Artificial Intelligent based Medical Chatbot

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***Abstract*— When people fall ill they usually get appointments with doctors, who diagnose the disease and give vital treatments. People with chronic diseases also have the need to visit their doctors at regular intervals. Sometimes people may find it difficult to visit a hospital or consult a doctor, and situations like the pandemic are inevitable. This study intends to enhance the existing medical chatbot and compare the current algorithms used in a basic chatbot. In order to build a chatbot, this paper contemplates the use of the RASAframework. Certain questions regarding the current situation of illness are asked to the user. The User's symptoms are takenas input in the form of either text or voice and processed by Google API. The bot will perform specific algorithms and predict the most suitable treatment. At serious cases the bot will recommend doctor left with patient's choice of treatment. This study will help other budding developers to get a better idea of this framework.**

Keywords— Artificial intelligence, Natural language processing, Support Vector Machine (SVM), RASA framework

I. INTRODUCTION

As the famous saying states "Health is wealth", leading a healthy lifestyle is of utmost importance for a successful life and inner peace. As we know, sometimes we may find it difficult to visit a doctor every time and tend to compromise things. This may lead to severe health issues and may even be fatal. To prevent such situations and quickly get remediesto our health issues many researchers have proposed various medical chatbots that take several inputs from the user regarding their current situation. These are processed by Google API [5]. Natural Language Processing (NLP) is the main module that plays a crucial role in communication between the user and the chatbot [13]. Questions concerning health issues faced by the user are asked by the chatbot [3]. In NLP, the decision-making engine is connected to MySQL which contains disease-symptom data stored within it for diagnosing the disease that the user might be affected with. They search for the list of diseases in the database that matches the mentioned symptoms and diagnose the disease via the Support Vector Machine to process the data [2]. And also the severity of the disease is recognized by the chatbot. If the severity is high then the chatbots will advise the users to contact a doctor. The chatbot would even get an appointment with the particular domain doctor. At times the application recommends some homemade remedies and herbs for minor seasonal diseases [22]. Usually, chats and phone calls help the patient to be connected with the doctor via the application. After all, the consultation fees of the doctor will be processed. The GSM works in the backend by connecting their bank account with the chatbot from its transaction server to the payment server. The payment credentials are intimated to the user via SMS. This study aims to bring out the most efficient algorithm which suits the RASA framework.

II. LITERATURE REVIEW

At present, health plays a huge role in the development of every sector all over the world. Traditional methods of diagnosing the disease are a great hindrance and Medical chatbot helps to overcome this issue. Chatbots interact with the user by getting the query as input in natural language and give an effective solution. Chatbots are capable of replacing humans in the field of medicine. These bots decrease medical expenses and consume much less time and money. This literature review consists of the past review and the forms of emerging chatbots. Isn't it wonderful that an artificial program can communicate with a crew? Alan Turing proposed a test to examine it and it is named as turning test which determines the ability of a computer to actlike humans. Some of the past works of chatbots include Eliza, Parry and Alice. K-Bot is a medical chatbot that deals only with Asthma so it lagged to treat other diseases.

This paper consists of pieces of information satisfying the needs of the consumer and clearing doubts about their health issues. Question and answering systems are managed by virtue of Natural language processing. The plain text is used as input and the answers are given by the qualified application as output [4]. The purpose of it is to give a clear solution to the query. This paper recognizes the reality in texts and the software built analyses messages of the application. Admin gives input to the machine which identifies the text and gives results responding to the query. Typically, datasets stored in MySQL are used for testing purposes. MySQL is used at the point of symptom-matching operation. If the query does match the symptom, then the query will be remodelled and the input sentence is divided into two parts or Glove vectors [2]. By predicting the disease based on the given input, we can find out the problem and give the solution. It is found with the help of Artificial Intelligence [24]. The Chatbot is generally developed using AIML(Artificial Intelligent Markup Language) and Google API voice synthesizer identifies the input text given by the user and NPL is used for understanding and analyzing. Chatbot's API recognizes the voice query and speech synthesis for text-to-speech and speech-to-text so that the users can feel better satisfaction by using the application [25].Below mentioned are some past works in the field of medical chatbots.

A. Past works

- ELIZA(1966):It is a miniature of a psychotherapist's operation and it processes the user's sentence in an interrogative structure. It uses pattern matching. The drawback faced by Eliza was its limited ability to communicate and it cannot respond to long queries and it cannot discover or learn from a discussion.
- PARRY(1972):Parry has a better structure and responds to emotions through the change ofarticulations. The drawbacks faced by parry are they had low capabilities to understand language and are time-consuming as the speed of response is slow.
- ALICE(1995):Alice works on pattern matching, butit lacked intelligent features and can't respond to emotions like humans.
- FLORENCE(2017):Florence acts as a medical assistant which gives reminders to take the medications provided. Recently a new function is added to it which acts as a dictionary that consists of diseases and their symptoms.
- Dr.A.I(2021):Doctor.A.I is an application of HealthTap that checks on the symptoms with the help of artificial intelligence. It consists of Telemedicine consultations.
- BABYLON HEALTH(2013):Babylon health gives instant diagnosis by getting the health status and at last, it locates us to the nearby hospital or books an online consultation.
- MELODY(2016):Melody was developed by Baidu research laboratories where this chatbot is a part of their medical application. This acts as a platform to meet doctors by knowing the scale of theirsymptoms to diagnose it earlier. The limitation is itis available only in English and it doesn't provide any other management services

B. Present works

- KBOT(2019):Knowledge-enabled personalized Chatbot for Asthma Self-Management.

  Authors:DipeshKadariya,Revathy Venkataramanan, Hong Yung Yip,Maninder Kalra, Krishnaprasad Thirunarayanan

  Narration: It is designed for the use of Asthmapatients and to help them by connecting them to doctors whenever needed.

- PATHBOT(2019):An Intelligent Chatbot for Guiding Visitors Locating Venues

  Authors: Katlego Mabunda and Abejide Ade-Ibijola

  Narration: It is a navigation tool for students and visitors inside the campus and the major drawback was it can't help if the user is lost due to network issues.

- SPEECH RECOGNITION USING DEEP NEURAL NETWORKS(2019)

  Authors: Ali Bou Nassif, Ismail Shahin, Mtinan Attili, Mohammad Azzeh, and Khaled Shaalan

  Narration: Automatic speech recognition recognizesthe words and phrases in an arrant language and changes them into machine language. It lags in accent recognition and the difference between the two languages.

- COVID – 19 : DEEP LEARNING APPLICATION (2019)

  Author: Connor Shorten, Taghi M Khoshgoftaarand Borko Furht.

  Narration: It is a survey that investigates the uses ofdeep learning and guides future research toward COVID-19. Functionality, notion metrics, and data privacy were the list of challenges faced by this module.

III. SYSTEM ARCHITECTURE

The chatbot helps the user to acquire knowledge about their health condition. The User can know about theirhealth issues by Artificial intelligence used in the bot. Artificial intelligence in the bot consists of many modules starting from the bot's API to the diagnosis of the disease. The main principle used in the bot is Artificial intelligence prediction. The chatbot is something that gives the gist or complete information of any medical reference which is useful for everybody to learn about their health. The people using the chatbot feel like they are embracing their health insuch a way they can lead a healthy lifestyle. The main postulation of this chatbot is the communication between thepatient and the bot. The patients are impetrated to submit their discomfort or queries regarding their health. The main desire for developing the chatbot is to connect with the patients to know about the hassle which are faced by them and to give the rigorous solution for the problem. This givesthe apt solution for a healthy lifestyle. Nowadays, people do not understand the importance of a healthy lifestyle. Some people contemplate the symptoms and some do not. This type of condition may cause severe health issues. The old chatbot does not disclose all the diseases and they are not updated to the current scenario. The bot does not require human intrusion. The functioning of the system follows:

A. Logging into Chatbot application

Chatbot's API interconnects the user and the chatbot application by signing in the user. The user is logged into the application and can give voice/text input which is then transferred to the bot's API.

B. Interrogative segment

The user can ask questions about their health or any difficulties faced by them. The queries can be lodged as either text or voice. The bot's API decodes the question and extracts answers for the user under natural language processing. Implementation of tokenization, word segmentation, stemming, and lemmatization, semantic reasoning by the NLTK libraries reaches the logical conclusion for the user's given query.

C. Diagnosing symptoms

MySQL database is preferred to store the disease-symptom data which is later used to match with the user's health-related symptoms for diagnosing the disease. The chatbot is made with all the symptoms stored in the database server. NLP, consisting of database requests, leads the application to enter into the database server and coordinates the symptoms, and diagnoses the disease by artificial intelligence of the bot's application.

D. *Need for doctor*

User's disease is diagnosed by the bot's AI and perceives the condition of the disease . If the condition is not serious, the chatbot suggests some medicine to cure the disease . If the disease condition of the user is serious it suggests the doctor who has to be consulted immediately and is left with the patient's choice of treatment.

E. *Chatbot prescribing medicine*

The chatbot prescribes medicine by analyzing the patient's symptoms. If it is not in serious condition the bot itself recommends the medicines stored in the database. They can even follow some home remedies and siddha herbs which cures the disease.Artificial intelligence of thechatbot plays a major role at this stage of prescribing medicine from the database server of MySQL and uses Support vector machine, KNN and decision tree algorithm for diagnosing the disease of the user

F. *Payment*

Global System for Mobile Communication (GSM) takes care of paying consultation fees to the doctor with a GSM number. Using the predefined keyword of GSM it generates a GSM number and informs the consumer about transactionsto be made in the format of sending the text. The transactionis itemized on the doctor's phone. The chatbot and the GSM operators simply provide an alternative payment method between the user and the doctor.

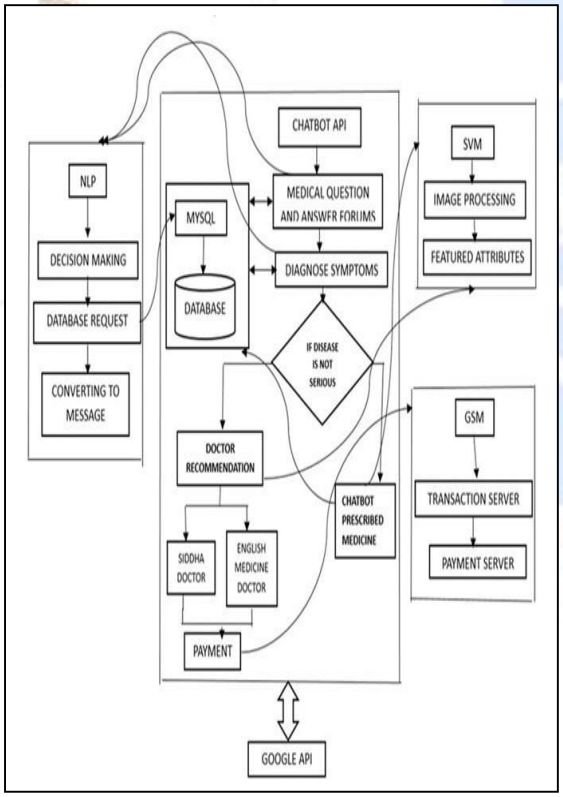


Figure 1: System Architecture of A.I based medical chatbot

IV. METHODOLOGY

A. *PRINCIPLE OF RASA NLU*

Keeping in mind the understanding of chatbot language and AI assistants the RASA is built in such a way that it focuses on intent classification and entity extraction. The pipeline called "spacy_sklearn" consists of various components from NLP libraries like spaCy,sci-kit-learn and sklearn-crfsuite. These components are vital for analyzing messages.The three Basic principles involved in this process are:

1) The "tokenizer_spacy" component uses spaCy, whichis an NLP written in Python and Cython, to induce tokenization and annotation of Parts of Speech(POS).In spaCy, containers are used to store word vectors, lexical attributes and strings.

2) A whole sentence is formulated by concatenating the GloVe vectors extracted from a token. Support Vector Machine (SVM) are typically trained with the help of these and uses the "intent_classifier_sklearn" component to detect the user's intentions.

3) Extraction of entities from training data is performed by using Conditional Random Field(CRF) provided by the "ner_crf" component. If it is an undirected Markov chain, then CRFs use words as the time steps and entity classes as the states. The intent classifier is trained using sci-kit-learn whereas the entity extractor is instructed using.
the sklearn- crfsuite library.

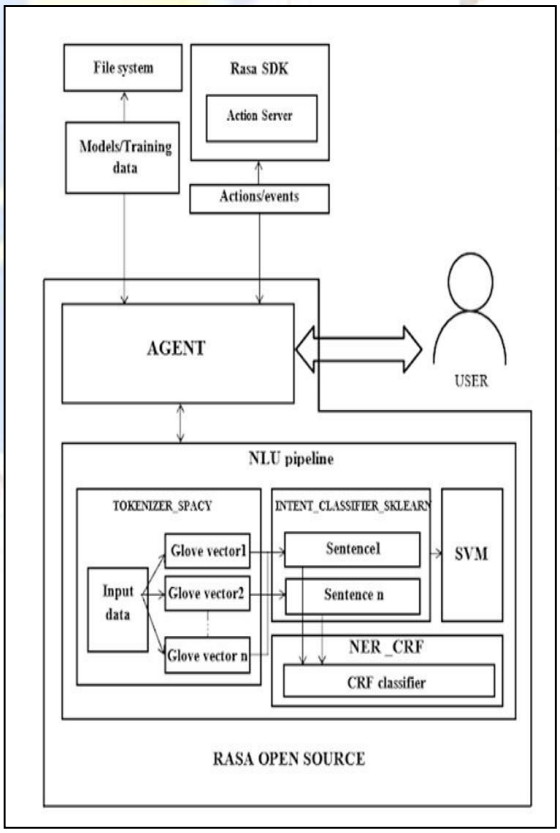


Figure 2 : Data flow architecture diagram of Rasa NLU

B. *RASA Architecture*

When Rasa receives a message from user ,Rasa NLU tries to extract and predict the "intents" and "entities" in the message.The rasa stack performs action/utter as soon as the user's intent is identified.The action to be done after that is handled by Rasa Core.

C. *Support Vector Machine(SVM) algorithm*

SVM is one among classifiers that can distinguish two classes[20].SVM training algorithm developed a model that classifies the test image with respect to the classes.In SVM,the cost of computation is very high in spite of using single pose(frontal) detection.

D. *NLP(Natural language Processing)*

Humans give input to NLP and their speech is processed using certain programming languages to give accurate output. NLP makes the user ask queries as human language is not accurate and does not include a lot of compositevariables [25]. From the user's query, the NLP understands important elements that relate to a particular data set and formats the answer [13]. MYSQL contains every disease's symptoms and treatments to it the main task of NLP is recognizing the meaning of the user's query and matching it with the data of MYSQL. Porter streaming algorithm works by discarding words of a user's text/speech and taking only related words stored in a database with inflectional endings of user input.

E. *KNN (K NEAREST NEIGHBOUR) and Decision Tree*

KNN and decision tree are the two algorithms that train the datasets for testing dataset accuracy based on the input data as a model. The best algorithm is selected at the backend process of the chatbot for generating accurate results. The symptoms are extracted from the user in predicting disease by the algorithm of these two to give accurate results. The highest accuracy result is taken and the symptoms are diagnosed in matching with data in the database and disease is predicted. As per our results, the accuracy of Decision Tree and KNN is 92.6% and 95.74% respectively. Once the classification model is selected, it is applied to the symptoms extracted from the chatbot to predictthe disease of the patient.

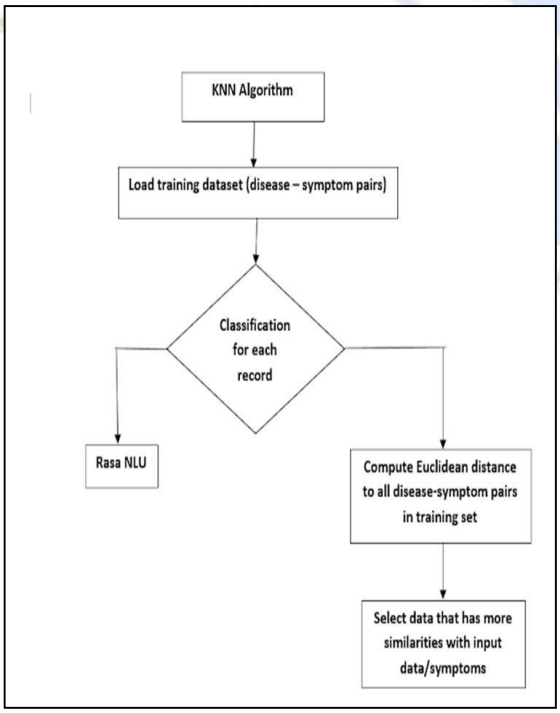


Figure 3 :Working of KNN algorithm

F. *GSM operator*

Global System for Mobile Communication (GSM) number as a short code sends a text to the doctor with information regarding the transaction[19]. The bank alerts the doctor about a transaction that is about to happen by the short code i.e the GSM number. The GSM number is aggregated for the transaction and is itemized in the user's mobile, then the total balance is provided after the transaction. In GSM, the aggregator distributes the payment by linking the bank account of the user and the doctor. Then it performs a safe transaction from the user's bank accountto the doctor's bank account by any means of an online payment method. Thus the doctor's consultation fee in an online payment method is processed by the chatbot.

V. CONCLUSION

There are many chatbots related to our domain in medicine. However, there are only some chatbots that are out in the market for consumer use.

Maria V. Vasileiou et al. in Research Article the Health ChatBots in Telemedicine: Intelligent Dialog System for Remote Support, have developed a Covid-19 AI model and have performed an analysis on training loss, evaluation loss, learn rate, and duration of that model concerning the number of iterations. The values analysed are mentioned below

Table 1: An analysis on training loss, evaluation loss, learn rate, andduration of Covid-19 AI model [15]

Iter	Training loss	Evaluation loss	Learn rate	Duration (sec)
0	0.3219	0.3239	0.2	2.31
1	0.2598	0.2644	0.4	2.99
2	0.1972	0.2044	0.8	2.37
3	0.1553	0.164	1.6	2.33
4	0.1276	0.1349	3.2	2.65
5	0.1004	0.1041	6.4	2.54
6	0.0741	0.0762	12.8	3.11
7	0.066	0.0626	12.8	2.25
8	0.0587	0.0594	3.2	2.71
9	0.0548	0.0539	6.4	2.66
10	0.0508	0.0518	12.8	2.29
11	0.0471	0.0447	6.4	2.5
12	0.0447	0.044	3.2	2.31
13	0.0428	0.0418	6.4	2.29
14	0.0394	0.0385	12.8	2.68
15	0.035	0.0326	25.6	2.88

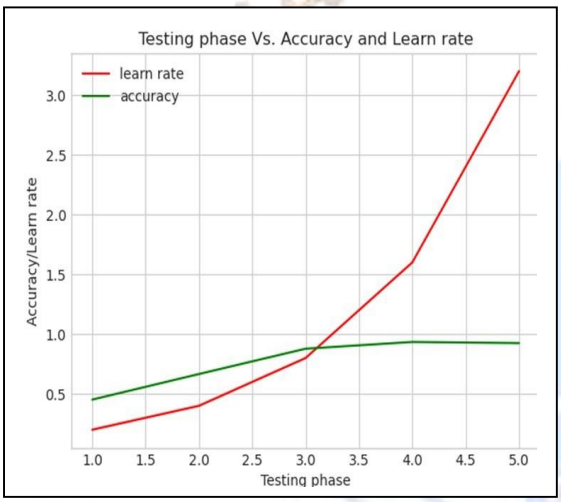
Sanjay Chakraborty et al. in An AI-Based Medical Chatbot Model for Infectious Disease Prediction designed an AI Chat Bot using LSTM for the treatment of Covid SARS virus. The accuracy values of the given model under the testing phase are

Table 2: Accuracy values of the given model under the testing phase ofAI chatbot designed using LSTM [14]

Model	Testing phase	Accuracy (%)
chatbot_model.h5	1	45.2
chatbot_model.h5	2	66.6
chatbot_model.h5	3	87.8
chatbot_model.h5	4	93.45
chatbot_model.h5	5	92.5

Analyzing both models, we can conclude that accuracy gradually steadies with experience whereas the learn rate increases cautiously and adversely affects the accuracy rate.

Figure 4: Testing phase Vs. Accuracy and learn rate



Maria V. Vasileiou et al. in Research Article The Health ChatBots in Telemedicine: Intelligent Dialog System for Remote Support, have calculated the accuracy of various algorithms used in a typical chatbot.

Table 1: Algorithmic model comparison[15]

TABLE 5: Algorithmic model comparison.

Model	MAE	Accuracy	
		Test (%)	Train (%)
Logistic regression	0.18	82	86.7
SVC	0.44	56	100
Naive bayes	0.2	80	87.68
Decision tree	0.22	78	100
Random forest	0.19	81	100

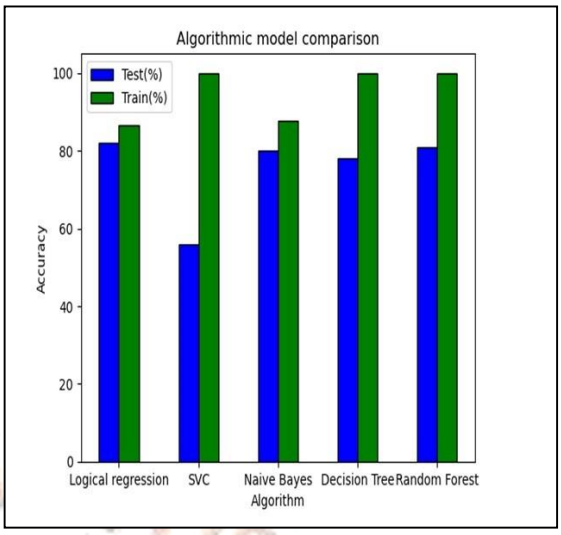


Figure 5: Algorithms Vs. Accuracy

Due to its consistent performance in both the test and train phase, Naive Bayes is considered the best algorithm for chatbots and it attempts to classify text into certain categories so that the chatbot can identify the intent of the user, thereby narrowing down the possible range of responses.

FUTURE SCOPE

The demand for medical robots is increasing rapidly due to their ability to improve precision and accuracy in surgeries, reduce physical demands on healthcare professionals, simplify routine tasks, and aid in assistive andrehabilitation processes. A chatbot is capable of tracking claims, checking existing coverage, and helping in reducing medical insurance fraud. An artificial intelligent agent provided with the necessary computer vision and robotic control can easily replace a human representative in the medical field. They can be used to detect certain seasonal diseases and assist patients with chronic diseases by scheduling appointments.

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