Conversational AI Chatbot for HealthCare

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Abstract. Health is a state of total physical, mental, and social wellbeing. chatbots have been applied to this industry frequently and in a variety ofways in the past, there is still room for more inventive uses. Healthcareconversational AI use cases are flexible and may be tailored to the industry. Patients might use them to gain additional knowledge about their disease, the therapies that are available, or even their insurance coverage. Because research has shown that healthcare chatbots can improve patient satisfaction and significantly reduce wait times, many healthcare organisations are considering incorporating them into their operations. Chatbots for healthcare can be used for a number of purposes, such as monitoring, anonymity, personalization, in-person involvement, and more. In this case study, the user's input on the patient's symptoms will be used to determine the patient's likely ailment type. According on the type of sickness, precautions will be suggested, and the patient will be sent to a doctor who specialises in that field. A sequential model was utilised to extract the text's symptoms, and the KNN method was then applied to predict the patient's ailment type.[1]

1 Introduction

By responding to user-submitted queries, the major objective is to bridge the communication gap between patients and healthcare providers. Internet addiction is more common than ever now, yet self-care is valued less. People sometimes decide against going to the hospital for mild ailments that could easily turn into serious ones. It has been proven that creating question-and-answer forums, as opposed to sifting through a long list of potentially useful web resources, is a successful response to such queries. There are several limitations and shortcomings with the current approaches, two of which are that patients frequently do not receive a prompt answer and must wait a long time for professionals to respond to their demands. With some surgeries, there

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might be a fee.The system develops a convincing Graphical User Interface to give the user the impression that they are conversing with a real person. a chatbot that might be applied to a number of industries, including navigation, healthcare, and education.

2 Literature Survey

Chatbots with AI can evaluate patients and point them in the direction of the best course of action. Compared to chatbots, web searches are thought to be less reliable and accurate. To have a happy life, one must be in great health. However, making a doctor's appointment is getting harder and harder. The goal is to create a medical chatbot that uses AI to suggest physicians that specialise in a particular area.

The user's input inquiry would be synced with the knowledge base by the chatbot. Every query has been associated with the knowledge base of the chatbot. From the input sentence, significant keywords are extracted, and the resemblance of sentences is discovered. Applying the N-gram, TF-IDF, & cosine similarity measures, a keyword's ranking and similarities in sentences are determined[1]. Released the retrieval-polished (RP) response generation technology, which refines a brand-new answer based on a recovered prototype. A prototype selector was specifically used to find a prototype with a similar context. To deliver a polished response, the following step is to develop a generation-based polisher. The recovered answer and the polished reply were then chosen as the final results using a polished response filter.

Extensive testing on a conversational corpus shows that our approach outperforms retrieval-based and gen-based chatbot with regard to of proficiency, contextual relevance, and reply diversity[2].Currently, there are just two fundamental models used in chatbot creation.models that draw on both generating and retrieval processes. End-to-end trainable neural networks, one of the most recent developments in deep learning and artificial intelligence, have swiftly supplanted prior techniques that depended on written instructions, patterns, or statistical techniques. A unique deep neural network-based strategy for building chatbots is suggested in this study. Using this technique, a neural network with numerous layers is built to absorb and comprehend the input[3].

Users can submit health-related problems to medical chatbots thanks to natural language processing, which underpins how they function. The user can utilise the chat-Bot to ask any specific queries they may have concerning their medical care without having to go to the hospital in person. By converting voice to text as well as text to voice using the Google API. The Android app displays a pertinent response after asking a question of the chatbot.This web-based platform was developed by the System primarily to analyse customer sentiment[4].In this work, The chatbot system can answer questions concerning the public sector's services. The framework supports complex dialogues and assists the user by providing tips and hints[5].By answering their questions, the suggested chatbot assists users. In addition to features that were taken from our prepared dataset, The system using an ensemble learning technique called random forest is built.The proposed technique is now operational as a Telegram bot.[6].

In this study, the corpus dataset is used to train the chatbot. In this dataset, 11,292 unique character pairings from 617 distinct movies are interacted with 210,579 times. In order to convert sequences from a single field to course in other and retrieve features from the input text, the chatbot makes use of Bag of Words and the seq2seq model. The developer can avoid manually writing the chatbot's replies by using this method. Because of its innovative design and potent NLP technology, the chatbot can provide the user informed and useful replies. The chatbot's vocabulary may be increased only by adding more text corpora[7].The basic working theory, core concepts, and applications

of artificial intelligence-powered chatbots across a range of industriesincluding telecommunications, This article discusses e-commerce, call centres for customers, banking, and health. Additionally, the results of a sample donation service created for a telecom service provider using the suggested design are shown[8].

In-depth evaluations of some of the newest chatbot systems and articles written in a range of topics are conducted in this article. In order to comprehend the most current developments in the creation of chatbot systems, these recent publications have been evaluated with special attention paid to the type of knowledge offered to these systems, the domain for which these systems have been established, among other characteristics[9].In this workoutline a novel recommendation strategy that primarily relies on a chatbot that is specifically designed and that can be linked with the website Moodle through a web-based setup. A chatbot is an automated communication tool designed to simulate human communication skills and participate in conversations with other people. With the suggested strategy, it should be possible to provide real-time answers to learners' questions and a set of concepts that are applicable to their requirements[10].

The main goal of this post is to showcase Dost, a Rasa-built Telegram chatbot, as a resource for mental health. Before making suggestions for ways to make the user's situation better, it is expected that the system would first try to comprehend the user's difficulties through regular, informal talks. In order to make mental health facilities accessible to everyone, from students to senior residents, and to provide round-the-clock assistance in the absence of physicians, chatbots will play a critical role in the future of healthcare[11].This study differs from others in that it uses the Chabot platform to give virtual training in a health enterprise context. The purpose of internal training is to increase the knowledge and skills of the employees so that the health organisation can accomplish its goals.Because there are numerous factors to take into account when choosing between various Chatbot platforms, this study suggests the Fuzzy Analytic Hierarchy Process as a remedy.

Finally, it is advised that the business conduct internal training using the Carik platform[12].This study is unique from others in that it conducts virtual training for a health organisation using the Chabot platform. Internal training's goal is to improve staff members' knowledge and abilities so that the health organisation can achieve its objectives.This study recommends the Fuzzy Analytic Hierarchy Process as a solution because there are many things to consider while deciding between different Chatbot systems. Finally, it is advised that the company use the Carik platform for internal training[13].A chatbot that would routinely evaluate senior folks' health proposed. In order to construct personal health records (PHR), the data from the elderly is gathered. Conversational chatbots are created to engage with seniors using the LINE platform. Doctors may more correctly diagnose illnesses and offer treatments thanks to the results of this study, which they can use after analysing daily PHR. Additionally, the geriatric blood pressure trend was tracked using the linear regression technique[14].

In this study, Machine learning methods to use characteristics to predict cardiovascular disease is suggested. One of the factors which are focused on for prediction was BMI. For predicting cardiovascular disease, BMI is crucial. The paper's primary discussion points are BMI and the prognosis of cardiovascular disease. It has been proposed that the model make use of a variety of attributes as well as regression and classification techniques[15].

Today, chatbots can do a variety of tasks with the least amount of waiting time and expense, including reducing agent transfers, speeding up issue resolution, enhancing self-service, etc. Other chatbots are now able to carry out prediction tasks thanks to developments in AI and data mining methods, especially in the medical sector.The

purpose of this study is to assess the usefulness of the existing chatbots in terms of platforms as well algorithms to instruments, and software, thereby among other factors[16].In this post, we'll show you how to create an intelligent chatbot that can handle issues unique to this area of expertise.

It plays the part of a teacher, offering direction and teaching the student problem-solving strategies. This programme might keep the student interested by using a chatbot to answer questions. Our system's tutoring is an identical replica of the instruction teachers provide their pupils[17].This project investigates the concept and creation of a chatbot with sophisticated voice recognition. To illustrate how the recommended architecture, which would allow such a bot (a Web service), to operate, the article gives a technical exampleThe Web service employs a "black box" strategy by managing the communication path from and to the Web service, yet it continues to enables various client types to communicate with the server side from any platform. The built-in interface of the service makes parsing XML simple, and because it is extensible, its useful life is extended[18].

For the study, after lookingat number of publications and discussed the various types of chatbots, their advantages, and disadvantages. The analysis resulted to the conclusion that chatbots could be employed anywhere due to their precision, absence of reliance on human resources, and accessibility around-the-clock[19].The goal of this project is to create a chatbot that students may use to interact with and ask questions via the college website. Using text and/or voice, chatbots are pieces of computer software that mimic real-world discussions.

Chatbots may mimic human speech using AI. Humans react to other people based on their emotions and mood. Contrarily, chatbots are constrained by a set of standards, making it feasible for them to offer a client proper and polite service. Students may ask the chatbot a question at any time of day, and they will receive a prompt response. At any time of day, thousands of individuals can converse with chatbots at once[20].

3 System Architecture

The term "architecture" refers to the conceptual representation of a system's structure, behaviour, and other characteristics. A formal description and representation of a system designed to make it simpler to reason about its operations and structures is known as an architectural description.

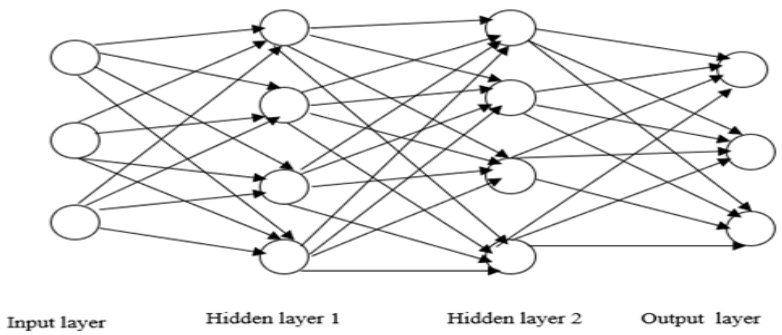

Fig. 1. Architecture diagram of a Sequential Model

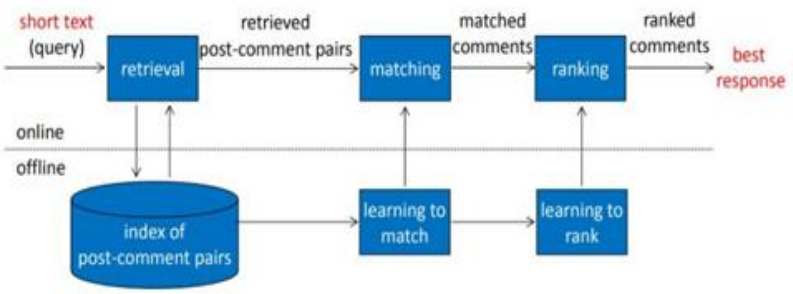

Fig. 2. System Architecture

4 Methodologies

4.1 Dataset

The dataset is in the JSON file type and contains intent and tags. The purpose specifies the specific illness, and the tag for each ailment has a number of inquiry types.

This dataset consists of two parameters

1. Text

2. Symptoms

This dataset is mostly used to identify symptoms in text.

```
{
    "intents": [
        {
            "tag": "abdominal_pain",
            "patterns": [
                "I have abdominal pain",
                "My abdomen hurts",
                "I have pain in stomach",
                "I feel pain in abdomen"
            ]
        },
        {
            "tag": "abnormal_menstruation",
            "patterns": [
                "I have a heavy period",
                "Heavy flow on my period",
                "Period lasts longer than usual",
                "My period is really painful",
                "I have strong menstrual pain",
                "Menstrual cramps are strong"
            ]
        },
        {
            "tag": "acidity",
            "patterns": [
                "I have acid reflux",
                "I have acidity problems",
                "I have heartburn"
            ]
        },
        {
            "tag": "acute_liver_failure",
            "patterns": [
                "My liver hurts",
                "I have pain around liver",
                "Upper right abdomen hurts"
            ]
        },
        {
            "tag": "altered_sensorium"
```

Fig. 3. Sample Dataset for training data

```
# synthetic dataset created for neural network validation
xy_test = [
    (['ca', "n't", 'think', 'straight'], 'altered_sensorium'),
    (['suffer', 'from', 'anxeity'], 'anxiety'),
    (['suffer', 'from', 'anxeity'], 'anxiety'),
    (['bloody', 'poop'], 'bloody_stool'),
    (['blurred', 'vision'], 'blurred_and_distorted_vision'),
    (['ca', "n't", 'breathe'], 'breathlessness'),
    (['Yellow', 'liquid', 'pimple'], 'yellow_crust_ooze'),
    (['lost', 'weight'], 'weight_loss'),
    (['side', 'weaker'], 'weakness_of_one_body_side'),
    (['watering', 'eyes'], 'watering_from_eyes'),
    (['brief', 'blindness'], 'visual_disturbances'),
    (['throat', 'hurts'], 'throat_irritation'),
    (['extremities', 'swelling'], 'swollen_extremeties'),
    (['swollen', 'lymph', 'nodes'], 'swelled_lymph_nodes'),
    (['dark', 'under', 'eyes'], 'sunken_eyes'),
    (['stomach', 'blood'], 'stomach_bleeding'),
    (['blood', 'urine'], 'spotting_urination'),
    (['sinuses', 'hurt'], 'sinus_pressure'),
    (['watery', 'from', 'nose'], 'runny_nose'),
    (['have', 'to', 'move'], 'restlessness'),
    (['red', 'patches', 'body'], 'red_spots_over_body'),
    (['sneeze'], 'continuous_sneezing'),
    (['coughing'], 'cough'),
    (['skin', 'patches'], 'dischromic_patches'),
    (['skin', 'bruised'], 'bruising'),
    (['burning', 'pee'], 'burning_micturition'),
    (['hurts', 'pee'], 'burning_micturition'),
    (['Burning', 'sensation'], 'burning_micturition'),
```

Fig. 4. Sample test Dataset

Finally, using this information, able to determine the type of sickness from the symptoms and present warnings and a description for that particular ailment. Additionally, it recommends a doctor who specialises in treating that illness.

4.2 Algorithm

4.2.1 KNN Algorithm

Decision trees are used in the gradient boosting technique known as XGBoost. In comparison to other algorithms or frameworks, artificial neural networks performed better in prediction tests utilising unstructured input (images, text, etc.). On the other hand, decision tree-based algorithms now maintain the top spot for small to medium-sized structured/tabular data. The use of XGBoost facilitates execution speed and model execution.The XGBoost programme is used to create gradient boosting decision tree approaches. When had a lot of observations, it may be utilised. Additionally, when the data contains both category and numerical information. The K-nearest neighbours (KNN) method predicts the values of new datapoints using "feature similarity," further demonstrating that the new data point will be given a value depending on how closely it resembles the points in the training set..The Euclidean metric must be used for measuring distances.

$$d(x,x') = sqrt(pow((x_1-x_1'),2)+.....+pow((x_n-x_n'),2)) \quad (1)$$

The class having the greatest probability is then finally given the input x.

$$P(y = j|X = x) = \frac{1}{k} \sum I(y^{(i)} = j) \text{ where } i€A \qquad (2)$$

The process will be the same as for regression, except that the target value will be used to determine the seek out value for the concealed datapoint rather than the neighbouring classes. You can use the average, mean, or any other appropriate function to calculate the desired value.

4.2.2 Sequential Model

Sequence models are machine learning techniques that allow for the input or output of data in sequences. Sequential data includes text streams, audio clips, video footage, time-series data, and more. In sequence models, the method referred to as recurrent neural networks (RNNs) is frequently utilised.

4.2.3 Work Flow

ChatBot

1. The dataset is in json format. Patterns and tags exist. The tags correspond to diseases, and the pattern outlines the kinds of questions that will be answered for each tag.
2. Importing the required libraries is the initial step in creating the retrieval-based chatbot.
3. Now, the dataset is added.
4. The preprocessing steps will include tokenization (splitting the input into tokens), lemmatization (removal of the endings of the words to return the base word, also known as a lemma), and the elimination of unnecessary symbols.
5. Make list tags for the terms three, X, and all.Although Tag contains all tags and X contains both the pattern and its tag as well as all patterns, All words contains all of the various word types that are present in the text.
6. Sort the words and tag alphabetically before putting them in a pickle file.
7. Then turn the X into a bag of words using the all words, tag list. (If the term appears in every word or tag, give it a 1; otherwise, give it a 0.)
8. Separate the X into its y and x (from start to end-1) components (end)
9. Use Sequential, Dense to modify the dropout layer. Construct the model. Change the epoch value to get the highest level of accuracy possible.
10. Keep the design
11. Accept the categorization and then make a fresh observation or assertion.

Disease Prediction

12. dataset is made up of CSV documents.
13. where the type of the disease is listed in the first column and its symptoms are listed in the following columns.
14. The dataset should be adjusted such that the 0/1s are in the rows and the symptoms are in the column.Columns with independent variables are placed after the dependent variable in the figure.
15. Assemble training and testing datasets.
16. Train the model using the KNN method.
17. Compare the results of the y test to your expectations. to ensure the truth.

Website

18. A user looks through a webpage.
19. The user enters words to describe their problems.
20. After accepting the string, then do preprocessing on it by deleting any extraneous symbols, tokenizing (dissolving the string into tokens), lemmatizing (removing the word's ending to reveal the underlying word, also known as a lemma), and merging the outcomes into a test list.
21. After that, create a bag of words from the test list using the entire word list. If a word appears in every word, it receives a 1, otherwise it receives a 0.
22. Forecast the class tag using the RNN model, then add the predicted tag to a list of symptoms.
23. Click Done when the user has finished entering.

4.2.4 Evaluation

After the Sequential and Knn model is constructed, the models are assessed using the Precision and Recall measures.

Recall : The system's ability to deliver all the relevant items.

Recall = DIV(no.of relevant items retrived, no.of relevant items in collection) (3)

Precision **:** The system's ability to deliver only relevant items.
Precision = DIV(no.of relevant items retrived, total no.of items retrieved) (4)

F1 Score: The harmonic mean of recall and accuracy is used to get the F1 score.
F1 score = 2*(DIV((Precision*Recall), (Precision+Recall))) (5)

5 Experimental Results And Discussions

```
sentence = "My head hurts"
array([1.19330562e-05, 4.34156050e-07, 3.85600814e-08, 1.04980045e-05,
       1.53186647e-05, 2.04953508e-07, 1.16050721e-03, 3.57316130e-05,
       2.26885386e-05, 8.27601252e-05, 1.02278955e-06, 9.97735441e-08,
       1.40030068e-07, 1.86780289e-06, 2.43614522e-07, 3.54917908e-08,
       2.78845761e-07, 1.13804936e-06, 1.01995215e-06, 4.61822736e-07,
       1.54221880e-08, 7.46847263e-07, 1.07688970e-06, 1.02285740e-05,
       2.24895702e-09, 5.63473634e-07, 7.14551834e-06, 3.27421446e-07,
[{'intent': 'headache', 'probability': '0.995122'}]
```

Fig. 5. Extraction of symptoms from the given text data.

```
symptoms = ['headache']
```

```
Hypertension
```

Fig. 6. Prediction of the type of disease based on symptoms.

Hypertension (HTN or HT), also known as high blood pressure (HBP), is a long-term medical condition in which the blood pressure in the arteries is persistently elevated. High blood pressure typically does not cause symptoms.

Fig. 7. Description of the disease.

Table 1. Comparision of Algorithms

	Accuracy	precision	F2_score	recall
Sequential(RNN)	96	94	90	92
Random Forest	88	83	85	82
Decision Tree	79	75	72	76
KNN	70	68	69	64

Fig. 8. GUI Result.

8 Conclusion And Future Enhancements

The conclusion is that the equipment in this situation achieves the desired results as a result of our examination. To obtain better and more reliable results, and make use of a dataset that is enough for sickness prediction. Additionally, a platform was created that hospitals and other healthcare organisations can use to respond to inquiries and provide information about nearby providers. The interaction between a machine and a user is made feasible via NLP. Therefore, based on chatbot results, disease may be predicted using the KNN algorithm. The user may discover more about their illness and the medical professionals who specialised in it. The use of speech and facial recognition by counsellors to forge closer connections with patients will be replicated by future technologies.

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