Deep Learning Techniques for Implementation of Chatbots

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Abstract—**Chatbots are software programs that interact with clients using natural languages. The motto of the researchers was to know if chatbots can able to fool the clients that they were real humans. To develop a chatbot that can pass the Turing test, plenty of effort done with the introduction of the ELIZA chatbot in the year 1966. Various approaches for the development of chatbots and different technologies in the creation of chatbots developed because of those efforts. NLTK is a module in python which can able to perform Natural Language Processing. It is used to analyse the input in the form of speech and generate responses that are similar to humans. Nowadays there is a lot of demand for virtual assistants such as Siri, Cortana, Google Assistant and Alexa, and speech-based search engines. Nowadays Chatbots are gaining massive demand mainly in the business sector for automating client service and also for reducing efforts of humans. Chatbots typically used for information acquisition in dialogue systems. To perfectly imitate a human response, a chatbot should examine the query asked by a client correctly and design an appropriate response. In this study we compare and discuss the different technologies used in the chatbots and also address the design and implementation of a chatbot system.**

Keywords- Chatbot, Natural Language Processing, Natural Language Toolkit, Turing test, Search Engine

I. INTRODUCTION

THE chatbot is a software program that is used to interact with clients using natural language. Initially, chatbot created for simulating human conversation for the motto of entertainment. It uses AIML to represent knowledge. Humans can replace by chatbots for monotonous jobs of answering queries and giving efficient responses, e.g., E-help desks, Customer cares. Chatbots also used in operating systems as virtual assistants such as Cortana in windows, Siri in mac [5]. Nowadays the popularity of chatbots in business sector is increasing day by day as they have massive potential in automating client service and also in reducing efforts of humans.

Researchers have studied chatbots and other types of conversational agents for decades, starting with the well-known chatbot ELIZA. Chatbots are the taxons of conversational agents that are designed to communicate with clients using natural language. The best source of solutions to the user's queries in any domain is ultimately chatbot. Mostly Chatbots used for acquiring knowledge. It can be implemented on our mobiles and local personal systems and can access the internet. Chatbots communicates with clients in any particular domain with their query as input in general conversational statements. When the user starts asking questions on some specific topic the discussion begins, and the chatbot starts answering their queries. Chatbots are the software entities which act as human entity [1].

An efficient response will generate the client's question based on the predefined knowledge database. Initially, chatbots developed for entertainment purposes, and they used some keyword matching algorithms to find a response to the user's query, e.g., ELIZA. Nowadays, with the improvement of natural language processing based machine-learning techniques, chatbots able to make better decisions [2].

Even though some pattern matching rules can apply to the user's query and an appropriate response can be generated, but the performance of the chatbot will be less because they won't store the chat history and also, to be frank, they will not understand what you asked. Based on knowledgebase, the responses generated. In the context of Chatbot, a metric is used to measure the performance of a chatbot [3, 4].

Several parameters designed, which helps in creating a useful chatbot, and some of them discussed below.

A) Scalability: A chatbot is said to be more scalable if it accepts enormous amounts of queries from clients and responds quickly and efficiently. A scalable chatbot is capable of working in any environment.

B) Turing Test: Alan Turing introduced the Turing test in the year 1950, which is for testing the ability of a machine that exhibits intelligent behaviour equivalent to a human. If the tester is unable to distinguish the answers provided by humans and machines, then we say that the computer has passed the Turing test.

C) Interoperability: Interoperability is the ability of a system to exchange and make use of information. An interoperable chatbot should support multiple channels, and users are allowed to switch quickly between channels.

D) Speed: Speed is the measure of time taken by the chatbot in generating an efficient response to the user's query. Intelligent chatbots should be able to deliver interventions quickly.

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TABLE I COMPARISON BETWEEN DIFFERENT CHATBOTS

Metrics	Jabber wacky	Eliza	Alice
Speed	Low	Average	High
Interoperability	Low	High	High
Turing test	Not passed	Passed	Passed
Scalability	Not scalable	Not scalable	Not scalable

II. LITERATURE SURVEY

Sahil Gupta and Yashvardhan Sharma proposed "Deep Learning Approaches for Question Answering System," in which they introduced Alice. The following are some of the problems found in this Question Answering system:

1. The history of conversation will not save.
2. This system does not understand whatever queries you asked. It fetches merely the responses from its knowledge base.

By avoiding this problem, Inorder to check whether the answers are readily available, a check is done to find the similarity of predefined questions with the processed input. If the confidence value of the fetched statement is more significant than 0.5, then it will give as the response to the client. If the information does not match with any of the questions which fetch from the knowledge base, then that input will be saved in the log file, and later it will be updated by the admin that leads to further improvement of the system.

Fryer, L. K., et.al., entailed that the from the present examination, they draw a bunch of starter ends. To begin with, that a bounce back in intrigue in the end pursues curiosity impacts, proposing that a dispersed way to deal with chatbot use may bolster intrigue. Second, that for language practice, enthusiasm for correspondence exercises like those utilized in the present examination emerges primarily from the enthusiasm for conversing with human accomplices and enthusiasm for language course extensively. These wellsprings of premium must be taken care of first if instructive innovation is to assume its job in a mixed way to deal with language learning.

Y. Chai portrayed that the future use and plan of chatbots for language practice should think about under studies fitness level. Instructors should concentrate on confining the chatbot discussions as an open door for understudies to find out more and unexpected things in comparison to one could get from a human language learning accomplice as opposed to the chatbot's comfort. This could mean the scaffolder presentation of new jargon, language structure, and articulations, which a human accomplice is probably not going to display. it could likewise mean giving predictable reasonable redundancy, which a human accomplice is probably not going to need to give. Later, chatbots will on a very basic level change how we adapt new dialects, for a long time to come, nonetheless, utilizing chatbots will bring about a mix of benefits and faults. We recommend that language learning-focused chatbot plan components and fitting teacher guided use may manufacture a decent way and bring these incredible gadgets solidly into the language student's tool compartment.

Anupam Mondal, Monalisa Dey proposed "Chatbot: An automated conversation system for the educational domain." In this research, a chatbot in the educational domain develops, and data is processed using the random forest algorithm. Here the issue is random forests with deep trees with either no subsampling or too much subsampling can be inconsistent. To overcome this issue, the Bag of Words Representation can use.

Balakrishnan and S.Reshmi proposed," Implementation of an inquisitive chatbot for database supported knowledge bases." Generally, chatbots only respond to the questions which exist in the existed knowledge base, whereas these inquisitive chatbots are different. These inquisitive chatbots can react even when the queries are not precise. They make the question more efficient by getting more information from the users.

Matthew Verleger, James Pembridge proposed that the Chatbots can bolster under proposal request from understudies who may be horrible or quelled to share in a standard class session. They can moreover possibly allow to offer legitimately significant responses to under proposal request conversely with those they can find when all is said in done web look. Author has developed an Artificial Intelligence Chatbot which is called EDubot, is developed as a plugin or Chatbox to the Canvas Learning Management System. When students posed EduBot a question, the Artificial Intelligence sought an answer from a Question and Answer database. In the event that an answer couldn't be found, EduBot would consequently answer that an answer couldn't be found, and that the teacher had been informed. Anyway, these applications have large prospective in offering current services for the users like an exhibition of promotion operations based on the user favourites. The usage assessment for estimating the precision of the data and confidentiality metric for evaluating the mechanism of the closeness of the actual value acquired after modification.

AvinashShrivas, Meera, and Vaibhav Shukla proposed a "Question Answering System Based on Artificial Intelligence for Restricted Domain." This Question Answering System tries to answer the query efficiently by processing the query asked in natural language, which is related to some particular domain.

The issues found in this Question Answering system are:

1. Answers are related to only that particular domain.
2. While asking questions, the client has to follow a specific input format.

To overcome this issue, the sequence2sequence model can apply for text summarisation.

III. DESIGN

Initially, we have gathered data from the Cornell Movie Dialogs Corpus dataset to train our chatbot. Then we have removed punctuations, extra symbols and other unnecessary things from this dataset and wholly cleaned the dataset. Then we have applied Bag of words technique to identify and remove the redundant Logos from the dataset and completely prepared our data. Even though we made a decent effort in

cleaning the input data and making it into clean vocabulary and beautiful sentences [6,7].

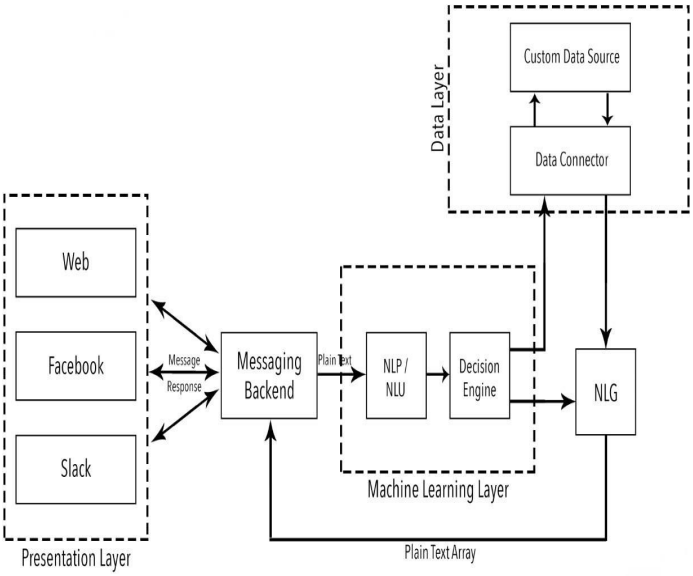

Fig 1: Chatbot Architecture

These models expect input as the torch tensors. So we used seq2seq model to prepare the processed data. All successors of each level are generated and sorted in increasing order based on the cost of heuristics [8].

The distribution of the corpus by genre is:

Type	Film count
Horrer	149
Biography	003
Comedy	299
Adventure	167
Animation	035
Family	039
Fantasy	121
Crime	240
Drama	580
History	003
Action	289
Romance	192
Sci-Fi	155
Thriller	373
War	026
Western	013
Musical	022
Sport	003

Thus the response made to the user queries is very efficient. Corpus dataset is used here for training our chatbot. This dataset contains conversations collection, which is fictional. They extract from the raw movie scripts. This chatbot uses information retrieval technique to fetch the responses from this dataset by matching the input with the conversations.

It is diverse and tremendous, and there is a significant difference in periods, formality and also sentimental conversation. So we assume that this vast difference will make our chatbot robust. Film scripts classify by genre, but one film can be in multiple types.

IV. METHODOLOGY

A) BAG OF WORDS:

This algorithm used for finding the frequency of a word in a given sentence. It is a way of extracting features from the given text.

To understand this, let us take an example:

"Today is Sunday"
"Today is a holiday."
"It is a chatbot. "
"I like the horse."

We divide each sentence into words by neglecting punctuation marks.

Today, is, Sunday, a, holiday, it, chatbot, I, like, horse

Next we should create tensors from the data. These vectors are used to process the data. Let us check the frequency of words in the first sentence

"today" = 1
"is" = 1
"sunday" = 1
"a" = 0
"holiday" = 0
"it" = 0
"chatbot" = 0
"i" = 0
"like" = 0
"horse" = 0

Later the documents will be represented as shown below:

"Today is sunday" = [1, 1, 1, 0, 0, 0, 0, 0, 0, 0]
"Today is a holiday" = [1, 1, 0, 1, 1, 0, 0, 0, 0, 0]
"It is a chatbot" = [0, 1, 0, 1, 0, 1, 1, 0, 0, 0]
"I like horse" = [0, 0, 0, 0, 0, 0, 0, 1, 1, 1]

BAG OF WORDS MODEL MATRIX REPRESENTATION:

Documents	Today	is	Sunday	a	holiday	it	chatbot	I	like	horse
1	1	1	1	0	0	0	0	0	0	0
2	1	1	0	1	1	0	0	0	0	0
3	0	1	0	1	0	1	1	0	0	0
4	0	0	0	0	0	0	0	1	1	1

Here the word is called gram.

Here the order of words in the given sentence is not the same in the vector representation — the bag of words used in email filtering.

B) SEQ2SEQ MODEL:

The Seq2seq model is all about training models. It is used to convert sentences from one domain to another domain. Initially, it introduces for performing machine translation. Before seq2seq enters, machine translation shows in a very natural way. By using deep learning, this model revolutionised

machine translation. While performing machine translation it not only takes the current word into account but also all the words which are in its neighbourhood. This model will take a sequence of words as its input and then generates series of words as its output. The recurrent neural network use in seq2seq model. At a time it takes two data. One input from its previous production and other from the user, it is said to be recurrent. It contains two things encoder and decoder, so it is known as the Encoder-Decoder Model [9].

An encoder is to convert the input words to hidden vectors. It uses deep neural network layers. A decoder is also similar to the encoder. The input to the decoder is the hidden vector generated by encoder, and it uses its hidden states and also the current word for generating the next hidden vector. Thus it finds the next word. Its aim is to find probability q(x1,x2,x3...,xn0|y1,y2,y3...,yn) where x1,x2...,xn0 is input and y1,y2...,yn is the output.Seq2seq technique depends on recurrent neural networks. Since both RNNs are different, their length is also not same. They can implement in the form of Gated Recurrent Unit and Long Short Term Memory. The first state of this search decoder equates with the above-represented notation, by taking the output of this unrolled decoder network at each time words are generated as output and will be fed into a function, which will provide the conditional probabilities of the words in the document which give as input. Chatbot training is same as recurrent neural networks, and it means the probability of a correct target sequence T given the source sequence S maximise. Both RNN's will train at a time, and errors will be sent back by using optimistic techniques such as Stochastic Gradient Descent; their weights will optimise [10].

In Neural Machine Translation the input sequences will be in one language and are to be converted to the output sequences which are in some other language. Some of individual elements are tensors that represent embedding's of the word. In this chat modelling, treating an utterance by client as input statement and the response gives to it from another speaker as the output sequence is the simplest approach.

C) BEAM SEARCH DECODING:

This decoding technique is a heuristic-based approach. It uses the breadth-first search technique for building the state-space tree. Greedy search use in it. It identifies the most possible and likely sequences as output. It expands all the reasonable next steps and keeps the n most likely sequence which may occur and controls the number of beams through the progression of the probabilities. At each level, it produces the successors of all the present states, and then sorting in ascending order is applied which depends on their heuristic values. However, it only stores only some predefined number of best countries at each level. Only those states will expand next. If no response found to the query, this procedure will repeat by expanding the beam.

V. RESULTS AND DISCUSSION

This paper has discussed some of the techniques based on NLP for designing chatbots. In addition to this, a comparison has been made between several chatbots so far developed. On the completeness of this work, our chatbot can successfully answer the frequently asked Questions (FAQs) efficiently. The implemented chatbot based on NLP techniques. Chatbot aims to provide a friendly interface that can interact with using natural language. In this paper the chatbot is trained using Corpus Dataset. This Dataset contains 210,579 interactions between 11,292 pairs of different characters from 617 movies. To extract the features from the given text chatbot uses bag of words and seq2seq model for converting sequences from one domain to courses in another area. The benefits of using this method are that the developer does not need to write the chatbots responses manually. By intelligent design and a sound NLP system the chatbot can provide the user with efficient and smart answers. To increase the vocabulary the chatbot only needs to be provided with more text corpora.

SAMPLE CONVERSATION WITH NLP BASED CHATBOT:

Human: Hi.
Chatbot: Hi.
Human: Who are you?
Chatbot: I am a chatbot.
Human: How are you?
Chatbot: fine.
Human: Nice to meet you.
Chatbot: same here.
Human: Where is Tajmahal?
Chatbot: Agra.
Human: Where are you from?
Chatbot: Mumbai.
Human: It is too late.
Chatbot: I know.
Human: Bye.
Chatbot: Bye.

VI. CONCLUSION

This paper has discussed some of the approaches for designing chatbots. In addition to this, a comparison has been made between several chatbots so far developed. It is challenging to get complete information on a single page without searching multiple pages. So the main aim of chatbot is to provide a unique user-friendly interface for making the customers work fast and more comfortable. The structure of the chatbot is the combination of dataset and machine learning algorithms. A chatbot is to build interaction between a computer and a human by using natural language. Customers can ask their queries freely. Chatbot quickly fetches the answers to those queries and provides in a single interface. Chatbot also offers related links to those queries by matching some of the keywords. Its database contains complete information about keywords, questions, solutions, and logs. Chatbots, along with improving customer service, also reducing human load and increasing productivity.

VII. FUTURE WORK

Instead of seq2seq model-based bot, other algorithms can implement. We will include voice-based query recognition. The clients give their voice as input, and chatbot provide text as the output. We will also allow the chatbot to access the internet, which can help to solve all the queries of user and improve the probability of success in the bots. After successful execution of chatbot in our college, we will implement it in other fields like medical, sports, forensic, etc. It will be very beneficial in all the areas as without spending much time, and we can access the relevant information and that too without any sorting. On success, we will make this chatbot available to all the users as an android app.

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