

A Survey on Healthcare Chatbot Using Machine Learning

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ABSTRACT

Chatbot is a computer program that is used to hold conversations via text or speech. Nowadays providing medical support for patients has become a greater challenge due to various factors like cost, decreasing healthcare professionals and getting doctor appointment. Thus, medical chatbot is used to act as a medical assistance and it provides general information to people about their health and helps them to know about their current health status. This paper provides a brief look about various healthcare chatbots being implemented along with the methods and algorithms used.

Keywords

Medical Chatbot, Machine Learning, Natural Language Processing, Disease Predictions.

1. INTRODUCTION

Machine learning is an application or subfield of Artificial Intelligence that is used to give the ability to the system to automatically learn and improve through experience. Machine learning differs from traditional computational method. The machine learning algorithms are used to train the data and bring output within a specific range by using statistical analysis. There are lots of machine learning algorithms available such as Natural Language Processing (NLP), Naive Bayes, Decision Tree, K-Nearest Neighbor, K-means, Linear and Logistic regression, Support Vector Machine (SVM), Random forest. Nowadays machine learning is used for providing automation in healthcare and biological data. In healthcare the machine learning can be integrated with chatbot in order to provide various uses such as cost savings and easier way to promote the application in the global market. Chatbot is an artificial intelligence feature that can be used in many messaging applications. It is a computer program designed to simulate human conversation and work independently from a human operator. Thus the chatbot for healthcare in artificial intelligence is used for the patients to have a periodic health checkup, book appointment and to check their current health status.

2. RELATED WORK

Chatbot can be implemented using various machine learning algorithms and methods. Health care chatbot can be used in hospitals, smart phones to diagnose the disease along with treatment.

2.1. A Chatbot Feels You-A Counseling Service for Emotional Response Generation

The author elaborates about a chatbot system that is used for psychiatric counseling service [1]. The chatbot works by sensing the emotional flow through continuous monitoring of conversation. The emotional response generation is done by following four steps, namely the feature extraction, response decision, generating sympathetic response, generating informative response. The emotional response recognition is based on the Natural Language Processing (NLP). For sentence analysis, we use Gated Recurrent Unit (GRU). The response is generated by using a probabilistic model that decides and gives a sympathetic response to the user. The similarity measuring is done using cosine similarity. The user intention has two components namely the document context and user emotion. The expected reaction feature is also added in addition to the user intention feature. The advantages for using and Natural Language Processing is that document efficiency and accuracy can be improved and Gated Recurrent Unit occupies less memory and executes faster as it has less training parameters.

2.2. Emergency Patient Care System Using Chatbot

The author aims to provide a medical chatbot application using machine learning [2]. The application is used to diagnose the disease and provide the possible diseases before the patient consults the doctor. This chatbot is provided with SOS button. There is map for showing the nearby doctor which is used for getting immediate help. The working on the map is done with the help of google Application Program Interface (API). The doctors can also view and update the profile of the patient's medication using the application. The machine learning algorithms used is Natural Language Understanding (NLU), Natural Language

Processing (NLP) and Multinomial Naive Bayes algorithm. Natural Language Understanding is computational software that is used to understand the user's input which is in the form text or speech. Natural Language Processing (NLP) algorithm is also used. It takes a combination of steps to convert the patient's text or speech into structured data. Multinomial Naive Bayes is a probabilistic algorithm used for text classification and NLP. The advantage of using Natural Language Understanding along with Natural Language Processing is that it is used for improving the flexibility and efficiency of the chatbot system and by using Multinomial Naive Bayes the training dataset can be reduced.

2.3. Chatbot a Virtual Medical Assistant

The author has provided a web application with chatbot that acts as a virtual medical assistant [3]. The chatbot interface is designed in such a way that is used to get the users symptoms by entering manually. Based on the symptoms provided by the user the chatbot predicts the disease and shows the nearby hospital to the patient. The patient can book a appointment with the physician. The model used is retrieval based Natural Language Processing (NLP). These are bots that are trained with a set of questions along with the possible outcome. The web application consists of various modules such as one for the user and administrator, chatbot module and Knowledge Base (KB) for storing the history of all user queries. The algorithm used is the Decision Tree. It is used for prediction in data mining, machine learning and statistics. The implementation is done using Google's dialogflow Application Programming Interface (API). The dialogflow is built-in Natural Language Processing that imparts the feature of Artificial Intelligence to chatbot. The advantages of using google dialogflow Application Programming Interface (API) is that it is robust towards context-based input recognition and it can be used in various messaging platforms.

2.4. A Self Diagnosis Medical Chatbot Using Artificial Intelligence

The author aims to develop medical chatbot using Artificial Intelligence (AI)[4]. A text to text conversation is carried out which helps the bot to know about the patient's current medical status. Based on the disease predicted the bot provides personalized diagnosis. The system has three conversational phases namely, the acquisition of basic information, symptom extraction and diagnosis. The system also consists of three main components. First is the user validation and extraction of user's symptoms. Second is to map the extracted symptoms to the documented symptoms. Third is to refer the doctor if necessary. The symptoms are extracted using the string search algorithm. The string search algorithm carries the search by using the substring to match the symptoms of the user and the bot replies only if the symptoms are specified directly by the user. The extracted symptoms are mapped to the trained dataset by generating a list of suggested close symptoms. Also the symptom entered by the user is compared to common diseases in the database. The advantage of using the healthcare chatbot is that it is always available and can assist the user with medicinal information whenever needed.

2.5. Chatbot for Healthcare Using Artificial Intelligence

The author aims to develop the chatbot for health care purposes that store the patient's information in the database [5]. The system identifies the keywords in sentences and takes the decision based on the symptoms entered. The bot uses TF-IDF, N-gram and Cosine similarity It is used to find the keyword ranking and

sentence similarity. The Term Frequency (TF) is used to find word frequency and Inversed Term Frequency (IDF) is used to compute the weight of uncommon words over the document. The N-gram is used for text compression and reduces the size of the document. It reduces the size of the document. The chatbot developed is an android application. The knowledge base is created for storing the question and answer. The algorithm used is the Support Vector Machine (SVM). Support Vector Machines are used for classification and regression analysis. Here the SVM is used for classifying the dataset. Porter algorithm is used to discard the unwanted dataset input. The advantages of using Support Vector Machine is that it can avoid the difficulties in using linear function and it is memory efficient and TF-IDF have high level of accuracy which is relevant to the user's query.

2.6. A Novel Approach for Medical Assistance Using Trained Chatbot

The author aims to develop the chatbot that is developed by artificial intelligence to fulfill the user's requirements [6]. The artificial intelligence will help to predict the disease and give the List of available treatments. The user can decide the right treatment by giving all the necessary information to the bot and it recommends the correct medicines. The architecture of the chatbot integrates the language model and computational algorithm to emulate informal chat between human and computer using Natural Language Processing. The chatbot was developed as a mobile communication bot to help the customer to save time. The chatbot is considered as a messenger application which will help to gain the health information and treatments for the health issues. The system recommends age based dosage medicine and it helps all age groups to converse with the bot and get the correct dosage of medicine. The users can give the name of the medicine and the company and the bot will list all the details about the dosage and side effects of the medicine. The chatbot can work in all kinds of platforms like PC, mobile, windows and android. The algorithm used in the system is Natural Language Processing which will help to converse with the bot very effectively. The advantage of this system is that it provides age based medicine dosage details and it can be easily integrated and is also upgradable.

2.7. kbot: Knowledge-Enabled Personalized Chatbot for Asthma Self-Management

The author developed the chatbot as a kBot that is, Knowledge enabled chatbot designed for health application and adapted to help pediatric asthmatic patients [7]. The system monitors the patient's health and is also responsible for tracking relevant health signals. The personalization is achieved from patient answering questionnaires and day-to-day conversations. kBot follows a client-server architecture where the client is a lightweight front-end chat interface. The system supports text messages as well as images, audio and video messages. For speech-based communication, the voice input is first captured and then converted to textual data by the client. kBot uses rich media contents and presents information more effectively. The system provides the images of asthma medicines and inhalers to help the patients to quickly identify the various types of medicines. The DialogFlow helps to identify the asthma related entities easily. KBot script is designed and written according to the standard UX design guidelines. The system creates a user profile based on the information retrieved from the previous medical records. A preliminary evaluation is done to evaluate the technical viability and effectiveness. The evaluation criteria are chatbot quality, technology acceptance and system usability. An online survey

form was presented to the evaluators at the end to assess kBot. The survey contains two aspects where the first set is to access the technology acceptance and the second is to set as the System usability scale (SUS). The advantage of the system is it helps to predict the asthma symptoms and monitors the patient's health continuously.

2.8. A Medical Chatbot

The author developed this system which gives the information regarding the convenience of the consumers to consult about their health issues in an efficient way[8]. The user can ask any query related to health care through the chatbot. The bot helps the users to resolve the issue by providing human way interactions using LUIS and cognitive services implemented on an AWS public cloud. The system allows the patient to report the query to the chatbot and the bot provides the related answers and displays the answers on android application. The system's major concern is to develop web based platform to analyze customers' sentiments. It helps in recognizing the contents in texts and it uses Software as a Service (SaaS) which helps to analyze the message of each application server. The system replies according to the queries asked by the user and it recommends medicine and dosage details based on the age of the user. The user can even ask about the medicine related details on the basis of medicine names. Support Vector Machine (SVM) algorithm is used to predict the disease based on the symptoms provided. The chatbot API sends query to chatbot and gets related answers and refer this answer analysis on that and displays answer on android application. The algorithm implemented in the system is Support Vector Machine (SVM) which is a learning algorithm for classification that attempts to discover the finest distinguishing hyperplane which minimizes the error for unseen patterns. SVM can also handle better complex classification tasks. The advantage of this system is that it improves customer service and provides support and additional information.

2.9. Pharmabot: A Pediatric Generic Medicine Consultant Chatbot

The author developed the chatbot to analyze and choose the right generic medicine for children [9]. The pharmabot acts as a medical consultant and helps the patient to know about the right generic medicines. This chatbot acts as a pharmacist which provides generic drugs for children. The chatbot is designed with four menus in the main page, namely start, instruction, guidelines and exit. The bot will first allow the user to choose their age and according to the patient's age. The treatment and medicines will be recommended for the patient. The user can start the conversation with 'how' or 'what' and if it matches the requirements, the process proceeds to the next step. After getting all the details and symptoms, ailments, the chatbot will prescribe the medicines, including the dosage and precaution of medicines. The chatbot provides a survey questionnaire for better efficacy. The survey questionnaire is divided into four sections, namely user-friendliness, appropriateness, consistency and speed of response. The author gathered the data and computed the bot by two groups of respondents namely experts and students. After computation, it is understood that there is no significant difference between the assessment of student and expert. The algorithm implemented in this system is NLP: left-right parsing algorithm which is a bottom up and left-right parsing approach. The advantage of this system is that it recommends right generic

medicine for children and provides a survey questionnaire for better efficacy.

2.10. Chatbot Utilization for Medical Consultant

The author implemented the chatbot based on the symptoms and treatment gathered from the doctorMe application[10]. The system implementation process includes four steps, namely analysis, design, development and testing. The treatment and symptoms information are extracted from the doctorMe application to train the chatbot. The Dialogflow as a major tool to develop the MedBot. In the Dialogflow, the agent is first created and generates the intent using health information and training phrases and responses are included in the agent. The last step is to test the bot by using system testing and training testing. The Dialogflow can include more than 20 languages into it as it contains a lot of tools. After completing all the process, a training process is performed to check the speed and conversation of the bot. The chatbot contains 16 of symptoms with treatment trained in that. The bot will respond to the question with a proper answer if the symptom is available in its trained dataset. The chatbot system decreases the operation cost of medical consultant service. The algorithm used in this chatbot is Natural Language Processing. The advantage of this system is that it easily integrates with many IM platforms and makes use of more than 20 languages for the usage of all types of customers throughout.

2.11. A Graph Based Chatbot for Cancer Patients

The author describes about the chatbot that is specifically used for cancer patients and it provides a possible treatment solution to them[11]. The chatbot gets trained by various information from different medical forums and also sentiment analysis was implemented. A user can ask anything to the chatbot that involves asking about the cancer symptoms, treatment and survival. The data are stored in the database using python and beautiful soup. Beautiful soup is a library in python used for data extraction. The raw data given by the user may be in improper format that can be preprocessed using NLTK (Natural Language Tool Kit) present in python. The preprocessing can be done using many steps that involve tokenization, removal phase and finally the lemmatization. After implementing all the steps in the data it generates a graph using Neo4j database. In this graph, data are stored as edges and nodes which efficiently connect and determine the relationship of various data. Also Cbot will categorize the type of cancer and provide related information to the patients. The algorithm used here is NLTK (Natural Language Tool KIT) that process input sentences and checks it with the database and provides essential details like list of symptoms of cancer with explaining to the patients. The advantage of Cbot is that the patients feel more comfortable to share their health information than to human and it clears up all their doubts regarding cancer.

2.12. Chatbot meet Ehealth: Automating healthcare

The author aims to design a HOLMes (Health On-Line Medical Suggestions) chatbot which is implemented with several techniques to enhance the interaction with patients like human for medical purpose and it provides a better way to prevent various diseases[12]. Details about these diseases are given to the bot

using Medical Decision Support System. Big data is used in some of the resources that include Electronic Medical Records (EMR), Mobilized Health Records(MHR), and Personal Health Records(PHR).The chatbot records the health information of patients and it provides medicine by verifying the historical information. The chat like conversation is done based on the Watson conversation API. The Sparks ML libraries make use of machine learning techniques. These libraries classify treatment for each disease and gives faster response to the patients. eHealth gives services to healthcare and in the technology field. There are some problems in eHealth which includes sensitivity of data, process time and scalability. These are solved by big data analytics techniques. The algorithm used in HOLMes chatbot is Deep learning Algorithm that makes the bot to, understand user input and display the response. The advantage of eHealth Chatbot helps the patients by giving accurate treatment for different diseases with the help of Medical Decision Support System. This can be done through social media, often easily accessed by more users.

2.13. Sanative Chatbot for Health Seekers

The author explains a medical chatbot that provides an instant reply to the user by extracting the keyword [13]. The user input is pre-processed by extracting a noun phrase using parts of speech (POS) tagger. To determine medical concepts, the keyword is extracted from the input sentence. Then, the relevant medical words are mapped with a dataset using lexical similarity. A lexical similarity is an approach that matches words with languages given. After mapping is done, relevant medical information is given to the user. The local mining and global learning algorithm are implemented in the bot to recognize irrelevant data and it provides answers to the patients. The advantage of the chatbot is that it provides scalability and gives a faster reply to user queries.

3. CONCLUSION

Chatbot is a user friendly interface and any person can chat with the bot through conversation or text. The chatbot in medicinal field is used to provide information about the user's current medical status and recommends treatment along with the medicine. Various Machine Learning algorithms are used to implement the medical chatbot. In future chatbot with voice feature can be implemented so that it can be easy for the users to use and also physically challenged people can use them without finding any difficulty.

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