

Cover Page

Multilingual Chatbot in Healthcare

Project report submitted for
4th Semester Minor Project

in
Department of Machine Learning

By,
Parth Bhandakkar(211010241)
Srijan Ratrey(211020454)



Dr. Shyama Prasad Mukherjee
International Institute of Information Technology, Naya Raipur
(A Joint Initiative of Govt. of Chhattisgarh and NTPC)
Email: iiitnr@iiitnr.ac.in, Tel: (0771) 2474040, Web: www.iiitnr.ac.in

Table of Contents

Title	Page No.
TABLE OF CONTENTS.....	i
LIST OF FIGURES.....	ii
ABSTRACT.....	iii
 CHAPTER 1 INTRODUCTION	 1
CHAPTER 2 LITERATURE REVIEW	1
1. Research Area I	1
2. Research Area II.....	2
3. Research Area III.....	2
4. Challenges.....	2
CHAPTER 3 PROPOSED SOLUTION	2
1. Enhance Natural Language Processing(NLP).....	2
2. Incorporate Clinical Decision Support (CDS)	2
3. Ensure Data Privacy and Security.....	3
4. Use Patient Feedback to Improve the Chatbot.....	3
5. Integrate with Electronic Health Records (EHRs)	3
6. Provide Multilingual Support.....	3
7. Text to Speech feature.....	3
CHAPTER 4 RESULTS	3
1. Training Dataset.....	3
2. Model.....	4
3. Bot GUI	4
CHAPTER 5 CONCLUSIONS	5
REFERENCES	5

List of All Figures

Figure No.	Figure Title	Page Number
3.1	NLP working.....	2
4.1	Training Dataset.....	3
4.2	Preprocessing before training.....	3
4.3	Model used.....	4
4.4	Prototype GUI chatbot.....	4
4.5	Final GUI of chatbot.....	4
4.6	Query for treatment.....	4
4.7	Suggestion for illness.....	5

minor

ORIGINALITY REPORT

11 %
SIMILARITY INDEX

5 %
INTERNET SOURCES

1 %
PUBLICATIONS

10 %
STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Dr. S. P. Mukherjee International Institute of Information Technology (IIIT-NR) Student Paper	5 %
2	Submitted to Cambridge International Examinations (CIE) Student Paper	2 %
3	Submitted to Show Low High School Student Paper	1 %
4	Submitted to RICS School of Built Environment, Amity University Student Paper	1 %
5	Submitted to University of Missouri, Kansas City Student Paper	1 %
6	www.collectionscanada.ca Internet Source	1 %

Exclude quotes Off
Exclude bibliography On

Exclude matches Off

Multilingual Chatbot in Healthcare

Abstract

This project uses natural language processing (NLP) techniques to develop a chatbot for the web. A chatbot is able to understand user queries and respond to them in a conversational manner, providing a more personalized and efficient experience for website visitors. The chatbot is trained on a dataset of frequently asked questions and uses techniques such as tokenization, sentiment analysis, and intent classification to understand and respond to user input. The ultimate goal of this project is to improve the user experience on the site by providing quick and accurate answers to common questions.

Index

Terms—preprocessing, hyperparameters, *lemmatizer*

I. INTRODUCTION

A chatbot is a software application used to conduct an online chat conversation via text or text-to-speech, instead of providing direct contact with a live human agent. Chatbots are computer programs that are able to maintain a conversation with a user in natural language, understand their intent and respond based on pre-set rules and data. Designed to convincingly simulate

the way a human would behave as a conversational partner, chatbot systems typically require constant tweaking and testing, with many people in production unable to converse adequately; in 2012, none of them passed the standard Turing test.

Chatbots are used in dialog systems for a variety of purposes, including customer service, routing requests, or gathering information. While some chatbot applications use extensive

others simply search for general keywords and generate answers using common phrases obtained from an associated library or database.

Most chatbots are accessed online through website pop-ups or via virtual assistants. They can be divided into usage categories that include: business (e-commerce via chat), education, entertainment, finance, health, news and productivity.

II. LITERATURE REVIEW

Chatbots, also known as conversational agents or virtual assistants, have become increasingly popular in the medical field in recent years. They are designed to mimic human conversation and allow patients to communicate with healthcare providers in a more natural and efficient way. The following literature review provides an overview of recent studies on the use of chatbots in the medical field.

A. Research Area I

One of the most promising areas for the use of chatbots is mental health. A study by Fitzpatrick et al. (2020) evaluated the effectiveness of a chatbot in individuals with anxiety and depression. The study found that the chatbot was also able to significantly reduce symptoms of anxiety and depression

to improve overall mental health and well-being.

B. Research Area II

Another study by Yaghoubzadeh et al. (2019) evaluated the use of a chatbot in patients with chronic diseases such as diabetes and hypertension. The study found that the chatbot was effective in improving patient self-management, reducing hospitalizations and increasing patient satisfaction.

C. Research Area III

Chatbots are also used in patient education and health promotion. A study by Sharma et al. (2020) evaluated the effectiveness of a chatbot for promoting healthy behavior in individuals at risk of cardiovascular disease. The study found that the chatbot was effective in increasing knowledge and awareness of cardiovascular risk factors as well as promoting healthy lifestyles.

In addition to patient care, chatbots have also been used for medical education and training. A study by Al-Ta'ar et al. (2020) evaluated the effectiveness of a chatbot for medical students in learning about clinical decision making. The study found that the chatbot was effective in improving students' clinical decision-making and knowledge retention skills.

D. Challenges

However, there are also concerns about the use of chatbots in healthcare. One of the main concerns is patient privacy and confidentiality. A study by Abbasi et al. (2021) emphasized the importance of ensuring that chatbots comply with privacy regulations and that patients are aware of the risks and benefits of using them. Also, chatbots need to be trained

and built in different native languages so that users can easily access them.

Overall, the literature suggests that chatbots have the potential to improve patient care, education, and training in the medical field. However, further research is needed to fully understand their effectiveness and to address any privacy and confidentiality concerns.

.III. PROPOSED SOLUTION

Some key troubleshooting steps are as follows

A. Enhancing Natural Language Processing (NLP)

Natural language processing is the core technology behind chatbots. Improving NLP can make a chatbot conversational and effective. Advanced machine learning techniques such as deep learning and neural networks can be used to enhance NLP.

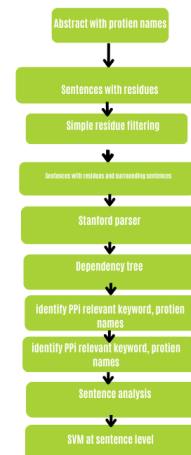


Fig 3.1

B. Incorporate Clinical Decision Support (CDS)

CDS can help chatbots provide more personalized recommendations to patients. For example, the chatbot can suggest different treatment options based on the patient's medical history and symptoms.

C. Ensure Data Privacy and Security

Healthcare data is sensitive and should be treated with utmost care. The chatbot should comply with HIPAA regulations and ensure that patient data is protected.

Enhancements Done

A. Use Patient Feedback to Improve the Chatbot

Collecting patient feedback can help identify areas of improvement for the chatbot. This feedback can be used to train the chatbot and enhance its effectiveness.

B. Integrate with Electronic Health Records (EHRs)

Integrating the chatbot with EHRs can provide more accurate and personalized recommendations. The chatbot can access the patient's medical history and provide tailored advice based on that information.

C. Provide Multilingual Support

Healthcare is a global issue, and chatbots should be able to communicate in different languages to be accessible to patients worldwide.

D. Text to Speech(TTS) Feature

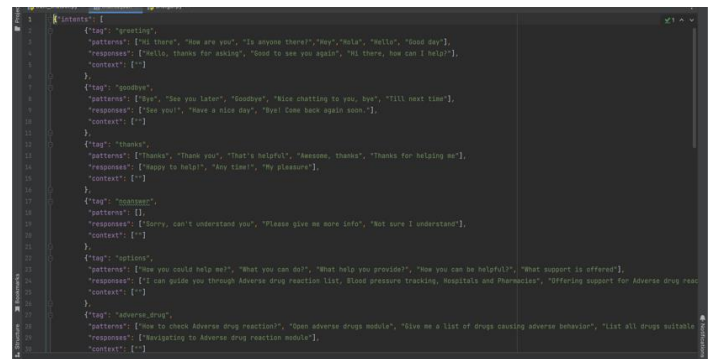
It is a technology that enables computers and digital devices to speak aloud text-based content in a natural-sounding voice. TTS technology is used in a wide variety of applications, including assistive technology for people with disabilities, language learning tools, and speech-enabled interfaces for smart home devices.

IV. RESULTS

We have managed to achieve training dataset from medical dictionary and trained our model based on the parameters. Also the GUI or website have also been made and is functional. The images of the same is inserted below-

Training Dataset

We have used most used sentences in the field of healthcare which will help our chatbot to give better results



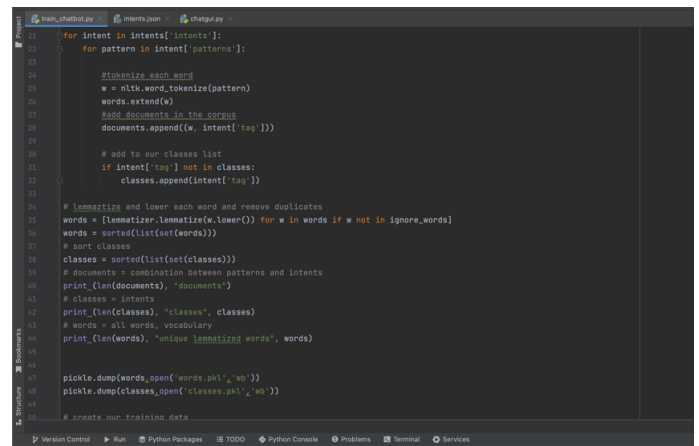
```
1 ["tag": "greeting",
2  "patterns": ["Hi there", "How are you?", "Is anyone there?", "Hey", "Hello", "Good day"],
3  "responses": ["Hello, thanks for asking", "Good to see you again", "Hi there, how can I help?"],
4  "context": []
5 ],
6 ["tag": "greeting",
7  "patterns": ["Hi", "How you later", "Goodbye", "Nice chatting to you, bye", "I'll text you"],
8  "responses": ["You too!", "Have a nice day", "Best time have again soon"],
9  "context": []
10 ],
11 ["tag": "thanks",
12  "patterns": ["Thanks", "Thank you", "That's helpful", "Awesome, thanks", "Thanks for helping me"],
13  "responses": ["Happy to help!", "Any time!", "My pleasure"],
14  "context": []
15 ],
16 ["tag": "confusion",
17  "patterns": [],
18  "responses": ["Sorry, can't understand you", "Please give me more info", "Not sure I understand"],
19  "context": []
20 ],
21 ["tag": "options",
22  "patterns": ["How you could help me?", "What you can do?", "What help you provide?", "How you can be helpful?", "What support is offered"],
23  "responses": ["I can guide you through Adverse drug reaction list, Blood pressure tracking, Hospitals and Pharmacies", "Offering support for Adverse drug reac",
24  "context": []
25 ],
26 ["tag": "adverse.drug",
27  "patterns": ["How to check Adverse drug reaction?", "Open adverse drug module", "Give me a list of drugs causing adverse behavior", "List all drugs suitable",
28  "responses": ["Referring to Adverse drug reaction module"],
29  "context": []
30 ]
```

Fig 4.1

Model

Using NLTK we have used lemmatizer to enhance model learning and understanding

Use of SGD as an optimizer have made model more efficient



```
1 #train_chatbot.py
2 # imports
3 # chatgpt
4
5 # for intent in intents(intents):
6 # for pattern in intent(patterns):
7
8 #tokenize each word
9 w = nltk.word_tokenize(pattern)
10 words.extend(w)
11 #add documents in the corpus
12 documents.append((w, intent['tag']))
13
14 # add to our classes list
15 if intent['tag'] not in classes:
16     classes.append(intent['tag'])
17
18 # lemmatize and lower each word and remove duplicates
19 words = [lemmatizer.lemmatize(w.lower()) for w in words if w not in ignore_words]
20 words = sorted(list(set(words)))
21
22 # sort classes
23 classes = sorted(list(set(classes)))
24 # documents = combination between patterns and intents
25 print(len(documents), "documents")
26
27 # classes = intents
28 print(len(classes), "classes", classes)
29
30 # words = all words, vocabulary
31 print(len(words), "unique lemmatized words", words)
32
33 # create our training data
34
35 pickle.dump(words, open('words.pkl', 'wb'))
36 pickle.dump(classes, open('classes.pkl', 'wb'))
37
38 # create our training data
```

Fig 4.2

```

171 random.shuffle(training)
172 training = np.array(training)
173 # create train and test lists: X - patterns, Y - intents
174 train_x = list(training[:,0])
175 train_y = list(training[:,1])
176 print("training data created")
177
178
179 # Create model - 3 layers, first layer 128 neurons, second layer 64 neurons and 3rd output layer contains number of neurons
180 # equal to number of intents to predict output intent with softmax
181 model = Sequential()
182 model.add(Dense(128, input_shape=(len(train_x[0]),), activation='relu'))
183 model.add(Dropout(0.5))
184 model.add(Dense(64, activation='relu'))
185 model.add(Dropout(0.5))
186 model.add(Dense(len(train_y[0]), activation='softmax'))
187
188 # Compile model. Stochastic gradient descent with Nesterov accelerated gradient gives good results for this model
189 sgd = SGD(lr=0.01, decay=1e-6, momentum=0.9, nesterov=True)
190 model.compile(loss='categorical_crossentropy', optimizer=sgd, metrics=['accuracy'])
191
192 # Fitting and saving the model
193 hist = model.fit(np.array(train_x), np.array(train_y), epochs=200, batch_size=5, verbose=1)
194 model.save('chatbot_model.h5', hist)
195
196 print("model created")

```

Fig 4.3

BOT GUI

The window for our chatbot appears as below which answers based on questions asked and it finds the answer via its database. The previous GUI is below and Final GUI is below it.

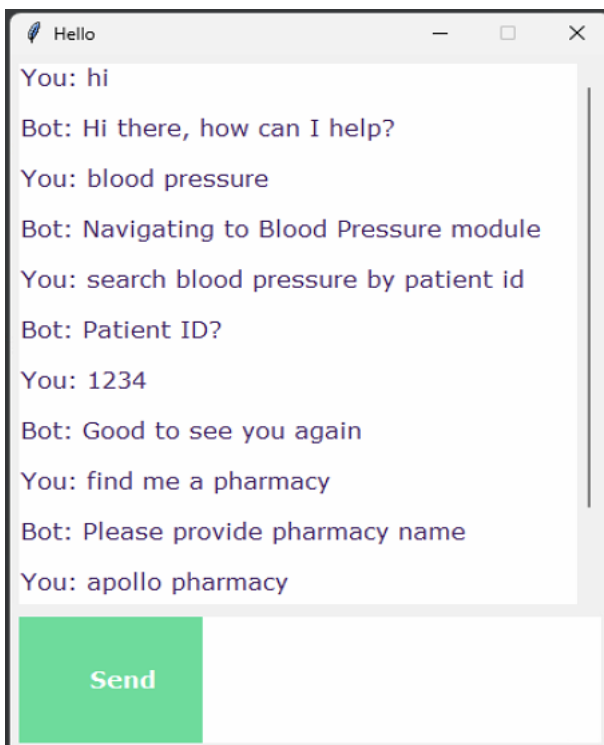


Fig 4.4

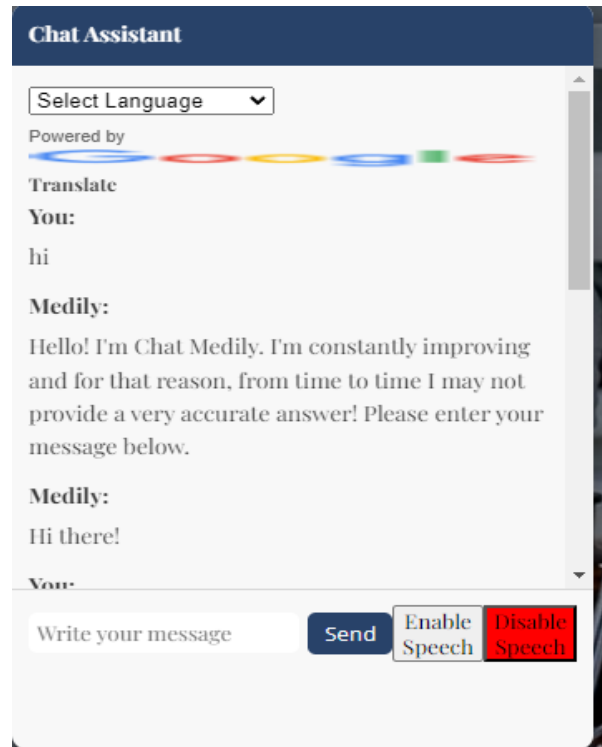


Fig 4.5

Responses given for specific query:

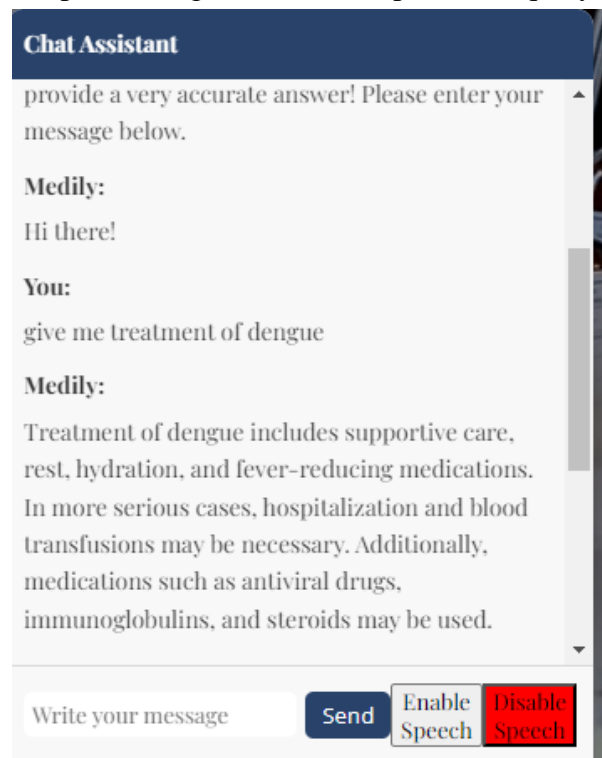


Fig 4.6

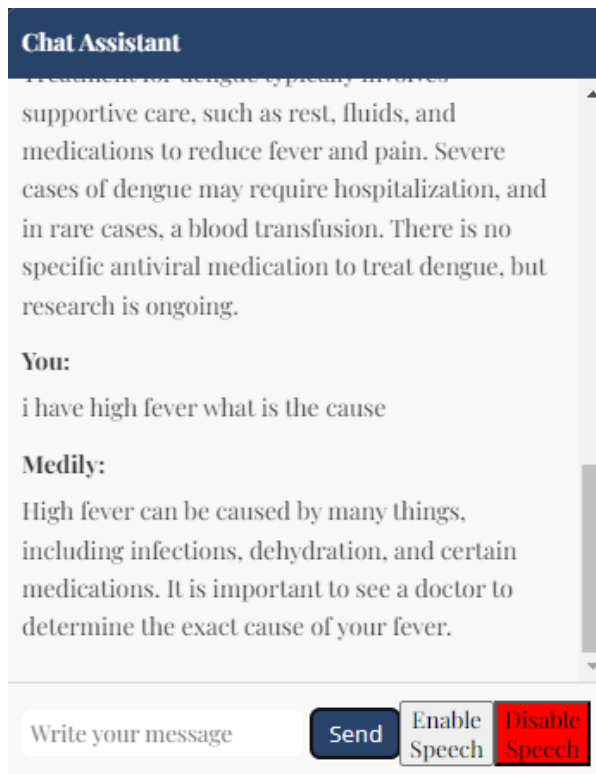


Fig 4.7

V .CONCLUSION

In conclusion, chatbots have emerged as a game-changing technology in the healthcare industry. They have the potential to revolutionize the way patients interact with healthcare providers and access medical information. By leveraging natural language processing and machine learning, chatbots can provide personalized and timely assistance to patients, offer medical advice, schedule appointments, and even monitor patients remotely.

Moreover, chatbots can significantly reduce the workload of healthcare providers, allowing them to focus on more complex tasks and providing quality care to patients. With the increasing demand for healthcare services and shortage of healthcare professionals, chatbots can bridge the gap and provide reliable and consistent care to patients.

However, as with any emerging technology, there are concerns about the accuracy and privacy of medical information and the need for ethical guidelines for the development and deployment of healthcare chatbots. Therefore, it is essential to continue to monitor and evaluate the effectiveness of chatbots in

healthcare and establish proper regulations to ensure their safe and ethical use.

Overall, chatbots have immense potential to transform the healthcare industry and improve patient outcomes. As the technology continues to evolve, it is likely that we will see more sophisticated and advanced chatbots being developed, leading to even greater improvements in healthcare delivery.

REFERENCES

1. Lu, Y., Chiang, T., & Zhang, G. (2019). Multilingual chatbot for healthcare based on deep learning. *IEEE Access*, 7, 120703-120711.
2. Abdullah, A., Zhang, W., Liu, Y., & Chen, H. (2020). Towards multilingual conversational agents in healthcare: An evaluation framework. *Journal of biomedical informatics*, 109, 103558.
3. Ribeiro, A., Gonçalves, R., Couto, F. M., & Lamurias, A. (2019). Multilingual chatbot for answering health-related questions. In *International Conference on Practical Applications of Agents and Multi-Agent Systems* (pp. 375-380). Springer, Cham.
4. Nwankpa, C., Jahan, A., & Kunapuli, A. (2018). Multilingual medical chatbot system for rural healthcare. In *2018 17th IEEE International Conference on*

Machine Learning and Applications (ICMLA) (pp. 321-326). IEEE.

5. Štajdohar, M., & Košmelj, K. (2021). Developing a multilingual chatbot for health-related purposes. *Journal of Healthcare Informatics Research*, 5(2), 118-132.
6. Krishna, A. (2021). A Review on Multilingual Healthcare Chatbots: A Case Study of 15 Indian Languages. *Journal of Advanced Research in Dynamical and Control Systems*, 13(6), 358-364.