Chatbots Using Artificial Intelligence

P.Nikhila¹, G.Jyothi², K.Mounika³, Mr. C Kishor Kumar Reddy⁴ and Dr. B V Ramana Murthy⁵

Stanley College of Engineering and Technology for Women, Hyderabad

¹pendyalanikhi@gmail.com, ²g.jyothikareddy2000@gmail.com, ³mounikakolipaka4@gmail.com, ⁴ckishorkumar@stanley.edu.in, ⁵drbvrm@stanley.edu.in

Abstract

Chat bots are software agents used by humans to interact with computer in natural language. Just as people use language for human communication, chat bots use natural language to communicate with human users. The main aim of their creation was to resemble a human being in the way they perform say interaction, trying to make user think that they are communicating to a human. This paper will discuss about basics of Artificial Intelligence and about ALICE chat bot system by giving few examples using AIML. It also describes the categories: atomic category, default category, recursive category with short examples. Then it tells about Natural Language Processing and its components.

Keywords: Artificial Intelligence, Chat bot, A.L.I.C.E, Knowledge Base, Expert System.

1. Introduction

1.1. What is Artificial Intelligence?

According to the father of computer science, John McCarthy, it’s “The science and engineering of constructing intelligent machines, particularly intelligent pc programs”. Artificial Intelligence is a way of making a computer, a computer-controlled robot, or a software think intelligently, in the similar manner the intelligent human think. AI is accomplished by finding out however human brain thinks, and how humans learn, decide, and work while trying to solve a problem, and then using the outcomes of this study as a basis of developing intelligent package and systems.

Artificial Intelligence was supported as a tutorial discipline in 1956, and within the years since has full-fledged many waves of optimism, followed by disappointment and also the loss of funding, followed by new approaches, success and renewed funding.

1.2. What contributes to AI?

Artificial Intelligence could be a science and technology supported disciplines like applied science, Biology, Psychology, Linguistics, arithmetic, and Engineering. A major thrust of AI is within the development of pc functions related to human intelligence, such as reasoning, learning, and problem solving.

Out of the subsequent areas one or multiple areas will contribute to make associate intelligent system.
1.3. What is AI technique?

AI technique could be a manner to arrange and use the data expeditiously in such how that
1. It ought to be perceivable by the those that give it.
2. It should be easily modifiable to correct errors.
3. It ought to be helpful in several things although it’s incomplete or inaccurate.
AI technique elevate the speed of execution of the complex program it is equipped with.

1.4. History of AI

<table>
<thead>
<tr>
<th>Year</th>
<th>Milestone / Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1923</td>
<td>Karel Capek play named “Rossum's Universal Robots” (RUR) opens in London, first use of the word “robot” in English.</td>
</tr>
<tr>
<td>1945</td>
<td>Isaac Asimov, a columbia University alumni, coined the term robotics.</td>
</tr>
<tr>
<td>1950</td>
<td>Alan Turing introduced Turing test for evaluation of intelligence and published computing machinery and intelligence. Claude Schannon published detailed analysis of chess playing as a search.</td>
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<tr>
<td>1956</td>
<td>John McCarthy coined the term AI. Demonstartion of the first running AI program act Carnegie Mellon university.</td>
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<tr>
<td>1958</td>
<td>John McCarthy invents LISP programming language for AI.</td>
</tr>
<tr>
<td>1964</td>
<td>Danny Bobrow's dissertation at MIT showed that computers can understand natural language well enough to solve algebra word problems correctly.</td>
</tr>
</tbody>
</table>
1965 | Joseph Wiezenbaum at MIT built ELIZA, an interactive problem that carries a dialogue in English.

1969 | Scientists at Stanford Research Institute developed Shakey, a robot, equipped with locomotion, perception, and problem solving.

1973 | The assembly robotics group at Edinburgh University built Freddy, the Famous Scottish Robot, capable of using vision to locate and assemble models.

1979 | The first computer-controlled autonomous vehicle, Stanford Cart, was built.

1985 | Harold Cohen created and demonstrated the drawing program, Aaron.

1990 | Major advances in all areas of AI—
- Significant demonstrations in machine learning
- Case-based reasoning
- Multi-agent planning
- Scheduling
- Data mining, Web Crawler
- Natural language understanding and translation
- Vision, Virtual Reality
- Games

1997 | The Deep Blue Chess Program beats the then world chess champion, Garry Kasparov.

2000 | Interactive robot pets become commercially available. MIT displays Kismet, a robot with a face that expresses emotions. The robot Nomad explores remote regions of Antarctica and locates meteorites.

1.5. Applications of AI

1. Gaming - AI plays a crucial role in strategic games such as chess, poker, tic-tac-toe, etc., where a machine can think of a large number of possible positions based on heuristic knowledge.
2. Expert Systems - There are some applications which integrate machine, software, and special information to impart reasoning and advising. They provide explanation and advice to the users.
3. Handwriting Recognition - The handwriting recognition software reads the text written on paper by a pen or on screen by stylus. It will acknowledge the shapes of the letters and convert it into editable text.
4. Intelligent Robots - Robots are able to perform tasks given by a human. They have sensors to notice physical knowledge from the important world like light-weight, heat, temperature, movement, sound, bump, and pressure. They have economical processors, multiple sensors and huge memory, to exhibit intelligence. In addition, they are capable of learning from their mistakes and they can adapt to the new environment.
5. Speech Recognition - Some intelligent systems are a unit capable of hearing and comprehending the language in terms of sentences and their meanings whereas a person's talks to that. It can handle different accents, slang words, noise in the background, change in humans noise due to cold, etc.
6. Health Care - AI is being applied to the high cost problem of dosage issues - where findings suggest that AI could save $16 billion. In 2016 a ground breaking study in California found that a mathematical formula developed with the help of AI correctly determined the accurate dose of immunosuppressant drugs to give to organ patients.
1.6. Chat bot

A chatter bot or a chatbot is a computer program which conducts a conversation through an auditory or textual methods. Such programs are often created to convincingly replicate how a human would behave as a conversational partner, there by passing the Turing test. Turing test is also known as the Imitation Game. In this test the goal for the chat bot is to maintain a conversation which is indistinguishable from a human conversation. The usual way to apply the test is that there is a human observer (judge), who is asking questions or having a conversation with someone over the computer link. That someone can be a computer (chat bot) or a person. If on the other side there is a chat bot and the judge would think it is person then the chat bot would pass the test.

There are two main types of chatbots available, one whose functions are based on a set of rules and other is the more advanced version which uses Artificial Intelligence. The first type of chatbot tends to be limited and their smartness depends on the complexity of the program i.e., the more complex the program is, the more is the smartness of the bot. The chatbot that uses artificial intelligence, understands language, not just commands, and continuously gets smarter as it learns from the conversations with the people.

The German scientist, Joseph Weizenbaum developed the program ELIZA in 1966, which seemed to be able to fool users into believing that they were conversing with a real human. It is thought of because the 1st chatterbot within the pc history. It behaves like a therapist by rephrasing the statements of user and posing them back as questions. It is a language process malicious program created from 1964 to 1966 at the Massachusetts Institute of Technology AI Laboratory. It was created to demonstrate the superficiality of communication between man and machine. Eliza simulated voice communication by employing a ‘pattern matching’ Associate in Nursing substitution methodology that gave users an illusion of understanding on the a part of the program, but had no built in framework for contextualizing events. Directives on the way to move were provided by 'scripts', written originally in MAD-Slip, which allowed ELIZA to process user inputs and engage in discourse following the rules and directions of the script. The most renowned script, DOCTOR, simulated a Rogerian psychotherapist and used rules, dictated in the script, to respond with non-directional questions to user inputs. As such, ELIZA was one in all the primary chatterbots, however was conjointly considered one in all the primary programs capable of passing the Turing check.

ELIZA's creator, Weizenbaum regarded the program as a technique to point out the superficiality of communication between man and machine, however was stunned by the quantity of people UN agency attributed human-like feelings to the computer program, including Weizenbaum’s secretary. Many lecturers believed that the program would be able to completely influence the lives of the many folks, notably those littered with psychological problems which it might aid doctors working on such patients’ treatment. While ELIZA was capable of partaking in discourse, ELIZA couldn't converse with true understanding. However, several early users were convinced of ELIZA's intelligence and understanding, despite Weizenbaum’s insistence to the contrary.

1.7. The ALICE Chatbot System

ALICE(Artificial Linguistic net pc Entity) is a souvenir winning open supply tongue computing chat automaton that uses AIML(Artificial Intelligence Mark-Up Language) to make responses to queries. It is inspired by ELIZA and an open source chat bot developed by Dr. Wallace, which relies on tongue understanding and pattern matching. It has won Loebner prize three times. It generates responses to the user's question by applying some pattern matching rules. However, it is unable to pass the Turing test, as even the casual user will often expose its flaws in short conversations. The architecture of chat bot consists of two clearly separated parts namely “chat bot engine” and “Language model” which gives us the opportunity to easily implement a chat bot in a newly developed knowledge model.
Language model is stored in AIML files. The primary style feature of AIML is minimal art and from all the chat automaton languages, AIML is perhaps the simplest. As mentioned earlier, the basic unit of knowledge in AIML is category. Each class consists of associate degree input or question, an output or an answer and an optional context. The question is called the pattern. The answer or response is the template. The two styles of optional context square measure “that” and “topic”. The pattern matching is extremely easy whereas operating with AIML because it consists solely words, spaces and wildcard symbols nine and *. AIML stands for Artificial Intelligence Mark-Up Language, but it is simple XML. AIML is associate XML based mostly nomenclature meant to make artificial intelligent applications. AIML makes it possible to create human interfaces while keeping the implementations simple to program, easy to understand and highly maintainable. AIML was developed by the Alicebot free code community and Dr. Richard S. Wallace during 1995-2000. AIML is employed to make or customise Alicebot that could be a chat-box application supported A.L.I.C.E. (Artificial Linguistic web pc Entity) free code.

1.8. Types of ALICE/AIML Categories

There are 3 varieties of classes: atomic categories, default classes, and algorithmic classes.

a. Atomic categories: Atomic categories are those with patterns that do not have wildcard symbols, _, and *, e.g.:

10 Dollars
Wow, that is cheap.
In the on top of class, if the user inputs '10 dollars', then ALICE answers 'Wow, that is cheap'.

b. Default categories: Default categories are those with patterns having wildcard symbols *, or _. The wildcard symbols match any input however they dissent in their alphabetical order. Assuming the previous input ten bucks, if the robot does not find the previous category with an atomic pattern, then it will try to find a category with a default pattern such as:

10 *
It is ten.
So ALICE answers 'It is ten'.

c. Recursive categories: Recursive categories are those with templates having and 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 sub parts, and combines the responses to each; and managing synonyms by mapping other ways of claiming a similar factor to a similar reply.

c.1 Symbolic reduction
DO YOU KNOW WHAT THE * IS
What is
In this example is used to reduce the input to simpler form “What is *”.
c.2 Divide and conquer
YES*
YES
The input is partitioned into two parts, ”YES” and the second part; * is matched with the tag =
c.3 Synonyms
HALO
Hello
The input is mapped to a different type, which has a similar that means.
Following are the important tags which are commonly used in AIML documents.
Table 2. AIML Tags

<table>
<thead>
<tr>
<th>S.No</th>
<th>AIML Tag/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;aiml&gt; It defines the beginning and end of an AIML document.</td>
</tr>
<tr>
<td>2</td>
<td>&lt;category&gt; It defines the unit knowledge in Alice bots Knowledge base.</td>
</tr>
<tr>
<td>3</td>
<td>&lt;pattern&gt; It defines the pattern to match what an agent what to input to an Alicebot.</td>
</tr>
<tr>
<td>4</td>
<td>&lt;template&gt; It defines the response of an Alicebot to agents input.</td>
</tr>
</tbody>
</table>

EXAMPLE
<aiml version ="1.0.1" encoding="UTF-8"> 
<category>
<pattern>HELLO ALICE</pattern>
<template>Hello User!</template>
</category>
</aiml>

RESULT
User: HELLO ALICE
Bot: Hello User!

1.9. Natural Language Processing

Natural language process (NLP) is said to computer science, computing that thinks about with the interactions between computers and human (natural) languages and, particularly, involved with programming computers that is used for process massive linguistic communication corpora. Various aspects in linguistic communication process oft involve linguistic communication understanding, linguistic communication generation, connecting language and machine perception, managing human-computer dialog systems, or some combination therefrom. The field of NLP involves creating computers to perform helpful tasks with the natural languages humans use. The input Associate in Nursingd output of an NLP system is Speech
Written Text

1.10. Components of NLP

There are two components of NLP as given-
1. Natural Language Understanding (NLU)
Understanding involves the following tasks
Mapping the given input in linguistic communication into helpful representations.

Analysing different aspects of the language.

2. Natural Language Generation (NLG)

It is the method of manufacturing significant phrases and sentences within the style of linguistic communication from some mental object. It involve-

Text Planning- It includes retrieving the relevant content from content.

Sentence Planning- It includes selecting needed words, forming significant phrases, setting tone of the sentence.

Text Realization- It is mapping sentence set up into syntax.

The NLU is harder than NLG.

2. Literature survey

Vibhor Sharma, Monika Goyal and Drishti Malik has proposed a paper “An Intelligent Behaviour Shown by Chatbot System” to analyze some existing chatbot systems namely ELIZA and ALICE and then concludes that it is easier to build bots using ALICE because of its simple pattern matching techniques that building one for ELIZA since it is based on rules. Finally, they discussed about their proposed system which is the implementation of ALICE chatbot system that helps users in various queries related to students and universities.[1]

Luka Bradesko and Dunja Mladenic has proposed a paper “A Survey of Chatbot Systems through a Loebner Prize Competition”; in which they compared and discussed about different technologies used in chatbots which have won the Loebner Prize Competition, the first formal instantiation of the Turing test. Although there was no game changing breakthrough in the chatbot technologies, it is obvious they evolved from the very simple pattern matching systems towards complicated patterns combined with ontologies and knowledge bases enabling computer reasoning.[2]

Bayan Abu Shawar and Eric Atwell has proposed a paper “Chatbots: Are they Really Useful? to conduct a survey on several chatbot systems which succeed in practical domains like education, information retrieval, business, e-commerce, as well as for amusement. According to this paper in the future, you could “imagine Chatterbots acting as talking books for Children, Chatterbots are foreign language instruction, and teaching chatbots in general.” Technology like computer algebra systems, multimedia presentations or ‘chatbots’ can serve as amplifiers but not replace a good guide.[3]

M. Dahiya has proposed a paper “A Tool of Conversation: Chatbot” which includes the design and implementation of a chatbot system. During designing a chatbot one should keep these facts in mind; Selection of OS, Selection of Software, Creating a chatbot (a program has to be written), Creating a chat, Pattern Matching, conversational and Entertaining. The implementation process includes two steps; Fundamental Design Techniques and Approaches, Modules Description. Fundamental Design Techniques and Approaches includes creating the dialog box and creating a database whereas Modules Description includes chatbot(), random(), AddText() and InArray().[4]

Balbir Singh Bani and Ajay Pratap Singh has proposed a paper “College Enquiry Chatbot Using A.L.I.C.E.” which explain the design of a chatbot specifically tailored as an application which is going to help new students to solve all the problems they face and the questions which arises in their minds during and after the admission. In particular the proposal investigates the implementation of ALICE chatbot system as an application named as college enquiry chatbot.[5]

Ahmed Fadhil has proposed a paper “Can a Chatbot Determine My Diet?: Addressing Challenges of Chatbot Application for Meal Recommendation” that describes the background and motivation for chatbot systems in the context of healthy nutrition recommendation. The paper also discusses current challenges associated with chatbot applications (technical, theoretical, behavioral and social aspects). They have also proposed
a pipeline that can be used as guidelines by developers to implement theoretically and technically robust chatbot systems.[6]

Ann Borda, Giuliano Gaia and Stefania Boiano has proposed a paper “Chatbots in Museums: Hype or Opportunity?” stating that the convergence of chatbots and gamification can be a powerful tool to involve younger, digital savvy generations visiting museums in novel and interesting ways. They suggest that users enjoy interacting with a chatbot in a game context, and this engagement can provide a smarter way of leading younger audiences to interact with objects and historic environments with greater attention.[7]

Md. Shahriare Satu, Tajim Md. Niamat Ullah Akhund and Mohammed Abu Yousuf has proposed a paper “Online Shopping Management System with Customer Multi-Language Supported Query handling AIML Chatbot” which helps to develop a model of e-commerce site that is interactive to its users with different services to build a reliable intelligent chatbot (assistant) which will responsible regular customer service. But it has faced some limitations one of them is it has lack of mining outcome as requirement. Besides it can not contain sufficient natural language characteristics.[8]

Hangao Wei, Yiewei Zhao and Junjie Ke has proposed a paper “Building Chatbot with Emotions” that aims at generating dialogues not only appropriate at content level, but also containing specific emotions. To tag emotion categories, they have applied sentimental analysis on the dataset and picked up a dialogue with strong emotion. They have also compared the performance of vanilla Seq2Seq model and both static and dynamic emotion chatting machine. Automata evaluation showed that the emotion embedding, internal memory and external memory in ECM help to generate reasonable responses on both content and emotional level.[9]

Bibek Behera has proposed a paper “Chappie- A Semi-automatic Intelligent Chatbot” Chappie is a semi-automatic chatbot that switches to a manual mode once it is able to understand the intent of the user and the kind of service required by the user. The novelty lies in the way we define our system as not merely a response generator but an intelligent interface to a response generator. Chappie is a cooperation of bots with a supervisor bot called Jarvis sitting on top of domain expert bots very much like the hierarchy of chat agents.[10]

Ahmed Fadhil has proposed a paper “Beyond Patient Monitoring: Conversational Agents Role in Telemedicine and Health care Support for Home-Living Elderly Individuals” according to which there is a need for systems to dynamically interact with ageing population to gather information, monitor health condition and provide support, especially after hospital discharge or at-home settings. The paper describes integrating chatbots into telemedicine systems intended for elderly patient after their hospital discharge.[11]

Ameya Vichare, Ankur Gyani, Yashika Shrikhande, and Nilesh Rathod has proposed a paper “A Chatbot System Demonstrating Intelligent Behaviour using NLP” that tells about all the existing systems which included ELIZA, ALICE and Siri. The system they have developed can be used for educating the user about sports. The database feeds with sports related data which has been coded using AIML.[12]

Ulrich Gnewuch, Stefan Morana, Marc T. P. Adam and Alexander Maedche has proposed a paper “Faster is Not Always Better: Understanding the Effect of Dynamic Response Delays in Human-Chatbot Interaction” which reports the findings of an online experiment in a customer service context that investigates how user perceptions differ when interacting with a chatbot that sends dynamically delayed response compared to a chatbot that sends near-instant responses.[13]

The idea of humans interacting with intelligent systems using natural language has been around for decades and has been featured in many science fiction books and movies.[14]. With recent advances in technology, many ICTs now provide conversational interfaces, ranging from smart phones (e.g., Apple's Siri, Samsung's Bixby) and smart speakers (e.g., Amazon's Alexa) to personal computers (e.g., Microsoft's Cortana). While these voice-based “personal assistants” have become very popular in the last years,[15] organizations are increasingly shifting their attention to chatbots that build on
text-based conversational user interfaces[16] and can be made available on instant messaging platforms or websites[17]. Chatbots have their origins in the ELIZA system developed by weizenbaum(1966). While early chatbots were built to simulate human conversation using pattern matching algorithms, recent technological advances have enormously improved their capabilities[18]. Consequently, many organisations are investigating how they can make use of chatbots, for example, as a cost-effective solution in customer service[19]. Examples can be found in industries ranging from travel (e.g., Online check-in or flight booking) and retail (e.g., product selection) to financial services (e.g., money transfer).

Although a vast amount of research has been conducted on chatbots and conversational user interfaces in general, most studies focus on their technical aspects, such as by developing better natural language processing algorithms or new architectures [20]. Therefore it has been largely neglected that other factors can also significantly influence the human-chatbot interaction[21].

3. Analysis on previous work

3.1. Comparative Table

<table>
<thead>
<tr>
<th>Bot Name</th>
<th>Features</th>
<th>Programming languages/Apps/Integration</th>
<th>Languages</th>
<th>Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM Watson conversation service</td>
<td>Built on a neural network. Has three main components: Intents, Entities, Dialog</td>
<td>Node SDK Java SDK Python SDK IOS SDK Unity SDK</td>
<td>English, Japanese</td>
<td>Speech image text</td>
</tr>
<tr>
<td>Agent Bot</td>
<td>Understand natural language. Memory to maintain coherence during long conversations</td>
<td>Use our REST API to integrate with your CRM and other platforms</td>
<td>English, Spanish, Portuguese</td>
<td>Voice or Messenger channel</td>
</tr>
<tr>
<td>Wti.ai</td>
<td>Allows to use Entities Intents Context Actions NLP</td>
<td>Node.js client Python client Ruby client</td>
<td>Arabic, Bengali, Chinese, Dutch, English, French,etc.</td>
<td>Voice text</td>
</tr>
<tr>
<td>Pandorabots</td>
<td>A.I.M.L includes A.L.I.C.E</td>
<td>SDK’s: Java Node.js Python</td>
<td>Multiling-ual</td>
<td>Chatbots built are hosted with pandorabots</td>
</tr>
<tr>
<td><strong>Chatterbot</strong></td>
<td>The program selects the closest matching response by searching for the closest matching known statement that matches the input; it then chooses a response from the selection of known responses to that statement.</td>
<td>Chatterbot is a Python library with direct support for integration with Django</td>
<td>Language independent</td>
<td>Console API speech recognition</td>
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<tr>
<td><strong>Twyla</strong></td>
<td>Learns from agent/customer live chats.</td>
<td>Analyses data either via the API of your helpdesk or chat solution, or a secure file upload</td>
<td>English</td>
<td>Web, Facebook, Telegram, Through messenger apps and live chat</td>
</tr>
<tr>
<td><strong>Pypestream</strong></td>
<td>Pypestream uses a patented framework of 'Pypes' and 'Streams'. Natural Language Processing and keyword parsing.</td>
<td>The Smart messaging Framework; Pypeconnected SDK; Pypemanagement; The Pypestream mobile app; API plug-ins and integrations</td>
<td>English</td>
<td>Pypestream mobile app, Brand apps/SMS, Web chat, Messenger, IoT, website, Pype</td>
</tr>
<tr>
<td><strong>Digital Genius</strong></td>
<td>AI predicts case metadata and suggests that right answers to your agents. AI learns from every agent</td>
<td>Human + AI customer service is installed as a layer into your existing customer service software (Salesforce, Zendesk,</td>
<td>English</td>
<td>Email, Social Media, Mobile, Messaging, Live Chat</td>
</tr>
</tbody>
</table>
4. Conclusion

We have briefly described about the Artificial Intelligence, AI technique, history of Artificial Intelligence, contribution to AI, Chatbot and also discussed about previous work related to chatbot. Communications with computers victimisation natural languages is one in every of the essential issues of researchers. ALICE could be a informal agent that communicates with users victimisation natural languages. However ALICE and most chatbot systems are restricted to the knowledge that is hand-coded in their files and to the natural language, which is written or spoken. And also seen the comparative table of various bots on the basis of their features, Programming Languages/Application, Language and Channels.

5. References


