CHAT-BOTS

PARAG PANDEY	**SWETA SHUKLA**	**PROF. PRAGATI GOEL**
Student,	Student,	Asso. Professor,
NCRD's Sterling Institute	NCRD's Sterling Institute of	NCRD's Sterling Institute of
of Management Studies,	Management Studies	Management Studies
Nerul, Navi Mumbai	Nerul, Navi Mumbai	Nerul, Navi Mumbai

paragdhan@gmail.com   shweta.shukla1995@gmail.com   goelpragati78@gmail.com

ABSTRACT

Despite the evolution and enhancements in technology that market is experiencing, there are still demands for some intensive technology in the market. There is always a need of some unique technology in the market which will fulfill user requirement. One such technology that we are going to discuss about in this paper is Chat-bots. Chat-bots are computer programs that interact with users. The main purpose of the chat-bot system is that the computer is performing natural conversation with human which is as human as possible. This paper presents a brief discussion about developments in chat-bot technology. The goal of this paper is to make a survey of chat-bot technologies and thus make it easier for a developer on to which technology to use for the further development of the chat-bot system. Finally, it summarizes the advantages and disadvantages of chat-bot technology.

Keywords: *Chat-bots, ELIZA, AIML, Flow chart, ChatScript.*

1. INTRODUCTION

In this paper we are focusing on chat-bot system, which are gaining popularity in today's environment. In the 1960's, this technology started with aim to see if chat-bot system could interact with users. Chat-bot system also serves some specific purposes such as organizing files, searching the web, scheduling the task, setting up appointments, etc. We have come across various successful virtual assistants such as Siri, Google Assistant, Cortana, Alexa, etc. Chat-bots are the technological machine-learned programs which are used to interact with the users.

Now the challenges the chat-bots are facing are of understanding the human inputs and its responses. Chat-bots are simply using the pattern matching approach where it accepts the input from the user and find the scripted response which matches the input. But this cannot

lead to a fully acceptable conversation between the humans and the bot or cannot lead to a conversation with the specific purpose that is mentioned above.

With such drawbacks the developers or the researchers kept adding new functionalities to the existing approaches. This development made chat-bot much more successful and also introduced various different approaches, systems and solutions to the same problem.

2. EARLY CHAT-BOTS

There were numerous chat-bots and chat-bot technologies mostly in games and focused domain expert systems, but it is not known how did well they performed and they were never compared against each other.

Eliza was the first known chat-bot which was developed in 1966. Its role was to behave as a Rogerian psychologist using simple pattern matching and mostly returned user sentences in a form of questions. It did not had good conversational ability, but it was enough to confuse people at a time when they were not used to interact with computers and to start the development of other chat-bot systems. The implementation of Eliza was done by the researches at Jozef Stefan Institute in Ljubljana, Slovenia and is still available for testing.

The first such system that was actually evaluated was PARRY (Colby, 1975). PARRY was designed to act as a paranoid person. Its transcripts were given to psychiatrists along with transcripts of real paranoid patients for comparison. When evaluated the psychiatrists were able to make the correct identification only 48% of the time.

[2]The 70's and 80's, before the arrival of graphical user interfaces, saw rapid growth in text and natural-language interface research, e.g. Cliff and Atwell (1987), Wilensky et al. (1988). Since that time, a range of new chatbot architectures have been developed, such as: MegaHAL (Hutchens, 1996), CONVERSE (Batacharia et al., 1999), ELIZABETH (Abu Shawar and Atwell, 2002), HEXBOT (2004) and AL-ICE (2007). Improved data-mining and machine-learning techniques, better decision-making capabilities, availability of corpora, robust linguistic annota-tions/processing tools standards like XML and its applications, chat-bots have become more practical, with many commercial applications (Braun, 2003).

3. TECHNICAL APPROACHES AND ALGORITHMS

- **Pattern Matching**

The most common approach and technique used in chat-bots is Pattern Matching. There are variations found in pattern matching algorithm that exist in various chat-bot system.

The pattern matching approaches can vary in their complexity, but the basic idea is the same. The simplest patterns were used in earlier chat-bots such as ELIZA and PC Therapist.

For example:

> Pattern: "I need a X"
> Response: "What would it mean to you if you got a X?"

For every question a suitable pattern must be available in the database so that the bot can provide a suitable response. Pattern Matching is quite robust. If used correctly, it can make your bot a lot better at listening and responding.

Flowchart for Pattern Matching[5]

- AIML interpreter: tries to match word by word to obtain the largest pattern matching which is the best one.

- Graph-master: an interpreter that models this behavior

- Contains a set of nodes called Node-mappers.

- Node-Mappers: map branches from each node where branches represent the first words of all patterns.
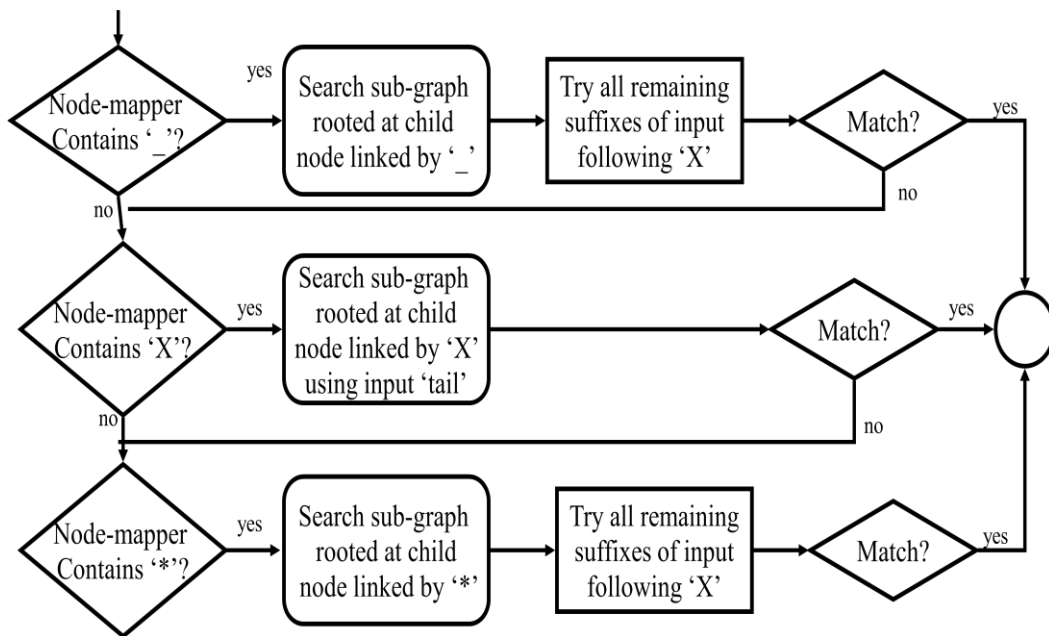
● Each leaf node contains a template.

Fig. 1: Flowchart for Pattern Matching

- **PARSING**

[1]Textual Parsing is a method which takes the original text and converts it into a set of words (lexical parsing) with features, mostly to determine its grammatical structure. On top of that, the lexical structure can be then checked if it forms allowable expression (syntactical parsing). The earlier parsers were very simple, looking for recognizable keywords in allowed order. Example of such parsing would be that sentences "please take the gold" and "can you get the gold" would be both parsed into "take gold". With this approach the chat-bot with a limited set of patterns can cover multiple input sentences. The more complicated parsers used in latter chat-bots do the complete grammatical parsing of the natural language sentences.

- **MARKOV CHAIN MODELS**

[1]The Idea behind Markov Chain Models is that each occurrence of a letter or a word in some textual dataset occurs with a fixed probability. The order of a model means how many consecutive occurrences the model takes into the account. For example if an input text is "agggcagcgggcg", then the Markov model of order 0 predicts that letter "a" occurs with a probability 2/13. The model with order 1 would state that each letter still occurs with a fixed probability, but that probability depends on the letter before. In chat-bots the Markov Chain Models were being used to construct responses which are probabilistically more viable and

thus more correct. In some cases these models were even used to generate a nonsense sentence that sounds right, as a failback method.

- **ONTOLOGIES (semantic nets)**

[1]Ontology or semantic network as it is called in some chat-bot systems is a set of hierarchically and relationally interconnected concepts. These concepts can have natural language names and can be used directly in chat-bots, to figure out hyponyms, synonyms and other relations between the concepts. Example of such an ontology which is often used or at least tried to be used in chat-bots is OpenCyc (Lenat, 1995). The advantage of the ontologies is that the concepts are interconnected into a graph, which enables computers to search through and using special reasoning rules even imply new statements (reasoning).

- **AIML**

Artificial Intelligence Modeling Language (AIML) is an XML based markup language. Topics and categories are the two data objects called as AIML objects. Topic has a name attribute and set of categories relate to that topic. Category is a rule for matching an input and converting to an output, and consists of a pattern, which matches against the user input and template.

Simple AIML rule pattern:

```
<category>
<pattern> I NEED HELP *</pattern>
<template>Can you ask for help in the form of a question? </template>
</category>
```

Types of AIML Categories

AIML categories are of three types: atomic categories, default categories and recursive categories.

Atomic categories: consists of patterns that do not have wildcard symbols, _ and *.

e.g.;
```
<category>
<pattern>10 Dollars</pattern>
<template>Wow, that is cheap. </template>
</category>
```

Default categories: consists of patterns having wildcard symbols, * or _.

e.g.;

```
<category>
<pattern>10 *</pattern>
<template>It is ten. </template>
</category>
```

Recursive categories: are those with templates having <srai> and <sr> tags, which refer to recursive reduction rules. Recursive categories have many applications: symbolic reduction that reduces complex grammatical forms to simpler ones; divide and conquer that splits an input into two or more subparts, and combines the responses to each; and dealing with synonyms by mapping different ways of saying the same thing to the same reply.

- **CHATSCRIPT**

[1]ChatScript aims to be a successor of the AIML language. It focuses on the better syntax which makes it easier to maintain. It fixes the zero word matching problems and introduces a bunch of additional functionalities such as concepts, continuations, logical and/or, variables, fact triples and functions. With these functionalities it tries to cover the need for ontologies inside the scrip itself. Example of a script defining a concept of meat and one pattern can be seen below.

concept: ~meat (bacon ham beef meat flesh veal lamb chicken pork steak pig)

s: (I love ~meat) Do you really? I am a vegan.

4. PROPOSED AREAS FOR IMPLEMENTATION

Chat-bots have been a great research in the field of technology and it looks like the trend is set to continue. Chat-bots are introduced in various fields to reduce manpower and cost. The Chat-bot is another medium for personalization allowing you to interact in a more fluid way. Major uses of chat-bots can be in-

- **Education- Library Management**
  o The chat-bots can be used in the libraries where all the data regarding the books can be stored and people can easily access the library through chat-bot without any human effort.

o The chat-bots can also be used in the public libraries that can inform a particular user about the payment dues as well as the issuing of books.

- **Telecommunication**

o Chat-bots can be used in the field of telecommunication where the dependency of a business is more on customer support. The business spends a lot of money on customer care that can be replaced by chat-bots. Instead of waiting for long hour queue to get issue resolved by a customer care executive chat-bots can actually help them within no time. Chat-bots can assist multiple users at one time.

- **Travel**

o Planning a vacation over a network is time consuming. Travelers need to discover the sites, plan an itinerary, pick hotel and various other tasks. These tasks are frustrating for travelers, chat-bots can actually make these tasks more easier for travelers. Text based reservation and booking systems can be easier to use and can complement online reservation system.

- **Finance**

o Chat-bots can actually act as an information service where it can be capable of informing users about their balances, recent transactions, credit card payment dates and so on.

o It can also help users to make payments or to transfer money through a conversation with them.

- **Media**

o News Delivery: It can be build to deliver summaries of news and shared details as users ask about them. This can create an engaging news experience for users.

5. ADVANTAGES

- **Chat-bots are Time Saving**

    Chat-bots can be Time saver for Business as it provides computerized answers to most of the queries of the user's. The use of chat-bots can also anticipate customers from getting delayed responses as they would have in the past.

    This allows your business to deliver higher number of customers at concurring time while reducing cost and Broadening potency.

- **Chat-bots can save your Money**

    Chat-bots can be more cost effective than hiring workers. The cost of a single Chat-bot can be around 10k or more depending upon the complexity required.

    Once they are constructed you will probably save in the long run. One of the main reasons to have it is that you don't have to pay for vacation times, low health days or contribute a large amount of money. It can work for 24*7 and doesn't require any medical help.

- **Better Customer Satisfaction**

    Chat-bots can provide a higher level of customer satisfaction. They don't work for particular time period instead they are available at anytime.

    Customers can get the responses back for their questions right away. If the customers have queries regarding your product the chat-bot can revert back to them in no time and could complete the sales for the company.

- **Increase Customer Base**

    Chat-bots can be multi tasking which can help in concurrently answering to multiple customers at the same time. It can also be used for business growth.

    They can also help in increasing the customer base by reaching out to more people.

- **Cut Down on Errors**

    Humans can make errors while handling customers but chat-bots do not make mistakes, they always answer to the user based upon the questions asked.

- **Add Good Humour**

    An added benefit of chat-bots is that they don't show emotions unlike humans. They will never turn away the users with their responses. You don't need to worry about chat-bots being in a mood. They can be programmed with a bit of humor that makes them seem humanlike.

6. DISADVANTAGES

- **Inability to Understand**

Customer can be dissatisfied if chat-bots are stuck by an unsaved query due to the fixed programs.

- **Complex Interface**

Chat-bots can be annoying to the users because of its processing time which is required to filter results in time. They are often complicated and may require more time to understand user's requirement.

- **Time-Consuming**

Chat-bots main motive is to reduce response time and improve customer interaction but due to limited availability of data and time consumption for self updation, this process appears more time consuming and expensive.

- **Increased Installation Cost**

Chat-bots are useful as they save a lot of manpower by ensuring availability of time and simultaneously serving several clients at once.

Unlike humans, chat-bots needs to be programmed differently for different business which increases the initial cost of installation. For preparing a complete chat-bot it takes a lot of time to program them.

The changes in the last minute can also be an added cost to it.

- **Zero decision-making**

Chat-bots are not capable of making decisions so it is very important to make your chat-bot prevent any such situation that can hamper the firm or brand.

- **Poor Memory**

Chat-bots are not capable to memorize the past conversations with the user which forces the user to type the same things again. This can annoy the users because of the required effort. Thus the comprehension of the user queries should be taken care of while designing the chat-bots and also respond to the user accordingly.

7. FUTURE SCOPE

Chat-bots can act as a virtual assistant and help the user to complete a task. They can be made more lively so that the user doesn't comes to know that he is interacting with a machine. The chat-bots can also be used in the additional fields such as hospitals, malls, etc. It can also be used as a learning tool in the field of education. The information required can be stored inside it and can be retrieved anytime by querying bots. The introduction of chat-bots into the business can increase the availability of the business to the customers and thus can improvise the need for the business to the user's.

Chat-bots can be the human replacement in the field of customer support service. They can reduce the cost of the business as well as can provide more benefits if programmed efficiently. Chat-bots can also emotionally be helpful to the humans, people can chat with them or talk to them and they can be a good entertainer for the user. They can also be used for learning multiple languages and getting the correct pronunciations. These can also be used in the field of Medical for solving the health related problems. Since chat-bots can predict and provide the accurate response to a proposed question, it is hard to imagine a future without it.

8. CONCLUSION

Chat-bots are one of the simple tool to convey data from a computer without having to think for proper words or browse several web pages. To get some information users can easily type their queries in natural language and retrieve information. In this paper, we can see how chat-bots have evolved from Pattern-matching systems to Statistical models of chats and towards the complicated pattern in combination with Ontologies and knowledge bases. Even the newer Approaches of AIML and ChatScripts are small improvements over the ELIZA pattern matching idea and the biggest improvement is the amount of script written for it. With ChatScript we can see that the Chat-bots are moving out of the scripted era. The future Chat-bots are more moving towards the semantic approach to incorporate more and more computer reasoning systems. General purpose of chat-bot is that it should be simple, user friendly, must be easily understood. In future, the discussed technologies will evolve more to provide better communication interface between human and computer. Also it's usage in various proposed areas can help to lower the manpower and increase the efficiency of work. We can expect that the Chat-bots will soon become the part of every individual's daily life.

REFERENCES

[1] Luka Bradeško*, Dunja Mladenić*, Artificial Intelligence laboratory, Jozef Stefan Institute, Ljubljana Slovenia- A Survey of Chabot Systems through a Loebner Prize Competition

[2] Shawar, Bayan & Atwell, Eric. (2007). Chatbots: Are they Really Useful?. LDV Forum. 22. 29-49.

[3] CHATBOTS: BOON OR BANE? -By Manish Gupta / In Chatbot / January 9, 2018 / 5 Min read

[4] 5 Must-Read Technical Papers On Chatbot Development- By Abhishek Sharma

[5] Chat Bots- Ruta Mehta, Mugdha Jain, Jeetendra Mirchandani