AI – BASED CHATBOT TO IMPROVE SELF-GUIDED LEARNING

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Abstract - *Dialogue generation or intelligent conversational agent like chatbot system attract huge interest in the recent years in many different field. It is a computer program, programmed in such a way that is capable of having a human-like conversation with a user by receiving and sending text messages for the purpose of automating a business process. Chatbots can range from simple to advance. They fall on a range of artificial insight. It uses deep learning, natural language processing or different machine learning techniques. These agents are generally used in an attempt to increase the efficiency and shortening the business process execution time replacing the human to human communication with a human to machine conversations and queries in natural languages. These agents today have several levels of capabilities as task oriented or general purpose chatbots. In practical terms, they allows businesses to increase their efficiency and reduce overhead. The decrease of staff for monotonous cycles requiring client service representatives is the greatest guarantee of chatbots in the long haul. Some chatbots are domain specific which are specific scenario based business purpose. They are normally used by financial organizations like investment companies, banks, brokerage funds, insurance companies, credit card companies. Among current chatbots which are deployed by companies majority of them are rule based which have limited capability. In this project I am building a self-learning conversational agent.*

Key Words: NLU (Natural Language Understanding), NLP (Natural Language Processing), LSTM (Long-Short-Term Memory), RNN (Recurrent Neural Network), DNN (Deep Neural Network), DRL (Deep Reinforcement Learning), GRU (Gated Recurrent Unit)

1.INTRODUCTION

A chatbot is a piece of programming that directs a discussion by means of hear-able or printed techniques. Such undertakings are consistently planned to convincingly reproduce how a human would carry on as a conversational associate. Chatbots are ordinarily utilized in exchange frameworks for different reasonable purposes including client care or data obtaining. Some chatbots utilize complex normal language preparing frameworks, however numerous easier ones check for catchphrases inside the info, at that point pull an answer with the most coordinating watchwords, or the most comparative phrasing design, from an information base. It is an associate that speaks with us through instant messages, a virtual partner that incorporates into sites, applications or moment couriers and causes business people to draw nearer to clients. Such a bot is a motorized game plan of correspondence with customers.

Figure 1: Chatbot

Chatbot work by analyzing and identifying the intent of the user's request to extract relevant entities, which is the most important task of a chatbot. When the examination is done suitable reaction is conveyed to the client. The chatbot work by adopting NLU and NLP methods. Natural language understanding (NLU) is the capacity of the chatbot to comprehend a human. It is the path toward changing over substance into coordinated data for a machine to appreciate. NLU follows three specific concepts. They are entities, context, and expectations. Entities represents an idea to the chatbot. For example, it may be a refund system in our ecommerce chatbot. Setting implies when a characteristic language understanding calculation identifies the solicitation and it has no chronicled background of discussion, it won't have the option to review the solicitation to give the reaction. Assumptions implies Bot should have the option to fulfill the client assumptions when they make ask for or ask a question client says sends a request. Natural Language Processing (NLP) bots are designed to convert the text or speech inputs of the user into structured data. The information is additionally used to pick an applicable answer. It comprises Tokenization, Sentiment Analysis, Normalization, Entity Recognition, and Dependency Parsing.

As of late, there have been significant increment of interest being used and sending of discourse age frameworks. Many major tech companies are using virtual assistant or chat agent to fill the needs of customers. Some of them include Google's Google Assistant, Microsoft's Cortana and Amazon's Alexa. In spite of the fact that they are basically question noting frameworks, their reception by significant

organizations has topped interest in clients and appears to be encouraging for further developed conversational specialist framework innovative work.

Banks are also using chatbot these days to improve their service. Bank of America's remote helper chatbot Erica can take orders through sort and voice order and perform capacities, for example, booking an installment and investigating ongoing exchanges inside their application.Kotak Mahindra Bank is the first to ever launch the voice chat bot named Keya. HDFC Bank's EVA (electronic virtual assistance) is largest artificial intelligence powered chatbot. EVA has already answered 5 million queries with 85 % accuracy.

A chatbot can work for the organization dependent on preparing gave to it and increment the efficiency of the work. A few supporting advances help the chatbot to fill in as a genuine associate. For example NLP, AI and IoT upheld apparatuses and applications are functioning as a spine for the chatbot.

A chatbot is a free element that offers authoritative types of assistance to the clients and specialized and social help to the customers. It can work in different modes like secretarial work, client assistance uphold, showcasing via web-based media, too as can do the web altering task for a specific website or application. For making business arrangements, setting updates, arranging occasions, going to calls; these chatbots are utilized.

Types of chatbots:

The chatbots are of two types:

- Rule based chatbot.
- AI chatbot.

Rule Based chatbot are the one which works on the set of predefined rules. In this sort of bots, discussions map out to imagine what a customer may ask and how the chatbot should respond. They even can't answer the question outside their scope, like outside the predefined set of rules. They don't gain from the historical backdrop of discussions. These sorts of chatbots are quicker as contrast with AI-Powered chatbots. These bots are used as an FAQ resource, used when there are a few conversations to feedbasically used by small companies and organizations.

We all have been exposed to robots but most likely have not noticed that. Every time we use the Google search engine we practically using a robot, engine spiders, that indexes web page. Chatbots had an astonishing growth in the past few years and being used in various forms in public and private sectors via websites, social media, and mobile platforms. Future Market Research in a recent article claimed that the Chatbots market with major players such as Facebook (USA), WeChat (China), IBM (USA), and Artificial Solutions (Sweden) will reach 6 billion by 2023.

In recent years there has been a fundamental shift in customer digital expectations. Consumers expressed their frustration with website sites that are hard to navigate, do not address simple questions, and difficult to find basic details about the organization. Customers would rather to pay more attention to the personal message and one-to-one conversation than broadcasted messages, access information on-demand 24/7 and no tolerance to search or wait for information via emails. They prefer to use messaging (text or talkto-text) more than any other modes of communication and would like to have interactions with smarter speech-enabled applications like Siri or Amazon Echo. The existing web interface used by the public and private sectors have caused disappointment and unpleasant experience for users as they lack a standard interface.
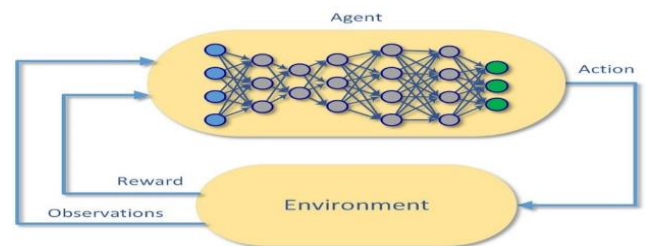

Figure 2: Drnn

1.1 Objectives

Chatbots are built to support business by helping and delivering actions or messages where humans cannot reach because of time or budget. The main aim of chatbot is to support business teams in their relations with customers, by offering efficiency and scalability.

The main objective of a chatbot is to engage with a user and provide the necessary information which has been asked. But as the query length increases the accuracy of the chatbot decreases. So another objective is to increase the accuracy of the chatbot so that if the user gives his/her query which is long or comprises multiple sentences our chatbot gives an intelligent reply. Sometimes chatbots are not ecient enough to understand multiple queries which are actually the part of a single query. They treat it as an individual query. Therefore the result is not the same as expected by the user. So the objective is to make a chatbot which senses the nature of the query.

2. LITERATURE REVIEW

In today's era digital technology is making our life simple and convenient. Either its finance, retail, sports, transportation or healthcare industry, technology has played an exceptional role. Let's take an example of banking industry. It has multiple electronic delivery channels in use to distribute technology assets and services for the benefit of their customers. Online banking is a commodity of commerce within financial services as well as banking industries. Progressions in innovation has changed a significant number of our administrations into the computerized time and the financial business is one of the essential enterprises to profit of these headways to improve their services.

Gone are the days when people used to stand in queues to avail the banking services. Artificial intelligence is substantially changing the world. It is leading to better customer experience, assistance and satisfaction of another level to the customer. As a result banking professionals understand the importance of these chatbots which helps in conversing with the customers and helps in providing better assistance. Banks implement technology to strengthen their processing capacity, acquire a larger market capital with customer base and expand the services they could offer. Internet banking has gotten more mainstream as it nullifies the requirement for clients to visit their nearby office as they can deal with their finances in a hurry to meet the demand of modern life. However we all know that most internet banking service providers struggle to get many of their customers to use their service. They identify lack of customer satisfaction when using online banking services to be a major cause. "Service quality, web design and content, security, privacy, speed and convenience" are the top factors influencing customer satisfaction.

This suggests that there is a lack of technology in place to enhance the customer online banking experience which could be improved by integrating a chatbot to provide an efficient, convenient and personal service.

Chatbots can analyses and understand not only the content but also the context of the customer's questions. As the research topic involves various terms like chatbots, perception and attitude it becomes imperative to explain each of them. Chatbots are defined as an artificially conversational agent which is enough intelligent to initiate and simulate human-like conversation.

2.1 Related Work

There have been numerous new turn of events and experimentation in conversational specialist framework. Apart from traditional chatbot development techniques that use rule based techniques, or simple machine learning algorithms, many advanced chatbots are using advanced Natural Language Processing (NLP) techniques and Deep Learning Techniques such as Deep Neural Network (DNN) and Deep Reinforcement Learning (DRL).
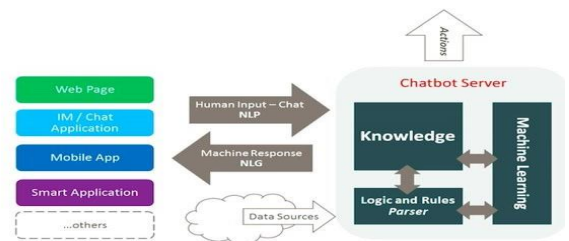

Figure 3: Anatomy of chatbot

2.2 Deep Reinforcement Learning

Profound support learning consolidates artificial neural organizations with a fortification learning design that empowers programming defined specialists to gain proficiency with the most ideal activities in virtual climate to accomplish their objectives. That is, it joins work guess and target enhancement, planning state-activity sets to anticipated prizes. This field of research has been able to solve a wide range of complex decision-making tasks that were previously out of reach for a machine. Seq2Seq model can generate coherent dialogues but may produce repeated generic responses regardless of input and can get stuck in a loop in longer conversations. This happens as Seq2Seq predicts expressions each in turn while disregarding their influence on future results. Seq2Seq models tend to generate highly frequent repeated responses like "I don't know". This is due to high frequency of generic responses in the training set, also this replies are more compatible with a wide range of input text.

2.3 Sequence to Sequence (Seq2Seq) Model

Seq2seq is a group of AI approaches utilized for language preparing. The calculation was created by Google for use in machine interpretation. Seq2seq turns one sequence into another sequence. It does as such by utilization of a recurrent neural network (RNN) or all the more frequently LSTM or GRU to stay away from the issue of evaporating inclination. The essential parts are one encoder and one decoder organization. The encoder transforms everything into a relating concealed vector containing the thing and its

specific circumstance. The decoder inverts the cycle, transforming the vector into a yield thing, utilizing the past yield as the info setting.
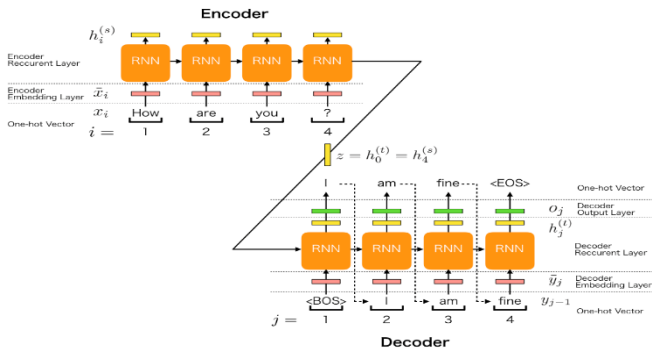

Figure 4: Seq2Seq

2.4 Frameworks

Botkit is a development kit from Howdy for creating and integrating bots, based on Node.js and provides several choices of NLP services, messaging platforms and databases.

Chatterbot is a Python library which implements a conversational dialog engine for chatbots using several human language and provides training and logic adapter that matches the user input against the training data.

Botpress is a framework for creating bots using independent modules and third parties.

BotMan is a PHP library for building chatbot that can be used by itself or in a Laravel-based bundle and supports several popular messaging channels as well as own drivers.

3. RESEARCH METHODOLOGY
3.1 Recurrent Neural Network

Recurrent Neural Network is a special Deep Neural Network Architecture used predominantly in Natural Language Processing (NLP) problems. In traditional Deep Neural Network, memory or sequence information is not taken into account. But, in Recurrent Neural Network, the sequential information is stored in memory and utilized for further processing which makes RNN suitable for sequential data or time series data where dependency exists in sequence.

3.2 Recurrent Neural Network Architecture

Recurrent Neural Network (RNN) is composed of input layer, multiple hidden layers and output layer. In info layer, input is feed as vector portrayal. Then, input vector is multiplied by some weight and some biases are added. Then, the output

from input layer is passed to next hidden layer where each consecutive hidden layer is composed of numerous RNN cells. After getting output from input layer, the cells in hidden layer multiplies the generated output from input layer by their own cell weights and biases. Next, in each of the hidden layer cells, some global activation function (sigmoid, tangent) is applied to generate output from hidden layer. Then, output from each hidden layer cells is passed to successive hidden layer. Similar to previous hidden layer cells, some weight, biases and activation function is applied to the input of current hidden layer cell. This procedure propagates though all consequent hidden layers. Finally, output generated from the final hidden layer is passed to output layer and the output layer applies some function (e.g. Softmax) to generate final output. For RNN, the output vector from final output layer is then again fed into the input layer as an input vector.

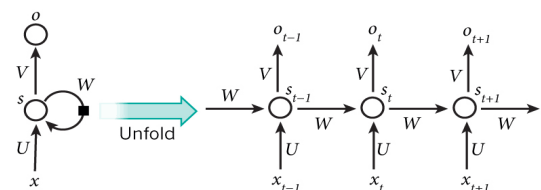Hence, the sequence information is stored in the memory and utilized.

Figure 5: RNN

But, vanilla RNN stores the complete sequence information. For large dataset with longer sequences, this can cause information bottleneck for the network. It may cause network to perform poorly due to information overload. As in many cases, complete sequential information may not be relevant in many NLP task including dialogue generation and can cause model to perform poorly. This problem is solved by special type of RNN cell Long-Short-term-Memory (LSTM).

3.3 Long-Short-Term-Memory

Long-Short-Term Memory (LSTM) is a special type of Recurrent Neural Network cell, which solves the data bottleneck for longer sequences. LSTM has forget gate along with the input and output gates. This helps remember longer sequence without overloading the network by discarding less relevant information.
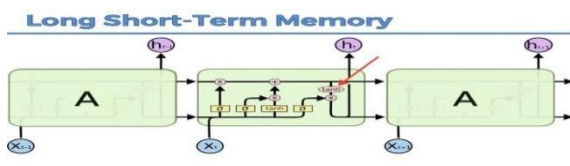
Figure 6: LSTM

Both encoder and decoder unit can be composed of different cell types other than vanilla RNN cell, including Long Short-term Memory (LSTM), or a gated recurrent unit (GRU). Also, encoder and decoder can be composed of unidirectional or bidirectional RNN. But, it has been empirically found that, LSTM works well for dialogue generation and other language problems as full sequence text can become information bottleneck and in many cases complete sequence is not required for efficient dialogue generation. Also, bidirectional RNN can help improve performance further more.

4. DATA COLLECTION

Data has been collected from Kissankerala an Integrated, multi-modal agricultural information system for Kerala.

4.1 Data Preprocessing

The principle issue with text information is that it is all in text format (strings). Nonetheless, Machine learning calculations need a type of mathematical component vector to play out the assignment. So before we start with any NLP project we need to pre-measure it to make it ideal for work. Basic text pre-processing includes:

Changing over the whole content into capitalized or lowercase, with the goal that the calculation doesn't treat similar words in different cases as different.

Tokenization: Tokenization is only the term used to portray the way toward changing over the typical content strings into a rundown of tokens i.e. words that we really need. Sentence tokenizer can be utilized to find the rundown of sentences and Word tokenizer can be utilized to find the rundown of words in strings.

Eliminating Noise i.e. all that isn't in a standard number or letter.

Removing Stop words. Here and there, some amazingly normal words which would have all the earmarks of being of little incentive in choosing archives coordinating a client need are rejected from the jargon totally. These words are called stop words.

Stemming is the way toward diminishing inflected (or some of the time determined) words to their stem, base or root structure — for the most part a composed word structure. Model if we somehow managed to stem the accompanying words: "Stems", "Stemming", "Stemmed", "and Stigmatization", the outcome would be a solitary word "stem".

Lemmatization: A slight variant of stemming is lemmatization. The major difference between these is, that, stemming can frequently make non-existent words, while lemmas are real words. Along these lines, your root stem, which means the word you end up with, isn't something you can simply turn upward in a word reference, however you can look into a lemma. Occurrences of Lemmatization are that "run" is a base construction for words like "running" or "ran" or that "better" and "extraordinary" are in a comparative lemma so they are seen as the same.

4.2 TF-IDF

An issue with the Bag of Words approach is that exceptionally successive words begin to rule in the archive (e.g. larger score), yet, may not contain so much "educational substance". Likewise, it will give more weight to longer reports than more limited records.

One approach is to rescale the frequency of words by how often they appear in all documents so that the scores for frequent words like "the" that are also frequent across all documents are penalized. This approach to scoring is called Term Frequency-Inverse Document Frequency, or TF-IDF for short, where:

Term Frequency: is a scoring of the frequency of the word in the current document.

TF = (Number of times term t appears in a document)/ (Number of terms in the document)

Reverse Document Frequency: is a scoring of how uncommon the word is across reports.

IDF = 1+log (N/n), where, N is the number of documents and n is the number of documents a term t has appeared in.

Tf-IDF weight is a weight regularly utilized in data recovery and text mining. This weight is a genuine measure used to evaluate how huge a word is to a report in a collection or corpus.

5. ALGORITHM DETAILS

Algorithm: Deep Neural Network (DNN), Recurrent Neural Network (RNN)

Main Technique: Sequence to Sequence (Seq2seq) modeling with encoder and decoder. Network (RNN)

Enhancement Technique: Long Short Term Memory (LSTM) based RNN cell, Bidirectional LSTM

5.1 Hardware Specification

Processor: Intel(R) Core(TM) i-5 3337 CPU @ 1.80GHz

Ram: 4 GB

Framework Type: 64-bit Operating System, x-64 based processor.

Graphics Card: 2GB AMD Radeon 520 Graphics.

6. RESULT

Following are some response derived after training on full dataset with training text. The initial test result produced moderately coherent sentences. The following responses were generated after inference from trained model. In inference, trained model produced candidate response for each input.
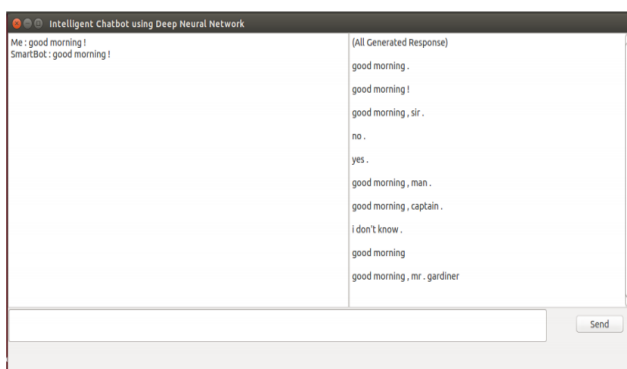

Figure 7: Output

Graphical User Interface (GUI) is developed using Python. On left top side, the chat response and history is shown and on the right text area, all possible response of input text has been shown. In the chat model training, number of output was around 30, more than one possible response is shown. On the left, one response of input text was randomly chosen from resultant responses generated after interference.

7. CHALLENGES

The challenge in developing chatbot or dialogue generator lies in developing coherent dialogue generation system. As the model used in this experiment is for machine translation, the dialogue generation is treated as translation problem, where history of earlier conversations are not taken into account. Hence, the model can be limited in performance regarding long conversation. Also, training is a long process which demands higher processing power and configured computing machine. Another problem is finding right hyper parameters to optimize the translation module for chatbot or dialogue generation system. There are multiple chatbots developed using GNMT or Seq2Seq module. GNMT is a rather self-contained with Bi-directional LSTM cells, Neural Attention mechanism and Beam search techniques. Most of this features improve dialogue generation as well as machine translation. Bidirectional LSTM cells with attention mechanism seems to produce better output. Seq2Seq module also has some of the advanced features of GNMT. Nevertheless, developing chatbot algorithm from scratch by building RNN, bidirectional LSTM and neural attention techniques would be better suited option as GNMT is primarily for machine translation. But, this will require multiple trial and error before reaching optimal performance for the comprehensive chatbot module and hence is better suited as research problem. After training, chatbot produced results with moderate relevancy. But many of the output were reparative and generic. Also, due to lack of real life quality data the chatbot performed somehow below optimum for imitating human interaction. Also, many utterance was discarded due to longer length or discrepancy. And, number of training utterance was much less than required and test and development dataset was quite larger in comparison which might have caused the model to underperform. Also, as data was limited, longer period of training may not have suited the dialogue generation problem.
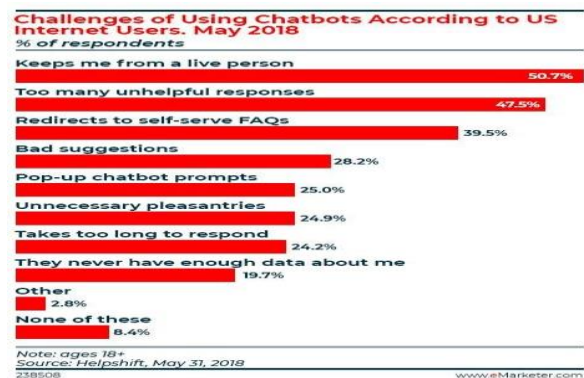

Figure 8: Challenges of Using Chatbots

Sometimes the unhelpful nature of chatbots aside, it's possible that it could take more time for consumers to get accustomed to this type of customer service. According to CGS, 60to 44 think companies are moving too quickly to replace humans with chatbots. This sentiment was shared by some younger generation and older consumers, but still one-third of those 18 to 24 and 4255 to 64 had concerns about companies making it harder to connect with live customer service agents.

8. FUTURE WORK

Looking ahead to the future scope of chatbots, bots need to additionally build up their NLP and capacity to go off-content. In organizations with numerous alternatives, items or administrations, clients will normally be moderate, distracted and interruptive. Chatbots will need to reflect the nuances of conversation, human memory and development in order to become a valid replacement for customer service agents who – even despite language barriers can exhibit patience, intelligence, understanding and flexibility. The usage of chatbot arrangements will broaden its viewpoints sooner rather than later. The chatbots details show that bots will be significantly more set up to coordinate human conduct and offer comparative administrations looking ahead to the future scope of chatbots, bots need to additionally build up their NLP and capacity to go off-content. In organizations with numerous choices, items or administrations, clients will normally be moderate, distracted and interruptive. Chatbots will need to reflect the nuances of conversation, human memory and development in order to become a valid replacement for customer service agents who – even despite language barriers can exhibit patience, intelligence, understanding and flexibility. The execution of chatbot arrangements will expand its viewpoints sooner rather than later. The chatbots details show that bots will be considerably more set up to coordinate human conduct and offer comparative administrations.

According to Global Market Insights, the general market size for chatbots worldwide would be more than $1.3 billion by 2024. But businesses using AI still find chatbots aren't perfect. It has far to convey a more prominent effect. However, the challenges still remain. Major challenges includes Chatbots often misinterpret the requests because they are not able to understand the right intent of the customer. Another challenge is misunderstanding the nuances of human dialogue. Because of absence of conversational insight, chatbots regularly neglect to decipher the subtleties of the discourse and that prompts an erroneous discussion.

8.1 Voice Interface

In the event that the future requests progressed chatbots that accomplish more than utilize scripted, single-turn trades, at that point their strategy for interface will likewise need to progress. A voice interface can help clients with incapacities or the individuals who are doubtful of innovation, however it likewise requires another layer of NLP advancement. Some experts tells that future is not all voice interfaces, but instead it should focus on working within device capabilities to boost user accessibility and flexibility. Some chatbots can offer voice-to-text interfaces, voice-to voice interfaces or text-to-voice interfaces, all depending on customer need or brand decision.

8.2 Futurebots

While voice interface might be discretionary, chatbots have been in the venture long enough for designers and specialists to start distinguishing what components of chatbots are backbone necessities. Natural Language Processing development, human-like conversational flexibility and 24/7 service are crucial to maintaining chatbots longevity in enterprise settings. Chatbots are AI devices and in future they need to do essential changes and keep up with AI trends, such as automated machine learning, easy system integration and developing intelligence.

9. CONCLUSION

A chatbot needs a purpose to be developed. In the world of technology there has been a fundamental shift in customer digital expectations. Gone are the days when people used to stand in queues to avail services. Artificial intelligence is substantially changing the world. It is leading to better customer experience, assistance and satisfaction of another level to the customer. However we all know that most organizations' service providers struggle to get many of their customers to use their service. They identify lack of customer satisfaction when using online banking services to be a major cause. Service quality, web design and content, security, privacy, speed and convenience are the top factors influencing customer satisfaction. Consumers expressed their frustration with websites that are hard to navigate, do not address simple questions, and difficult to find basic details about the organization. The existing web interface which is being used by business enterprises and multinational corporations have disappointed customers. Current chatbots also which are deployed for customer interaction are not much efficient enough to answer their queries. This suggests that there is a lack of technology in place to enhance the customer online banking experience

which could be improved by integrating a chatbot to provide an efficient, convenient and personal service. This led to search for some more promising solutions in chatbot.

Chatbots are built to support business by helping and delivering actions or messages where humans cannot reach because of time or budget. The main aim of chatbot is to support business teams in their relations with customers, by offering efficiency and scalability.

The Chatbot is to engage with a user and provide the necessary information which has been asked. But as the query length increases the accuracy of the chatbot decreases.

The Chatbot is to increase the accuracy of the chatbot so that if the user gives his/her query which is long or comprises multiple sentences our chatbot gives an intelligent reply. Sometimes chatbots are not ecient enough to understand multiple queries which are actually the part of a single query. They treat it as an individual query. Therefore the result is not the same as expected by the user.

So the consolation is to make a chatbot which senses the nature of the query.

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