

Multi Interactive Chatbot Communication Framework for Health Care

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Abstract

Health professionals are overload and having limited resources to care and support patients in their daily lives. While many advantages of the chatbots use in health care have been observed such as identifying symptoms, managing medications and monitoring chronic health problems, etc. Besides their benefits the design and the development of such kind of systems, have challenges as well, such as designing of multi interactive chatbots with the available frameworks is almost complex so, In this study, we have proposed an efficient and easy to implement framework with a novel approach which will support the development of Multi interactive chatbots system for Health care. The system will provide fruitful results regarding the coronavirus by identify the symptoms, diagnose the disease, along with some basic knowledge about the virus and will provide the proper medication with some safety measures before the physician consultation. The proposed system will be composed of User Interface, Chatbot Experts which will discuss with each other and will respond, and Socket System for creating the communication link. The Multi chatbot communication system will support text-based dialogues on a Limited set of question-related to the coronavirus. However, the system will be implemented in java and finally, to check the effectiveness of the system we will evaluate it using a confusion matrix.

Key words:

ChatBot, Machine learning, NLP, HealthCare, Coronavirus

I. Introduction

A chatbot is an agent or a conversational agent that simulates human conversation through voice commands or text or both. The agent will be able to start a conversation with a user whenever you give it input data and the agent must be capable to respond with something significant in that same language which means that the quality of a chatbot can be exclusively determined by the significance of the output which is being chosen by the chatbot in response. Chatbots have been deliberately designed and developed to duplicate an intelligent chat with a single or

multiple human users using audio or text-based techniques. Natural Language Processing (NLP) and Machine learning (ML) have been observed as the key intelligent feature of a Chatbot [1].

Chatbots have changed the way we think and live because chatbots could be present and ready to provide help by performing tasks while conducting conversations anytime and anywhere [2]. These intelligent chatbot systems are being used in many areas such as Banking, Customer support, Security, Education, and Health, etc.

Healthcare is very important for living a good and healthy life. But it is very difficult to get the proper consultation with the physician in case of health problems. According to surveys there are so many advantages of chatbots for health, as they may help us in disease diagnosing, managing medications, monitor chronic health issues and may provide some basic information regarding the disease before to any physician consultation which may also reduce the medical cost as well as enhance the access over medical knowledge. Medical bots also behave as a reference to medical books which may help the patient to get more information about their disease and help to improve their health [3,4].

Besides the benefits of the chatbots in medicine, their design has certain challenges as well, though there are only a few chatbots available for health care purposes. While there are some situations where the single chatbot is not sufficient to atomize various tasks, so in this study, we have proposed an effective, simple, easy and low-cost approach for designing the text-based interactive chatbots for health care.

Text-based messaging services have been proved to be the preferred way of communication for young people [5].

The proposed system will be composed of major three Components (1) User and user interface (2) Chatbot Experts and their Knowledge Base (KB) (3) Socket System. The system will consist of the user interface through which the

user will interact with the system however the responses will be generated based on the discussions between Corona Expert Chatbot1 and Corona Expert Chatbot2. While these chatbots utilize Artificial Intelligence Markup Language (AIML) which acts as the brain of these chatbots.

In the proposed system we will establish a communication link using Transmission Control Protocol (TCP) socket system to ensure the exchange of the knowledge between these chatbots

The major aim of this study is to identify the behavior and check the effectiveness of responses that the chatbots will generate while communicating with each other so that in future we may utilize these results for further studies.

This paper is divided into the following major sections. In section 2 we will discuss some existing chatbot systems, section 3 will demonstrate the Proposed Framework and its implementation along with tools and techniques that will be used to accomplish the research work, section 4 will illustrate the results and discussion which will describe how do multi-chat agents simulate conversation in a quiz-style on coronavirus, section 5 will explain the evaluation of the system which will demonstrate the accuracy of the system, section 6 will bring to a close of a paper with a note on future work.

2. Literature Review

Divya et. al. [3] created an intelligent medical text-based chatbot system which diagnoses the disease and provides basic knowledge about the disease to enhance the accessibility over health care and reduce the cost

Martínez [6] conducted a study on existing applications and open challenges on embodiment chatbots for suicidal behavior detection and prevention.

The chatbots for suicide must have the capability to discover high-risk situations along with their appropriate action should be taken these features are to be considered as the key elements while designs the chatbots for psychotherapeutic purposes.

Kretzschmar et. al. [7] have discussed the merits and demerits of chatbots usage for mental health purposes from a young generation point of view. The authors have claimed that designing the chatbots for mental health must have at least 3 principles: as there must be a user's privacy, must ensure the safety of the user and be evidence-based.

Huang et. al. [8] have developed the SWITCHes system for weight control and health promotion. The objective of the system was to facilitate the real-time reception and transmission of the data to the webserver. The system composed of two interactive web-based dashboards and a mobile application. The chatbot application work inside the SWITCHes app.

3. Proposed System

In the Proposed Health Care Multi Chatbots System have various components through which our desired outcomes will be achieved as shown in Fig. 1.

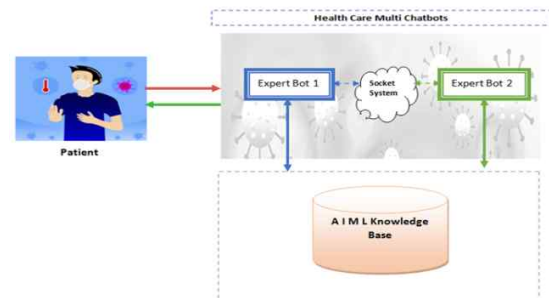


Fig. 1 An illustration of Proposed System

The patient will ask the queries regarding the coronavirus through the system interface then the query will be sent to the Expert Bot 1 the Expert1 will generate a response based on the given input and then the result will be displayed to the user. The response generated by Expert1 will act as an input for Expert2, and then the response will be generated by Expert2 accordingly and send back to user and Expert1 so in this way the discussion between the patient and chatbot Experts will take place until the patient is satisfied or the query is being cleared.

These chatbots utilize their KB to generate appropriate responses and trained using A Chatbots KB AIML is an Extensible Markup Language (XML) for creating natural language software agents AIML is one of the most popular languages for the definition of a chatbot KB [9] AIML work as the brain of the chatbots [10], To add the knowledge to the chatbots and To extract responses from the chatbots.

AIML is based on the concept of pattern recognition and pattern matching however, the technique it utilizes for the classification in K-Nearest Neighbors (KNN).

Whereas the Socket System provides a communication mechanism between the client and server using TCP.

4. Results and Discussion

In this research, we have proposed a Health care multi chatbot communication System for coronavirus.

The system will answer the patient's questions, identify the symptoms, diagnose the disease whether the patient is affected by coronavirus or not, provide proper medication for corona with some safety measures that how one can be prevented from the disease. The decisions will not only be made by a single chatbot Expert but will be made with the discussion between each other as explained in Fig. 2.

Besides this, the system also maintains the chat history or logs as well.

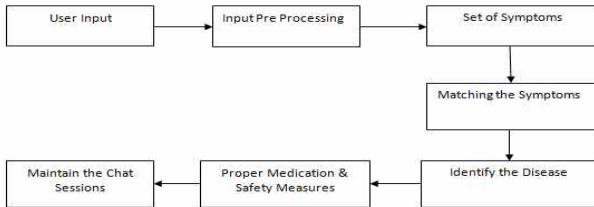


Fig. 2 PROCEDURAL Diagram of a System Data Description

Measure	Value	Derivations
Sensitivity	0.8929	$TPR = TP / (TP + FN)$
Specificity	0.9300	$SPC = TN / (FP + TN)$
Precision	0.9036	$PPV = TP / (TP + FP)$
Negative Predictive Value	0.4706	$NPV = TN / (TN + FN)$
False Positive Rate	0.9300	$FPR = FP / (FP + TN)$
False Discovery Rate	0.0964	$FDR = FP / (TP + FP)$
False Negative Rate	0.1071	$FNR = FN / (FN + TP)$
Accuracy	0.8300	$ACC = (TP + TN) / (P + N)$
F1 Score	0.8982	$F1 = 2TP / (2TP + FP + FN)$
Matthews Correlation Coefficient	0.8834	$TP(TN - FP)FN / \sqrt{(TP+FP)(TP+FN)(TN+FP)(TN+FN)}$

Fig. 4 Overall Accuracy of proposed system

5. Data Description

To Train the chatbot Experts the data have been obtained from different sources such as from Experts, websites World Health Organization (WHO), and from various Articles, etc. However, the total training Data sets are 600 AIML categories.

The Corona health care Multi chatbot system consists of the chat window with the text area reflecting the conversation and a textbox to introduce new requests so that the to maintain the conversation with the system. Fig. 3 shows the results of our proposed system.

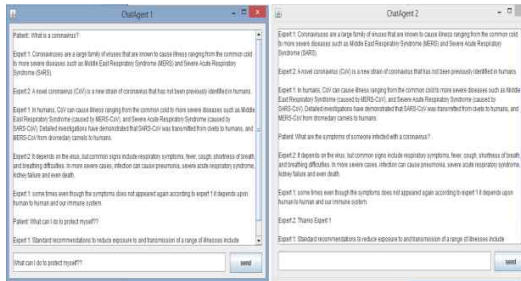


Fig. 3 Results generated From Health Care Multi Chatbot Communication System

6. System Evaluation

Our proposed system has been evaluated using the confusion matrix which works appropriately in this scenario for finding the accuracy of the system.

The system has been evaluated with the last 100 inputs to our system with the help of logs. After analyzing the True Positive (TP), True Negative (TN), False Positive (FP), and False Negative (FN) based on the responses generated by the Experts and finally putting their values in confusion matrix tool we found overall 83 % accuracy as shown in Fig 4.

7. Conclusion

In this study, we have proposed a Health care Multi Chatbot communication system for coronavirus. The system composed of a Patient, Two Chabot Experts which make discussion with each other and generate appropriate results based on the input and socket system which helped the chatbot experts to exchange the knowledge.

The system provides basic knowledge about the coronavirus, identify the symptoms, provide proper medications and some safety measure as well. Finally, we have evaluated the system using the confusion matrix and found an overall 83% accuracy. However, the system supports text-based dialogues only and has been implemented in java.

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