May - June 2020
ISSN: 0193-4120 Page No. 4518-4523

Chatbots Technologies and Applications: A Survey

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Article Info
Volume 83
Page Number: 4518-4523
Publication Issue:
May - June 2020

Abstract

Now-a-days there is huge advancement in Human Computer Interaction due to Machine Learning, Artificial Intelligence and Natural Language Processing. Chatbot is one way of interaction between the user (Human) and computer. It is an assistance that communicates with us either through text or voice. It can be developed by using natural language processing which provides the user to interact with the machine to get a solution for the queries. It can be used for many applications, like in the medical field, commercial purpose etc. The biggest challenge in developing chatbot is the QOSby natural language processing in machine learning during training and authenticating the chatbot from the attackers. In this paper, a discussion is presented along with comparative analysis of various chatbot characteristic features as well as their advantages, limitations and assessment of efficiency of the chatbot based on QOS and performance for various applications.

Article History
Article Received:*19 November 2019*
Revised: *27 January 2020*
Accepted: *24 February 2020*
Publication: *12 May 2020*

Keywords: *ChatBot, Natural Language Processing, Machine learning algorithms, Artificial Intelligence.*

1. Introduction

Chatbot is a piece of software for conversation of machine and human either through auditory or textual messages. It has evolved now-a-days with advanced NLP abilities used in background that can understand, process and predict responses in word and sentences form. It provides a human with the experience of a user-interaction towards a machine. It is an automated system of communication with users. Chatbot assistance enables human interaction with machine in different applications. Applications include e-commerce, banking sector, health care and many more. Implementing chatbot in different areas has made human to interact with bot and provide the services in a simple way of conversation.

Chatbot is merely a computer program that fundamentally simulates human conversations. Chatbot provides 24/7 digital support, advice, and human-like assistance which interacts with clients. The conception and implementation has been evolved due to natural language processing provided by artificial intelligence and machine learning [1].

Natural language processing (NLP) is a linguistic Artificial Intelligence concerned with the interaction between computer and human language. It helps computers to process large amounts of natural language data. It involves Speech recognition, natural language understanding and natural language generation. It helps to process and analyze Natural language text for detecting relevant information and predicting appropriate response.

TEST Engineering & Management

May - June 2020
ISSN: 0193-4120 Page No. 4518-4523

2. Related Work

Chatbot may be an informational or personalized use or specialized purpose like educational, medical etc, or it may help in booking flight, or hotel recommendation, educational, healthcare, agriculture etc. chatbot can be designed based on the type of requirement, technologies which include machine learning, artificial intelligence.

Some of the commonly identified technologies that can be used in chatbot are ANN (Artificial Neural Network), AIML, NLP, KNN, Machine learning algorithms, sentimental analysis.

AIML (Artificial Intelligent Markup Language) is a natural language meant for creating human interfaces by keeping implementation as simple XML programming. AIML has been defined in form of tags, such as " <aiml> - defines start and end of AIML ", " <category> - unit of knowledge in knowledge Base ", " <pattern> - defines the pattern to match ", " <template> - defines the response to the user ".

ANN (Artificial Neural Network) can be used to train the chatbot based on the data sets. RNN (Recurrent Neural Network) can be two or multiple layers where the intent and entities are trained for accuracy and precision. It is for analyzing the nearest answer using k-nearest neighbour algorithm.

Training a chatbot is based on a knowledge base where possible inputs and correct outputs are stored in the form of Q&A. It is suitable for solving general queries. Cloud Service Providers helps in solving general queries by providing QnA Maker for developing Q&A Chatbot which can be used to make a set of possible questions and answers.

NLP is a field of Artificial Intelligence that helps the machines the ability to read, understand and derive meaning from the queries [1]. NLP understands and predicts human behaviour through training. Cognitive service can be used to train the chatbot to predict and solve the queries at its best. It also consists of sentimental analysis to analyze the sentiments of users and classify them as positive and negative thoughts which is required for few chatbot to analyse human behaviour. Few examples of NLP are Google's Dialogflow, Microsoft's LUIS (Language Understanding Intelligent Service).

3. Challenges

Challenges in chatbot are more towards the training chatbot and securing the chatbot. Chatbot training is challenging because of limitations of NLP. Predicting the queries from user utterance is the biggest challenge, that depends on training of chatbot. Authenticating chats from unauthorized persons.

4. Literature Survey

In this section, a discussion of related papers is presented with a description of their methodology and contribution:

Ramya Ravi [2] methodology on chatbot using AIML (Artificial Intelligent Markup Language) which helps the user understand the website performance through query. The AIML is a pattern based where the user needs to type in the specific pattern. The Patterns (questions) are predefined and the user needs to follow the same format. when the pattern matches. If the pattern matches the template then that particular category is sent back to the user as a response.

The author has categorized the queries based on the type of data such as domain related query, general queries and none of the above. Users need to follow a pattern while questioning the chatbot. Further it can be implemented using NLP for predicting user questions and thinking.

Albert Verasius Dian Sano, Tanto Daud Imanuel, Mega Intanadias Calista, Hendro Nindito and Andreas Raharto Condrobimo [3] proposed a chatbot using AGNES Algorithm and Google's DialogFlow as a knowledge base. The methodology used involves 3 steps:

Step 1: Preparing the data based on latitude, longitude and preparing snapshots.

Step 2: Mining the data using AGNES algorithm and parameters used are linkage criteria, measurement type. Process the data using AGNES clustering by reading the excel and setting rules.

Step 3: Knowledge base for chatbot to solve the user queries are from DialogFlow framework by Google through intents.

It is used as a tourist chatbot and future work can be implemented by clustering on more regions.

Neelkumar P. Patel, Devangi R. Parikh, Prof. Darshan A. Patel and Prof. Ronak R [4] proposed UNIBOT (UNIversal chatBOT) using Artificial Intelligence and machine learning algorithms specifically designed for their chatbot . The implementation of the unibot was performed by designing the database and Algorithm for the chatbot with front-end developed using HTML,CSS, jQuery and Ajax used to call and get responses from PHP files. The table is created in the database which has a question and 3 fields for one question with 3 types of answers. Unibot is made for universities segregated according to departmental syllabus, events, admission fee, timetable etc. The algorithm developed for this unibot accept, prose and split the sentence then perform SQL query on the words to pick up the answers for the query. If multiple answers are matched, then options are generated to select one of them. If matching doesn't happen, answers are selected based on keywords. If no result is produced, display's sorry message to the user. Can improve Chatbot's accuracy and query prediction using NLP.

May - June 2020
ISSN: 0193-4120 Page No. 4518-4523

Shafquat Hussain and Prof. Athula Ginige [5] proposed chatbot using AIML and VDMS for Diabetics management system in patience.

In the proposed system when the user registers with the registration form, the data filled is first normalized. Normalization process then matched with pattern with previous stored responses in database and AIML database, if match found, response for the user query is displayed else search in the Wikipedia using MediaWiki API plug-in. If the query doesn't match any of the criteria a default reply is sent to the user.

Amber Nigam, Prashik Sahare and Kushagra Pandya [6] proposed chatbot using Recurrent Neural Network (RNN) by classifying intents (purpose) and entities (action to be taken for the user query). Proposed model has intents for user query into categories and sub-categories using RNNs and finding entities in multiple stages of neural network. The intents and entities are both achieved in parallel. There are 6 steps involved in this model.

Step 1: pre-processing before the first RNN model.
Step 2: predict category of the intent using RNN.
Step 3: Rule base classification for identifying subcategory of intents.
Step 4: Pre-processing before the second RNN model where some entities were replaced with keywords.
Step 5: Using RNN for predicting subcategory of intents.
Step 6: Finding remaining slot-entities using NER.

Weak pattern matching capability can be improvised by using NLP for predicting human behaviour.

Belfin R V, Shobana A J, Megha Manilal, Ashly Ann Mathew and Blessy Babu [7] proposed a chatbot for cancer patients using NLP, web scrapping technologies and Database will act as a knowledge base.

Step 1: Data Collection: Large amounts of datasets from cancer forums are sorted out and taken in the local database using a beautiful soup library of python and stored in the database in CSV(comma separated values) format.
Step 2: Data Pre-processing: The raw data is pre-processed using tokenization, converting to lowercase, punctuation removal, stop words removal and stemming.
Step 3: In the third step the processed data is then converted to a graph model using NEO4j in the form of nodes and edges. These graphs help in processing and differentiate and identify the relationship between each data easily.
Step 4:In the last step the based on the symptoms provided to the bot is identified and listed the name of cancer based on the classification of the symptoms of cancer and remedies for the cancer and related information is provided along with the treatments to cure cancer.

Without using a Knowledge base, NLP can be used for predicting the human behaviour of asking questions.

Chirstoph Matties, Franziska Dobrigkeit and Guenter Hesse [8] proposed a chatbot for Agile Retrospectives chatbot to track the progress of retrospective action items. Slack is used to communicate with the team members as chatbot front-end. This chatbot measures the capability of the employee to work using provided code statements and will inform team members about the status per action item. Based on these results the team members are initiated and act as a basis for data improvements on the sprint board to follow the agile principle. Helpful in the software industry.

Jitendra Purohit, Aditya Bagwe, Rishabh Mehta and Ojaswini Mangaonkar [9] proposed a chatbot to interview candidates for placement drives using NLP and decision making. The JARO chatbot is an automated interview process via voice and text. Based on the responses received from the candidate, a summary of the interview is generated into a final report and sent to the manager or HR via email. The implementation of chatbot involves JARO (to extract candidate's personal details), JARO chatbot (Based on the details and resume provided to the chatbot, the bot prepares a set of questions based on the job category selected by the candidate and recorded the response from the candidate) , Database (the response is stored in the database along with the questions and scores based on grades) and sentimental analysis (the responses are categorized into three levels as low, medium and high).

Advantageous in the education field for candidates interviewed during placement and reduces time.

Sathit Prasomphan [10] proposed chatbot by using NLU, ANN for the process of creating a web application for managing Facebook Page online selling. IT consists of two parts first is System part and second is User part, In System part, the system can add, edit products by the owners page along with name, information and image. Users can see the entire product list, he can click, upload images and edit information for products and can order products on the list page. Stable libraries can be used by using Reactjs and improvising the chatbot.

Rohit Binu Mathew, Sandra Varghese, Sera Elsa Joy and Swanthana Susan Alex [11] developed android application chatbot.

Step 1: Chatbot registration.
Step 2: processing messages using NLP for analysis, prediction of user analyses and responding to user queries.
Step 3: Based on the training using KNN for pattern recognition. The chatbot is made to detect the disease based on the symptoms provided by the patient during conversation, using KNN mapping them to their corresponding diseases.

The chatbot answers to the symptoms, future work can be advice for a good consultation.

May - June 2020
ISSN: 0193-4120 Page No. 4518-4523

5. Results and Discussion

Table 1: Comparison of existing chatbot with respect to methodology, advantages, disadvantages, limitations and applications.

Sl no.	Year	Methodology	Advantages	Disadvantages/limitations	Gaps	Applications
1.	2018 IEEE .	Artificial Intelligent Markup Language (AIML) [2].	Classification of scenarios are done perfectly	Should follow the patterns defined while entering the query in chatbot.	NLP can be used instead for predicting and analyzing user text.	Web analytics
2.	2018 International Conference on Information Management and Technology (ICIMTech).	AGNES (Agglomerative Algorithm), Natural Language Processing (NLP). [3]	Mapping based on AGNES clustering .	Mapped regions were only 39, limited to only local cities.	Can be mapped to more regions, which strengthen the app for all tourists.	Business (Tourism chatbot).
3.	2019 Third International Conference on Electronics Communication and Aerospace Technology [ICECA]	Artificial Intelligence and Machine Learning algorithm [4].	Use UNIBOT algorithm which consumes less memory with minimal database hits	No NLP is used for training the data set.	No training is provided for the Chatbot which can be provided by using NLP	Education(University chatbot)
4.	2018 32nd International Conference on Advanced Information Networking and Applications Workshops	VDMS(Virtual Diabetics Management System), AIML(Artificial Intelligent Markup Language) [5].	VDMS search based engine for diabetics.	VDMS was able to answer 65% of correct replies compared to search engines(which answered 80% correct replies).	AIML does not use a logic engine and has a weak pattern matching ability and limit on the amount of context. Can be replaced with NLP for predicting human behaviour and understanding.	Medical (Diabetics patients chatbot).
5.	2019 IEEE 13th International Conference on Semantic Computing (ICSC).	Natural Language Understanding, Recurrent Neural Network Model, Bi-	To avoid overfitting, added bias while training, RNN MODEL	Accuracy is not met after training the data set. Intent accuracy is 75.06%. Performance is moderate	NLP technique can be used to improve intent accuracy.	User-query chatbot application.

May - June 2020
ISSN: 0193-4120 Page No. 4518-4523

		LSTM[6]				
6.	2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS).	Natural Language Understanding (NLU) [7].	Advantageous for cancer patients.	Database is used as a knowledge base for solving queries .	Customized NLP and automation for training chatbot can be used.	Medical (specifically for cancer patients).
7.	2019 IEEE	Agile software development, slack [8]	Keeps track of software development , agile retrospective (Automated scrum master)	Specific for particular software development.	-	Software development
8.	2019 Third International Conference on Computing Methodologies and Communication (ICCMC).	NLP, Sentimental Analysis[9].	Automated interview.	No automation for result display for selected candidates.	-	Interview Process (placement drive).
9.	2019 IEEE 4th International Conference on Cloud Computing and Big Data Analytics.	NLU, Tensorflow, ANN, LSTM. [10]	Built with NLU along with RNN	Some libraries cannot run on Node.js. Libraries are unstable.	Can be used with React JS which supports many libraries and handles server and client side in web applications.	Business.
10.	2019 Third International Conference on Trends in Electronics and Informatics (ICOEI).	KNN, Machine Learning .[11]	Mobile app chatbot.	Only related to symptoms queries	Can include medical consultation and recommendations	Medical.

6. Conclusion and Future Scope

In this paper, different applications of chatbot with methodology, advantages, disadvantages limitations has been discussed (Table I). Chatbot is a way of communication with the computer to humans. Machine Learning shows much advancement in automation, NLP etc. NLP is a linguistic artificial intelligence specifically made for language understanding, we can make use of this linguistic artificial approach for chatbots to understand the

May - June 2020
ISSN: 0193-4120 Page No. 4518-4523

natural language of humans to interact with machines. It can be developed by different methodology but the effective chatbot can be designed and implemented by using natural language processing which trains the bot based on the datasets to give efficient and predict correct answers for the user queries. Many chatbot's have not used Natural Language Processing for predicting human thinking and behaviour while querying the chatbot. Hence, prediction using NLP gives a user friendly and better experience while using a chatbot.

References

[1] Vagelis Hristidis, "Chatbot Technologies and Challenges", published in First International Conference on Artificial Intelligence for Industries, pp. **126, 2018.**

[2] Ramya Ravi, "Intelligent Chatbot for Easy Web-Analytics Insights", published in IEEE International Conference, pp.**2194-2195, 2018**.

[3] Albert Verasius Dian Sano, Tanto Daud Imanuel, Mega Intanadias Calista, Hendro Nindito, Andreas Raharto Condrobimo, "The Application of AGNES Algorithm to Optimize Knowledge Base for Tourism Chatbot", published in International Conference on Information Management and Technology (ICIMTech), pp. **65-68, 2018.**

[4] Neelkumar P. Patel, Devangi R. Parikh, Prof. Darshan A. Patel, Prof. Ronak R. "AI and Web-Based Human-Like Interactive University Chatbot (UNIBOT)", published in the Proceedings of the Third International Conference on Electronics Communication and Aerospace Technology [ICECA], pp**. 148-150, 2019.**

[5] Shafquat Hussain , Prof. Athula Ginige "Extending a conventional chatbot knowledge base to external knowledge source and introducing user based sessions for diabetes education", published in 32nd International Conference on Advanced Information Networking and Applications Workshops, pp. **698-703, 2018.**

[6] Amber Nigam, Prashik Sahare, Kushagra Pandya, "Intent Detection and Slots Prompt in a Closed Domain Chatbot", published in IEEE 13th International Conference on Semantic Computing (ICSC), pp**. 340-343, 2019.**

[7] Belfin R V, Shobana A J, Megha Manilal, Ashly Ann Mathew, Blessy Babu, "A Graph Based Chatbot for Cancer Patients", published in 5th International Conference on Advanced Computing & Communication Systems (ICACCS), pp. **717-721, 2019.**

[8] Chirstoph Matties, Franziska Dobrigkeit, Guenter Hesse, "An Additional Set of (Automated) Eyes: Chatbots for Agile Retrospectives", published in IEEE/ACM 1st International Workshop on Bots in Software Engineering(BotSE), pp. **34-37, 2019.**

[9] Jitendra Purohit, Aditya Bagwe, Rishabh Mehta, Ojaswini Mangaonkar, Elizabeth George, "Natural Language Processing based Jaro-The Interviewing Chatbot", published in Proceedings of the Third International Conference on Computing Methodologies and Communication (ICCMC), pp. **134-136, 2019.**

[10] Sathit Prasomphan, "Improvement of Chatbot in Trading Systems for SMEs by Using Deep Neural Network", published in IEEE 4th International Conference on Cloud Computing and Big Data Analytics, pp. **517-522, 2019.**

[11] Rohit Binu Mathew, Sandra Varghese, Sera Elsa Joy, Swanthana Susan Alex, "Chatbot for Disease Prediction and Treatment Recommendation using Machine Learning", published in Proceedings of the Third International Conference on Trends in Electronics and Informatics (ICOEI), pp. **851-856, 2019.**