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Intelligent Bot for Novice Reciprocal Action: A Survey

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ABSTRACT

Chatbot is the software delegates or programs designed to carry out near natural conversation with people. It is an artificial intelligent conversational entity. Chatbot is the current trends which are capable of automating services and thereby reducing human efforts. Turing test is said to measure the intelligence of chatbot and hence it must be able to pass it. This has been implemented with varying degrees of success. One of the most popular languages for the definition of a chatbot knowledge base is artificial Intelligence Mark-up Language (AIML).Just as people make use of language for human communication, similarly Chatbots make use of natural language to communicate with human users [1]. The intent of their creation is to simulate a way how a human interacts, attempt to cause user assume that they are writing to a human. In this work, we portray the transformation of chatbots from a simple model to an advanced intelligent system. For a chatbot to fully emulate a human dialogue, it must scrutinize the input given by a user accurately and devise a pertinent and best fitting response.

Keywords: chatbot, Turing test, AIML, intelligent system.

I. INTRODUCTION

With the growth in World Wide Web, it turns out to be a very tedious task to access any requisite information briskly. For this action to occur in a smoother way, human and artefact collaboration is vital. A Chatbots is an interactive assistant that handles reciprocal action through textual or aural method integrated with other platforms to attain fruitful results [3]. Chatbots are devised to credibly simulate human kindred conversation. The term chatter box was originally coined by Michael Mauldin in 1994. Chatbots can be categorized into two groups: The basic one uses predefined set of rules and the advanced one uses artificial intelligence. The one that uses artificial intelligence, gets smarter as it learns from the conversation with people. A Chatbot must also be able to execute fundamental functions such as calculations, alarms etc.

A. Turing Test

It was proposed by Alan Turing in 1950. It was devised to check the machines intelligent behaviour. This test was introduced in the paper entitled “Computing Machinery and Intelligence”, where he proposed a question ‘Can machines thinks?’, According to this test there is a human evaluator who would judge natural language conversations between a human and a machine designed to generate human like responses. Here the evaluator has prior information that one of the two in the conversation is machine. If the evaluator fails to distinguish amid human and machine, the machine is said to have passed the test.

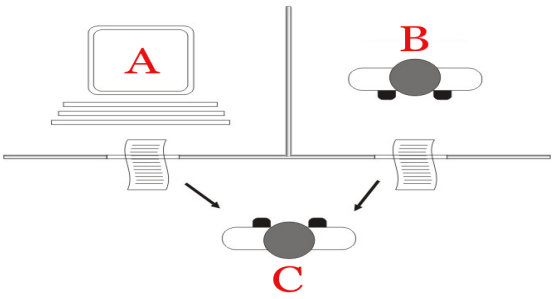

Figure 1. Illustartion of turing test [2].

B. Natural Language Processing (NLP) [3]

It is concerned with the interaction between humans and machines. Traditional Chatbot focuses on providing results based on keywords in the request, which is very difficult than pulling results based on intent behind the request. In order to understand the intent in the request, NLP and AI work together to bring the same intelligence that a person would respond for the corresponding request.

C. Artificial Intelligence Mark-up Language [4]

It is derived from base class named Extensible Mark-up Language (XML). It has class of data object called an AIML object that describes the behaviour of computer programs. It consist of units or tag called topics and categories. In AIML, categories are basic unit of knowledge. Each category consists of pattern which contains input and template which contain answer of chatbot.

Table 1. AIML Elements [9]

Sl.no	AIML Elements/Description
1	**<aiml> </aiml>** Defines the beginning and end of AIML document
2	**<category>** Defines the unit of knowledge
3	**<pattern>** Pattern to match what a user may input
4	**<template>** Defines the response based on user's input

There are three types of AIML classes:

1) Atomic categories
2) Default categories
3) Recursive categories

Atomic category: It is a sort of AIML classification where there is an exact match.

< category >
< pattern >How are you< /pattern >
< template >I am fine!< /template >
< /category >

In the above illustration if the client submits How are you then the chatbot will answer with I am fine!.

Default category: It is a kind of AIML class where the utilization of a wild card symbols, for example, * is utilized to coordinate any info.

< category >
< pattern >Who is * < /pattern >
< template > He is my brother < /template >
< /category >

In the event that ALICE does not discover an answer utilizing the main classification it continues to the next. For such situation if a client submits Who is Joy then ALICE will search until the wild symbol and if there is a match it will accompany the appropriate response.

Recursive category: It is a type of an AIML classification where exceptional labels are utilized to allude to a recursion to persuade the user to be more particular.

< category >
< pattern > Can you tell who the * is < /pattern >
< template > He is my brother < srai > Who is * < /srai > < /template >
< /category >

II. SURVEY OF CHATBOTS

Turing test proposed by Alan Turing, where he theorized that a truly intelligent machine must be indistinguishable from human during a text-only

conversation. This ideas eventually laid the foundation for the revolution of the chatbots [5][6].

ELIZA – it was an early computer program capable of passing the turing test and was also capable of natural language processing. It was created at MIT Artificial Intelligence Laboratory by Joseph Weizenbaum in the year 1966. It used to simulate human conversation using pattern matching and substitution methodology i.e., by matching user prompts to the scripted responses. It impersonates of understanding but has no built-in framework for contextualising events.

PARRY – it was scripted at Stanford University by psychiatrist Kenneth Colby in the 1972. It tried to simulate a person with paranoid schizophrenia. It incorporated an advanced conversational strategy than ELIZA, hence it was termed as "ELIZA with attitude". It was testing using a variation of Turing test in 1970s, where a group of psychiatrist analysed combination of real patients and computers running PARRY. The resulting transcripts from the test where provided to another set of psychiatrist to distinguish between human and computer, out of which they could make out 48 percent correct by random guesses.

Jabberwacky – it was programmed in 1988 and is one of the earliest attempt at designing an AI programs that would mimic human interaction and carry out conversation among users. It was mainly a form of entertainment. It aimed to move from a text based system to wholly voice operated system.

Dr. Sbaitso – it was an AI speech synthesis program released in 1992 by Creative Labs for MS-DOS based personal computers. It assumed the role of psychologist while interacting with other and was designed to showcase a digitized voice.

ALICE – (Artificial Linguistic Internet Computer Entity) also referred to as Alicebot was created by Richard Wallace in 1995. It a natural language processing chatterbot - that simulates conversation using heuristic pattern matching rules, but was still unable to pass Turing test. ALICE is based on XML knowledge bases i.e., it maps the user input to a pre-defined set of responses. Hence it is inefficient to answer all queries. But it has a potential to expand its knowledge bases through an XML dialect AIML. Hence by using this approach, it can be made a skilful domain specific chatbot.

SmarterChild – it was an intelligent devised by ActiveBuddy in 2001 and was widely distributed across global instant messaging and SMS networks. It offered a fun personalised conversation and was considered a precursor for Apple's SIRI and Samsung's S VOICE.

Watson - built by IBM in 2006, is a question answering (QA) computing system designed to apply advanced natural language processing, information retrieval, knowledge representation, automated reasoning, and machine learning technologies to the field of open domain question answering. Watson uses IBM's Deep QA software and the Apache UIMA (Unstructured Information Management Architecture) framework. It runs on the SUSE Linux Enterprise Server 11 operating system using Apache Hadoop framework to provide distributed computing. It participated in the Jeopardy! Competition and won in 2011.

Siri - Siri uses ASR (Automatic speech recognition) to translate human speech (which includes short utterances of commands, dictations or questions) into text. Using natural language processing (part of speech tagging, noun-phrase chunking, dependency and constituent parsing) it translates transcribed text into "parsed text". Using question & intent analysis it analyses parsed text, and detects user commands and actions. ("Schedule a meeting", "Set my alarm"). Siri did the groundwork for all later AI bots and personal assistants.

Google Now – it was developed by Google for Google search mobile apps. It was first included in Android 4.1 ("Jelly Bean"), which was launched on 2012. It employed natural language interface answer questions, make recommendation, and predict actions by passing requests to a set of web services. Google also came up with Google Assistant which was an intelligent extension of Google Now, which engaged in two-way dialogue with the user.

Mitsuku – it was created by Steve Worswick using AIML to understand and respond to people. Her intelligence includes the ability to reason with specific objects. She is a two-time Loebner Prize Winner in 2013 and 2016 as well as the 2015 runner-up.

ALEXA – it was scripted in 2015 which was a voice based service inhabiting the Amazon Echo device. Alexa uses natural language processing algorithms for voice interaction. She uses these algorithms to receive, recognize and respond to voice commands. She is capable of music playback, making to-do lists, setting alarms, streaming podcasts, playing audiobooks, and providing weather, traffic, and other real time information. Alexa can also control several smart devices using itself as a home automation hub.

CORTANA – is a virtual assistant developed by Microsoft for windows based devices in 2015. It is capable of performing tasks such as set reminders, recognize natural voice, and answer questions using information from the Bing search engine. It recognises natural voice commands and are available in different languages.

Bots for Messengers – in 2016 Facebook launched a messenger platform which allowed developers to create bots that could interact with Facebook users. By the end of 2016, M bots were available covering a wide range of use cases.

TAY – It was created by Microsoft via twitter to mimic the speech and habits of a teenage girl. It caused controversy when it began to post offensive tweets and became increasingly paranoid. It eventually had to be shut down just 16 hours after launch.

III. APPROACHES

A. The Linguistic Rules Approach

Here a chatbot developer takes a linguistic engine that has knowledge of a given language's syntax, semantics and morphology and then adds program rules that look for the key semantic concepts that determine that a sentence has a certain meaning. Here the bots are pre-programmed and are limited. Responds to a specific set of commands and fails to do so if given query doesn't match the database.

B. The Machine Learning Approach

It is based on neural networks. It has an artificial brain that's powered by Artificial intelligence. It not only understands commands but a complete language. It learns continuously with the conversation of past that eventually makes it smarter and better.

IV. ARCHITECTURE OF CHATBOT [7]

The above figure depicts the architecture of a chatbot. Intent of user message is identified. Since we are interested only in the structured data of the message, extracting it is the next task. The user request is processed as per domain and corresponding responses are generated. The response selector is responsible for selecting sensible responses corresponding to user input.

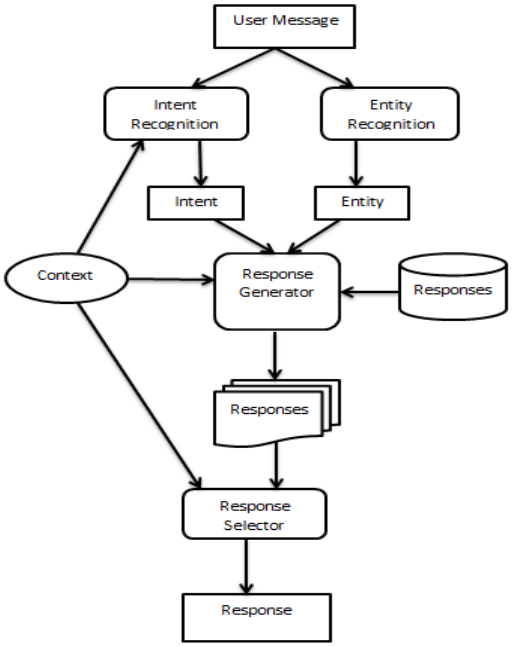

Figure 2. Chatbot architecture

V. MAKING OF CHATBOT

For designing any Chatbot, the designer must be aware of number of techniques such as:

1) Parsing: This process includes analysing the user request followed by manipulating it by using NLP functions.

2) Pattern matching: Here the responses are generated based on some pattern in the user request.

3) AIML: it is one of the important technique used in creation of chatbot.

4) Chat Script:. It fixates the suitable syntax to build a sensible default response.

5) SQL and relational database: Addition of database in chatbot design gives a way for the chatbot to learn from previous conversations.

6) Markov Chain:. The idea of Markov Chains is that there is a fixed probability of occurrences for each letter or word in the same textual data set.

7) Language tricks: Chatbot also has sentences, phrases and also paragraphs in order to build the knowledge base. The types of language tricks are:

- Canned responses.
- Typing errors and simulating key strokes.
- Model of personal history.
- Non Sequitur.

8) Ontologies: They are said to be semantic networks and are a set of concepts that are interconnected relationally and hierarchically. The aim of using ontologies in a Chatbot is to compute the relation between these concepts, such as synonyms, hyponyms and other relations which are natural language concept names.

1) Design

The basic idea of designing phase is to build the interaction between the user and the chatbot[1]. The designer has to specify the personality chatbot, the frequent possible queries from the users, and the overall interaction[2][3]. There are several available tools to design a chatbot that is packed with several features that makes the designing process a easy task [4].

2) Building

The Operation of building a chatbot can be prorated into two prime actions: understanding the user's query and answering correspondingly. The initial task is that the user input can be realised using NLP[6]. The final task of generating responses varies on the type of chatbot.

3) Analytics

The usage of the chatbot can be overseen in order to spot potential glitch or problems. It can also present pragmatic insights that can reform the final user experience[7].

4) Chatbot development platforms

The process of building, testing and deploying chatbots can be done on cloud based chatbot development platforms offered by cloud Platform[8] as a Service (PaaS) providers such as Oracle Cloud Platform and IBM Watson. [9][10][11] These cloud platforms provide Natural Language Processing, Artificial Intelligence and Mobile Backend as a Service for chatbot development.

[13] The three important criterion of an intelligent chatbot are:-

• Understanding rather than memorisation
• Ability to handle repetitive queries
• AIML based response mechanism

VI. CHATBOT CHALLENGES

Context Integration

Chatbots are expected to generate sensible responses. Context should be integrated in the chatbot but implementing it is the biggest challenge. Contextual data, location, time, date, details about users, and other such data must be fused with the chatbot.

Coherent responses

The chatbot must possess the ability to answer corresponding to the user input. For instance, an intelligent chatbot must provide the same answer to queries like Where are you from? and Where do you reside? Though it looks straightforward, incorporating coherence into the model is indeed a challenge. The secret is to train the chatbot to produce semantically consistent answers.

Model assessment

How is the chatbot performing?

The answer to this query lies in measuring whether the chatbot performs the task that it has been built for. Measuring is a challenge because there is a reliance on human judgment. Because the chatbot is built on an open domain model, it becomes increasingly difficult to judge whether the chatbot is performing its task. There's no specific goal attached to the chatbot. Moreover, researchers have found that some of the metrics used in these cases cannot be compared to human judgment.

Reading intention

In some cases, reading intention becomes a challenge. Take generative systems, for instance. They provide generic responses for several user inputs. The ability to produce relevant responses depends on how the chatbot is trained. Without being trained to meet specific intentions, generative systems fail to provide the diversity required to handle specific inputs.

VII. FUTURE SCOPE

To tag emotion categories, we apply sentimental analysis on the dataset and pick up dialogue with strong emotion. We take advantage of various machine learning techniques and introduce sentiment rewards during learning phase. [11]

Since timeliness of chatbot is a major concern, it gives a way to "Server less chatbots" where developers compose stateless functions to perform useful actions. Developers need to handle the coordination of the cognitive services to build the chatbot interface, conform the chatbot with external services, and worry about extensibility, scalability, and maintenance. [10]

VIII. CONCLUSION

Chatbot is a tool devised to speed up the interaction with human. A chatbot must preferably be simple, user-friendly and with a compact knowledge base [13]. We have surveyed several chatbot systems which success in practical domains like education, information retrieval, business, e-commerce, as well as for amusement. In the future, you could "imagine Chatterbots acting as talking books for children, Chatter- bots for foreign language instruction, and teaching Chatterbots in general". In general, the aim of chatbot designers is to build tools that help people, facilitate their work, and their interaction with computers using natural language.

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