converse with. The performance may be enhanced further by employing emoji-based responses, additional deep learning models, or a different pre-built chatbot framework.

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