CHAPTER 36
A Review of Chatbot for Healthcare System Using Artificial Intelligence

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ABSTRACT

Typically, a chat bot will communicate with a real person. Chat bots are used in applications such as e-commerce customer service, call centers and Internet gaming. Chat bots are programs built to automatically engage with received messages. Chat bots can be programmed to respond the same way each time, to respond differently to messages containing certain keywords and even to use machine learning to adapt their responses to fit the situation. A developing number of hospitals, nursing homes, and even private centers, presently utilize online Chat bots for human services on their sites. These bots connect with potential patients visiting the site, helping them discover specialists, booking their appointments, and getting them access to the correct treatment. An ML model has to be created wherein we could give any text input and on the basis of training data it must analyze the symptoms. A Supervised Logistic Regression machine learning algorithm can be implemented to train the model with data sets containing various diseases CSV files. The goal is to compare outputs of various models and suggest the best model that can be used for symptoms in real world inputs. Data set contains CSV file having all diseases compiled together. The logistic regression algorithm in ML allows us to process the data efficiently. The goal here is to model the underlying structure or distribution of the data in order to learn more from the training set. In any case, the utilization of artificial intelligence in an industry where individuals' lives could be in question, still starts misgivings in individuals. It brings up issues about whether the task mentioned above ought to be assigned to human staff. This healthcare chat bot system will help hospitals to provide healthcare support online 24 x 7, it answers deep as well as general questions. It also helps to generate leads and automatically delivers the information of leads to sales. By asking the questions in series it helps patients by guiding what exactly he/she is looking for.

Keywords: *chat bot, CSV files, Logistic Regression, machine learning algorithm etc.*

INTRODUCTION

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ARTIFICIAL INTELLIGENCE

The ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience. Since the development of the digital computer in the 1940s, it has been demonstrated that computers can be programmed to carry out very complex tasks—as, for example, discovering proofs for mathematical theorems or playing chess—with great proficiency. Still, despite continuing advances in computer processing speed and memory capacity, there are as yet no programs that can match human flexibility over wider domains or in tasks requiring much everyday knowledge. On the other hand, some programs have attained the performance levels of human experts and professionals in performing certain specific tasks, so that artificial intelligence in this limited sense is found in applications as diverse as medical diagnosis, computer search engines, and voice or handwriting recognition.

LEARNING

There are a number of different forms of learning as applied to artificial intelligence. The simplest is learning by trial and error. For example, a simple computer program for solving mate-in-one chess problems might try moves at random until mate is found. The program might then store the solution with the position so that the next time the computer encountered the same position it would recall the solution. This simple memorizing of individual items and procedures—known as rote learning—is relatively easy to implement on a computer. More challenging is the problemof implementing what is called generalization. Generalization involves applying past experience to analogous new situations. For example, a program that learns the past tense of regular English verbs by rote will not be able to produce the past tense of a word such as jump unless it previously had been presented with jumped, whereas a program that is able to generalize can learn the “add ed” rule and so form the past tense of jump based on experience with similar verbs.

REASONING

To reason is to draw inferences appropriate to the situation. Inferences are classified as either deductive or inductive. An example of the former is, “Fred must be in either the museum or the café. He is not in the café; therefore he is in the museum,” and of the latter, “Previous accidents of this sort were caused by instrument failure; therefore this accident was caused by instrument failure.” The most significant difference between these forms of reasoning is that in the deductive case the truth of the premises guarantees the truth of the conclusion, whereas in the inductive case the truth of the premise lends support to the conclusion without giving absolute assurance. Inductive reasoning is common in science, where data are collected and tentative models are developed to describe and predict future behaviour—until the appearance of anomalous data forces the model to be revised. Deductive reasoning is common in mathematics and logic, where elaborate structures of irrefutable theorems are built up from a small set of basic axioms and rules.There has been considerable success in programming computers to draw inferences, especially deductive inferences. However, true reasoning involves more than just drawing inferences; it involves drawing inferences relevant to the solution of the particular task or situation. This is one of the hardest problems confronting AI.

PROBLEM SOLVING

Problem solving, particularly in artificial intelligence, may be characterized as a systematic search through a range of possible actions in order to reach some predefined goal or solution. Problem-solving methods divide into special purpose and general purpose. A special-purpose method is tailor-made for a

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particular problem and often exploits very specific features of the situation in which the problem is embedded. In contrast, a general-purpose method is applicable to a wide variety of problems. One general-purpose technique used in AI is means-end analysis—a step-by-step, or incremental, reduction of the difference between the current state and the final goal. The program selects actions from a list of means—in the case of a simple robot this might consist of PICKUP, PUTDOWN, MOVEFORWARD, MOVEBACK, MOVELEFT, and MOVERIGHT—until the goal is reached.Many diverse problems have been solved by artificial intelligence programs. Some examples are finding the winning move (or sequence of moves) in a board game, devising mathematical proofs, and manipulating "virtual objects" in a computer-generated world.

PRECEPTION

In perception the environment is scanned by means of various sensory organs, real or artificial, and the scene is decomposed into separate objects in various spatial relationships. Analysis is complicated by the fact that an object may appear different depending on the angle from which it is viewed, the direction and intensity of illumination in the scene, and how much the object contrasts with the surrounding field.At present, artificial perception is sufficiently well advanced to enable optical sensors to identify individuals, autonomous vehicles to drive at moderate speeds on the open road, and robots to roam through buildings collecting empty soda cans. One of the earliest systems to integrate perception and action was FREDDY, a stationary robot with a moving television eye and a pincer hand, constructed at the University of Edinburgh, Scotland, during the period 1966–73 under the direction of Donald Michie. FREDDY was able to recognize a variety of objects and could be instructed to assemble simple artifacts, such as a toy car, from a random heap of components.

LANGUAGE

A language is a system of signs having meaning by convention. In this sense, language need not be confined to the spoken word. Traffic signs, for example, form a minilanguage, it being a matter of convention that means "hazard ahead" in some countries. It is distinctive of languages that linguistic units possess meaning by convention, and linguistic meaning is very different from what is called natural meaning, exemplified in statements such as "Those clouds mean rain" and "The fall in pressure means the valve is malfunctioning."

An important characteristic of full-fledged human languages—in contrast to birdcalls and traffic signs—is their productivity. A productive language can formulate an unlimited variety of sentences.

It is relatively easy to write computer programs that seem able, in severely restricted contexts, to respond fluently in a human language to questions and statements. Although none of these programs actually understands language, they may, in principle, reach the point where their command of a language is indistinguishable from that of a normal human. What, then, is involved in genuine understanding, if even a computer that uses language like a native human speaker is not acknowledged to understand? There is no universally agreed upon answer to this difficult question. According to one theory, whether or not one understands depends not only on one's behaviour but also on one's history: in order to be said to understand, one must have learned the language and have been trained to take one's place in the linguistic community by means of interaction with other language users.

CHATBOT

. The logistic regression algorithm in ML allows us to process the data efficiently. The goal here is to model the underlying structure or distribution of the data in order to learn more from the training set. In any case, the utilization of artificial intelligence in an industry where individuals' lives could be in

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PURPOSE AND SCOPE

Almost everyone kept on hold while operators connect you to a customer care executive. On an average people spend around 7 minutes until they are assigned to a person. Gone are the frustrating days of waiting in a queue for the next available operative. They are replacing live chat and other forms of slower contact methods such as emails and phone calls. Since chat bots are basically virtual robots they never get tired and continue to obey your command. They will continue to operate every day throughout the year without requiring to take a break

LITERATURE REVIEW

A literature survey or a literature review in a project report is that section which shows the various analyses and research made in the field of our interest and the results are already published, taking into account of the various parameter of the project. It is the most important part of the report as it gives us a direction in the area of our research. It helps us to set a goal for the analysis.

LITERATURE SURVEY

A REVIEW ON CHAT INTERFACE

This unit is the front end of the system. It is responsible for collecting the user queries from the user which are the input to the system. It is also responsible for displaying the system generated results to the user. Therefore, it can be said that the chat interface is the face of the system through which the entire communication takes place. It is the mediator of conversation between the system and the user. The query that user fires on the chat interface is passed on to the chatting backend which acts as a message delivering system between the Chat interface and the Machine Learning Layer. This interface can be accessed either as a website or as a smart phone app. The type of interface depends on the requirements of the user that are to be satisfied by the system. If the system is accessed from a smartphone, the interface will be in the form of an app and if the system is accessed from a website, then the interface will be in the form of a website. For building apps on the smartphone, it will require to use android for android phones or Swift for iOS. In this case, only the interfacing platform will be programmed on android and the complete backend processing of the system will take place on a server on which the system will be deployed. For making a website, either Java or Python web frameworks can be used. Java provides Spring and Struts as the most advanced and latest web frameworks. Similarly, Python allows usage of Django and Flask frameworks for building of a website. The criteria for selection of the programming language depends upon the functionalities that the system intents to provide, the requirements of the users that will use the system, the algorithms that are to be used by the system, etc. Selection of an appropriate programming language makes it simpler for developers to develop a system which provides maximum functionality to the user with high accuracy and minimum complexity.

A REVIEW ON NLU ENGINE NLU

Natural Language Understanding is a subpart of NLP (Natural Language Processing) which enables the system to understand the natural language or the conversational language spoken by the users. The conversational language used by humans for day to day conversations is not as perfect as the formal

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language. It does not focus much on the vocabulary and the grammar. Hence, it becomes difficult for a system to understand the intent of the sentence. The input received from the user is in unstructured text format which cannot be understood by the system directly. It understands input only in structured formats. The unstructured text received from the user is converted to structured format by extracting important words and patterns from the user text using the NLU techniques. Humans are capable of understanding any mispronunciations, homophones, swapped words, shortened form of words (like „it‟s‟ for „it is‟), slang words or phrases and also words which are not used in formal vocabulary but exist in regular conversations. NLU techniques enables the system to identify these twerks if the user makes use of them while conversing with the chatbot, so as to make the user feel that the conversation is taking place between two humans and not between a human and a bot. NLU systems do not directly understand the meaning of the user sentences. It involves a sequence of processes to derive the actual intent of the sentence. To understand a complete sentence, the NLU system needs to understand each word of that sentence. It means that the initial task is the segmentation of the sentences into individual words. Next, to understand the word, the system needs to understand the grammar of the sentence. This can be done by knowing the parts of speech of each word in that sentence. Here comes the POS (Parts-Of-Speech) tagger into picture. After knowing the grammatical weightage of each word, all of them are parsed to know the dependency among them. This is the most important step wherein the word with the highest dependency is extracted, from which the intent of the system can be known. It is not possible that the knowledge base would contain the exact sentence that the user has sent. It might contain a sentence with the same intent but with different words used in it. To match these types of synonymic sentences, synonym determination and sentence matching are required. The different tasks to be implemented under the NLU Engine and the methods to do the same have been discussed further.

A REVIEW ON WORD SEGMENTATION

Segmentation, also referred to as tokenization is the process of splitting text into smaller and meaningful units. These units could be paragraphs, sentences, clauses, phrases, words or letters. The smallest unit are the letters. Word segmentation is the splitting of sentences into individual words separated by blank spaces. The tokenized units of the sentences are called as tokens. The tokenizers split the sentences into words and punctuations marks as independent units. The most commonly used tokenizer is of space type, i.e. it splits the sentences into words at the blank spaces. It is also required that the tokenizer should consider abbreviations, acronyms, dates, numbers in decimal formats, etc., which cannot split at punctuations and blank spaces, as they will lose their meaning if done so.

[1]Mohammed Javed et al.[2016] explained a method to implement word segmentation. He proposed in his algorithm to calculate character spaces in the sentences. The character spaces should include all types of gaps between characters They include the gaps between letter, punctuations and the words. The algorithm functions on the basis of the amount of gap or character space between each unit in the sentence. After the calculation of character spaces, an average of the gaps is calculated to know the mean average between characters in the sentence. This average gap distance is then applied to the sentence which is to be segmented. The places at which the character space is more than the average character space are said to be the points of tokenization. The gap between words is always more than the average gap and hence tokenization takes place at the blank spaces between words in the sentences.

[2] Naeun Lee et al. [2017] proposed the implementation of word segmentation using NLTK. Natural Language ToolKit (NLTK) is a python package which caters to provide services for NLP. It has inbuilt tokenizers. Users need to import the package and use the required type of tokenizer which is present in the form of functions. The NLTK includes a wide range of tokenizers which are as follows standard, letter, word, classic, lowercase, N-gram, pattern, keyword, path, etc. The most commonly used tokenizer is the word-punkt tokenizer which splits the sentences at the blank spaces. The accuracy, speed and

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efficiency of the NLTK tokenizers is commendable. Also, it does not require any algorithm implementation as the package executes them at the backend.

[3] Tao Jaing [2011] explains the usage of CRF (Conditional Random Fields) Algorithm for word segmentation. This algorithm trains the system for spaces between the characters. Using this training, the system identifies the gap between characters in the test sentence. The system keeps a threshold value for the gap distance. If the value of gaps in the test sentence is more than the specified threshold, then the sentence splits at those points. CRF requires a lot of training to be given to the system, which makes the process time consuming. Comparing the three methods illustrated above, the NLTK proves to be more efficient in all aspects as compared to the other two. The usage of NLTK does not require the implementation of any algorithm as everything is taken care by the package itself. Also, the accuracy, speed and diversity provided by the package is better than the two algorithms.

[4] Jerome R. Bellegarda [2010] proposed a method called latent analogy for POS Tagging. In this algorithm, latent semantic mapping (LSM) technique is used. It requires the training on the available corpus. The LSM maintains a feature space of the trained corpus which has been tagged. Now, new sentences are provided to the LSM for tagging and the analysis is performed so as to determine the sentences from the training data which are closest to the test sentence. This is called as sentence neighbourhood. Sentence neighbourhood holds true for two sentences if they share the same intent matter. Once the intent matching sentences are found from the trained data, the POS tags attached to those sentences are then mapped to the test sentences

[5] Liner Yang et al. [2018] put forth the technique of implementing the POS Tagger using Neural Networks. This algorithm consists of „n" numbers of hidden layers. Theses layers are determined by the number of iterations or combinations required to tag the required sentence correctly. At each layer of the algorithm, each word in the sentence is tagged with an appropriate POS tag and then passed to the next later for checking the correctness of the tags. This keeps happening unless the next layer provides the same tags as provided by the previous layer. Another technique to implement the POS tagger is following the traditional approach i.e. of maintaining a dictionary of tags for the given language. Python NLTK provides an inbuilt Tagger which can be used just by importing the NLTK package. The NLTK has a predefined set of tags and a trained data of its own. It tests the sentence and applies an appropriate tag to it. On comparing the above three algorithms, the NLTK tagger proves to be speed and usage efficient. But highest accuracy is provided by the neural network algorithm as it undergoes many iterations.

[6] Bo Chen [2011] proposed a method for implementing the dependency tree. It initially finds out the dependencies among the words in the sentence. Each word is checked for its relationship or dependency with the other word. The word with the highest dependency is selected to be the root. The other words with a relation with the root node are attached to it as the child nodes. This keeps on continuing until all the words are placed in the tree. The tree form of the sentence is called the dependency parser tree. The dependencies among the words are found out by using the POS tags.

[7] Zhenghua Li [2014] provided a further improvised model of the dependency parser. In the traditional method mentioned above the parser creates a parsed tree for the required sentence. In the graph-based dependency parser, the tree created is converted to a graph where the words in the sentences are the vertices and the dependency between the words are the represented by the edges. This data structure shows a better representation of the parsed sentence. Parsing is always to be performed by the traditional method. But graph-based parser improves the visibility, readability and understandability of the parser.

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[8] LinHua Gao et al. [2018] explains the traditional dictionary method of synonym extractions. In this method, the system database maintains a dataset of synonyms for important keywords in that domain. The sentence sent by the user is then mapped on to that synonym dataset. The keywords detected from the sentence are then checked in that synonym set to check for same intent. All possible synonyms of that keyword are then looked out for a match in the main database. The sentence which is closest to the user sentence is extracted. This method is time consuming and requires more of storage and complexity.

[9] Sijun Qin [2015] proposed a feature selection method for synonym extraction. In this method, among all the parts of speech tags, words having the tags as noun, verbs and adjectives are marked as positive tags and the others as negative tags. The polarity for each feature (word) is then carried out by using the POS tags. If the overall feature polarity is positive, then it can be identified categorically. All the positive features are then grouped together and the synonyms detection for the group of features will be relatively strong, as an entire clause is checked for its synonymic meaning. The synonym sets which are extracted for that clause of features is then calculated for information gain. The one with the highest information gain is the strongest synonym extracted.

[10] Sachin S. Gavankar et al [2017] proposed the eager decision tree algorithm for prediction. This type of decision tree is the improvised version of the traditional decision tree. It creates this tree at runtime, based on the user's queries and keeps updating the tree on new user messages. Consider its working for disease prediction. In this algorithm, the symptoms detected in the user query are added as child nodes to the root node. The nodes keep on getting added for new symptoms detected. Further for every symptom, the algorithm checks for the second symptom which has the highest occurrence with the earlier symptom and asks the user for that symptom. If he says yes, then the system traces that path to check for the disease present at the root node. This will keep iterating for all users and the tree keeps getting updated for new entries or traces the path available.

CONCLUSION

Through chat bots one can communicate with text or voice interface and get reply through artificial intelligence. Typically, a chat bot will communicate with a real person. Chat bots are used in applications such as ecommerce customer service, call centers and Internet gaming. Chat bots are programs built to automatically engage with received messages. Chat bots can be programmed to respond the same way each time, to respond differently to messages containing certain keywords and even to use machine learning to adapt their responses to fit the situation. A developing number of hospitals, nursing homes, and even private centers, presently utilize online Chat bots for human services on their sites. These bots connect with potential patients visiting the site, helping them discover specialists, booking their appointments, and getting them access to the correct treatment. An ML model has to be created wherein we could give any text input and on the basis of training data it must analyze the symptoms. A Supervised Logistic Regression machine learning algorithm can be implemented to train the model with data sets containing various diseases CSV files. The goal is to compare outputs of various models and suggest the best model that can be used for symptoms in realworld inputs. Data set contains CSV file having all diseases compiled together

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