A REVIEW ON LIMITATIONS IN APPLICATION OF INTELLIGENT AGENTS

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Abstract

In today's era of virtual reality, most of the Intelligent Agents are text based.Thus, this paper describes the drawbacks of the prior intelligent agents. The common limitation to these agents is voice integration over simple text.Furthermore this paper reviews, Intelligent Agent which inhibits with Active Listening, which can be activated and deactivated by invoking specific keywords. Where in such cases, Microsoft Speech SDK enables Speech Synthesis to Intelligent Agents for better interaction. Intelligent Agent handles pattern recognition technique by using Machine Learning capabilities and efficient Database. Additionally providing better User Interface (UI) and better Authentication functionalities. The main motive behind its implementation is to develop an intelligent personal assistant for interactive human – machine communication.

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• **Introduction**

Artificial Intelligence (AI) has been a part of mainstream research since last 60 years. Initially, AI focused on common sense reasoning and obvious reactions. AI can be defined in couple of ways as, 'Machines which think intelligently and have the potential of reacting like human beings', 'Computation models to solve various decision making problems', 'Study of Intelligent Agents' etc. The study on human psychology and psychological analysis with reference to decision making proves to be a key term for machine learning. The decision making of these AI based systems is based on simple hypothesis. The fields of cognitive science and AI go hand in hand and have their application in Natural language Processing (NLP)[4].

The topic of NLP commenced within machine learning in 1950's.It was Allan Turing who proposed this theory which is today considered as the "Turing Test" on his behalf. It is the testing ability of the machine program and that machine program should be written in such a way that it would be difficult to predict whether the conversation is with the machine or the human actually.

The Systems which are built on the basis of Artificial Intelligence are usually termed as Intelligent Agents which sense the **Environment** using **Sensors** and works with the **Actuators**. A Rational Agent is the one which may give a logical answer by leaving the user in problem of deciding *how* and *when* to judge the agent's success [6].

Chat Robot, commonly known as Chatbot is AI and Natural language based intelligent agent that communicates with humans through various modes such as web, instant chat messengers, forums, voice conversations or even from offline standalone applications. These Chatbots may have an avatar and speech synthesizer to feel more like a human rather than virtual reality. Chatbots are more than a computer program because developing a Chatbot is like creating a fiction character for a novel or a movie with its clever, smart, original, humorous and interesting dialogues to keep humans engaged with it only by the illusion of artificial intelligence. In such cases, all Chatbots must pass the Turing Test in order to achieve its highest productivity. Turing Test holds good when user is unable to predict whether it was a human or machine when communicated via telegram or telephonic media instead of actual face to face conversation. The programs which can think like a human and are able to predict the next moves according to the prior knowledge are generally segregated under the Artificial Intelligence and

Machine Learning. Reasoning capabilities among the normal Chatbots enhances the human-computer interaction as per the human psychological terms and mind-set of common people.

The concept of machine intelligence came up with the machine languages such as the LISP (List Processing), PROLOG (PROgram LOGic) and FORTRAN (FORmula TRANslation) and AIML (Artificial Intelligence Markup Language). These languages were developed for their computational capabilities and can be used with Artificial Intelligence.

The AI based agent mentioned in this model receives the response in either of the form, Text To Speech (TTS) and Speech To Text (STT) for the active listening of the agent with specific keywords thus giving a friendlier interface for the user. With the need of handling thewide variety of unstructured data during pattern matching normal Chatbots use normal spreadsheet formats or other relational databasesbut at some extent, some Chatbots can also use Semi-Structured Databases for pattern matching.

- **Related Works**
  - A.L.I.C.E.

Artificial Linguistic Internet Computer Entity by ALICE AI Foundation developed by Dr. Richard Wallace is widely used Chatbot, a completely text based conversational agent[1].

  - ELIZA

A classic A. I. Program named as ELIZA psychiatrist [3] is a simple personal pronoun reversal program, to create the illusion of understanding when in fact it had none. The idea was to turn around and "reflect back" anything the client said, by replacing first person pronouns ("I" and "me") with second person pronouns ("You").(Pandorabots.com, 2005).

  - TeenChat

A text based Chatterbot System for sensing and releasing adolescence stress.

  - CALO

Cognitive Assistant that Learns and Organizes (CALO) developed to create cognitive software systems that can reason, learn from experience, be told what to do, explain what they are doing, reflect on their experience, and respond to surprises. [7]

  - ViDi

Virtual Diabetes (ViDi) [8] physician which is a Chatbot for diabetes education activity using One Match and All Match Categories Algorithm for Keywords matching in Chatbot.

- Cortana

Microsoft introduced Cortana, A personal digital assistant for Windows 10 PCs and Windows 10 Phones as a substitute to the inbuilt search. Cortana uses '*Satar*i' Database and improves search mechanism using '*Semantic Search*'. Cortana can set reminders and alarms, recognizes natural voices and even includes a music recognition system. From *Lumia Denim* series, Cortana includes '*Hey Cortana*' feature to activate it from any corner of a room.

•Review

•User Interface

As Java is Open Source, platform independent and supports better GUI Programming tools (such as Applets, Swings, Servlets, JSP), use of Java to create a better GUI (Graphical User Interface) for better UX (User Experience) is highly acceptable.

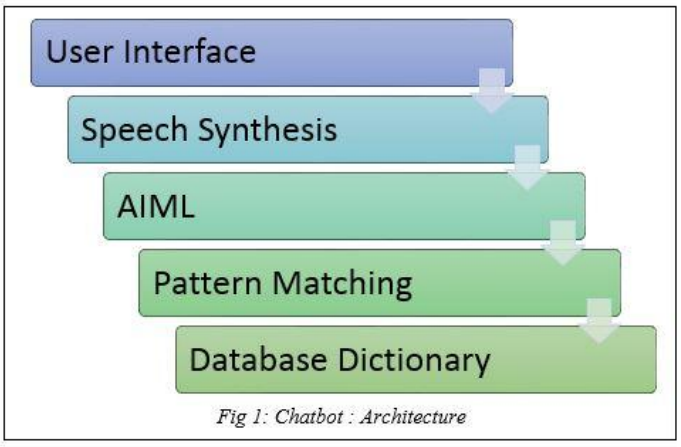


Fig 1: Chatbot : Architecture

•Speech Synthesis

Unavailability of Speech Synthesis and Speech Recognition in some Chatbots may leads to losing interest for more interaction with them. Text based systems may hold the user at some extent but increases the probability of leaving the conversation earlier. Hence, the emerging Intelligent Digital Personal Assistants such as *Siri* for Apple iPhones, *Cortana* for Windows 10 PCs and Windows 10 Phones use Speech Recognition and Speech Synthesis mechanisms for better User Experience.

The Microsoft Speech SDK 5.1 [2] is the developer kit for the Microsoft Windows environment. Tools, information, and sample engines and applications are provided to help you integrate and optimize your speech recognition and speech synthesis engines with the new

Microsoft Speech API 5 (SAPI 5).This proposes the usage of the SDK components and redistributable SAPI/engine run-time to build applications that incorporate speech recognition and speech synthesis.

Included in the Speech API architecture is a collection of speech components for directly managing the audio, training wizard, events, grammar compiler, resources, speech recognition manager, and TTS (Text To Speech) manager for low-level control and greater flexibility.

For instance, Microsoft Cortana accepts 'Hey Cortana' command by user as an active listening command which would enhance the usability of the application.

•AIML

AIML stands for Artificial Intelligence Markup Language, developed by A.L.I.C.E. AI Foundation. AIMLsource codes produce the bot's knowledgebase commonly termed as Chatbot Brain consisting of the bot's properties such as name, age, gender, birthdate, birthplace, size, location, ethics, emotions etc.

The bot should answer logically and sensibly to the user's questionnaire rather than responding specifically or correctly. That's where AIML comes into picture. AIML [5] programs consist of predefined answers to predefined matching patterns of questions.

Basic knowledge unit in AIML is called as "*Category*" which contains a pair of '*pattern*' and '*template*'. Patterns are simple string inputs to the Chatbot and templates are the responses to these asked questions. Developer has already set patterns and templates for each and every user inputs. From these, pattern matching algorithm picks up the appropriate answers stored in Chatbot's brain and represents it on screen in text format and/or by the means of TTS (Text To Speech).

AIML Tag	Description
<aiml>	Beginning and end of AIML document.
<category>	Basic unit of knowledge in bot's brain.
<pattern>	User input for pattern matching.
<template>	Bot's response to the user's input.
<star>	Used to match wild card *character(s) in <pattern>Tag.
<srai>	Multipurpose tag, used to match other categories.

<random>	Used to get random responses.
<topic>	Used to store a context which would be helpful for the later conversation on the same context.
<think>	Used in AIML to store a variable without notifying the user.

Table 1: Basic AIML Tags.

Following sample code depicts the basic structure of AIML files.

```
<?xml version="1.0" encoding="UTF-8"?>
<aiml version="1.0.1" encoding="UTF-8"?>
<category>
<pattern>Hello</pattern>
<template>
Hey there...
</template>
</category>
</aiml>
```

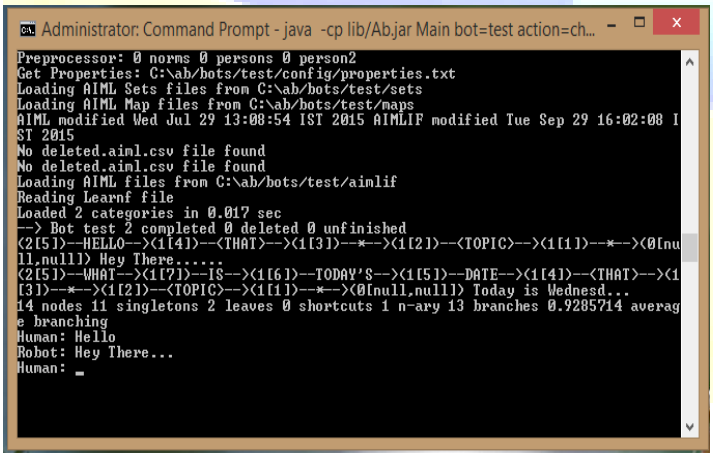


Fig 2: Screenshot showing implementation of AIML Program.

•Interpreter

Program AB by A.L.I.C.E. AI Foundation is the Java based primary interpreter between Chatbot's brain (AIML Files) and Chatbot vocabulary (dictionary in spreadsheet format). Pattern Matching algorithm works on matching the exact template from AIMLIF (AIML Intermediate

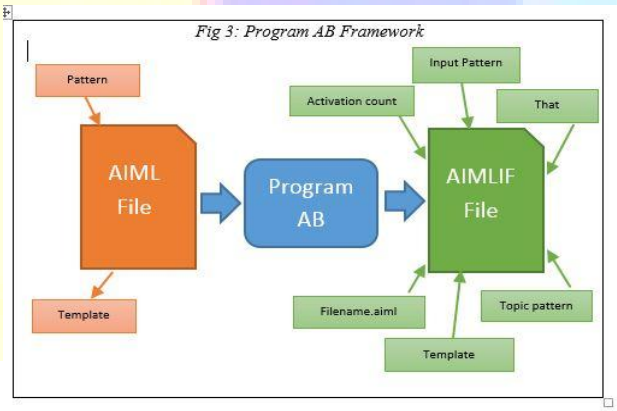
Format) Files with the use of Wildcard Characters such as '*' and '_' which matches one or more characters from already saved templates.

Suppose, user asked 'Who is Steve Jobs?' then interpreter matches all the words saved under the 'Who is *' category and its hierarchy and even answers to the patterns like 'Who is Bill Gates?', 'Who is your creator', 'Who is Mona Lisa?', 'Who is Indira Gandhi?' and so on. The main pattern matching algorithm named 'The Graphmaster' *(Pandorabots.com, 2005)* which contains collection of nodes called as 'Nodemappers'. These Nodemappers map the branches from each node. These branches are single words or Wildcards.

Program AB stores the hierarchical directories named as aiml, aimlif, config, sets and maps. AIML Files are the one which forms the bot's brain and aimlif files are the parallel copy of patterns from aiml files normally stored and can be edited by any spreadsheet editor.

AIMLIF files consist of 6 fields, which are: *'activation count', 'input pattern', 'that pattern', 'topic pattern', 'template', 'filename.csv'*. Now, again consider the sample code and the aimlif file parallel to it which includes:

```
0, Hello,*,*, Hey There…, test.aiml
```



Even we can use other AIML Tags to match multiple patterns for same question. Take a same question as 'Who is Steve Jobs?' and then Chatbot would select one from multiple answers. Its AIML file would look like

```
<category>
```

```
<pattern>Who is Steve Jobs</pattern>
<template>
<random>
<li>Steve was the founder of Apple Computers and Macintosh based Products. Thanks for asking about Steve</li>
<li>Steve Jobs, the great name from the field of personal computers who invented the iPhone, iPad, iPod, iOS and much more.</li>
<li>Apple Computers are completely incomplete without Steve.</li>
</random>
</template>
```

And its Parallel AIMLIF file would look like as below…

```
0, WHO IS STEVE JOBS, *, *, <random>#Newline<li>Steve was the founder of Apple Computers and Macintosh based Products and Thanks for asking about Steve</li>#Newline<li>Steve Jobs#comma the great name from the field of personal computers who invented the iPhone#comma iPad#comma iPod#comma iOS and much more. </li>#Newline<li>Apple Computers are completely incomplete without Steve.</li></random>, SteveJobs.aiml
```

Hence, Program AB (mainly used in ALICE bot) translates the matched patterns into human readable logically smart answers creating an illusion of AI based Human Computer Interface (HCI).

- **DataBase Tools**
  - **Dictionary**

AsChatbot's brain is full of aiml files and these can be retrieved by Program AB for logical and sensitive response of a Chatbot. Each aimlif file concerns with specific aiml files (6th field of csv file as *filename.aiml*) which can be stored and edited by any spreadsheet editor. Instead of using spreadsheet format, the Bot Dictionary can be stored into Database Systems

which supports NoSQL. Since, bot's responses are highly unpredictable, user may get surprised by mischievous responses from Chatbot.

Consider the same example of 'Who is Steve Jobs?' Bot matches the pattern of 'Who is *' and then search its succeeding hierarchy for specific responses. To match the wildcard '*' with one or more words and to get sensible response for one question, there may be multiple matching patterns with multiple responses. At this point, semi-structured database helps to reduce excessive use of spreadsheet files, hence we can use a NoSQL Database System like MongoDB.

- **Data Mining In Intelligent Agents:**

Commonly, Intelligent Agents can be classified as Online and Offline Agents. Pattern Matching in Online Agents works by matching of keywords by fetching them from Cloud Based Database Dictionary whereas, Offline Agents use already stored Database Dictionary. As already mentioned, Chatbot must produce the sensible responses and should also able to predict the upcoming questionnaires.

Sometimes it may happen that, unauthenticated user may order to change the files from the device, set faulty records, delete some important files or even plan for the upcoming wrong predictions. After all, Chatbot is a computer program, it listens to the user and does as user said to do. In such cases, system's all security fails to incorporate with its original user as some Chatbots are unable to provide strong authentication to the devise administrator.

Thus, Data Mining and further analysis of predicted patterns and data sets from cloud as well as the stored database would help in adaptive machine learning techniques for improved security purposes and also for development of better interactive human computer interface.

•Conclusion

This paper discusses the limitations of Intelligent Agents such as unavailability of voice integration, file authentication and security, complicated database handling systems. Hence, in order to overcome these drawbacks, efficient solutions such as Speech Integration using Microsoft Speech SDK, better file security using keyword encryptions, use of Semi-Structured DataBase, efficient algorithm for generating smart responses.

Thus, an Intelligent Agent can be a replacement for a human being and can reduce or completely nullify the work in some or the other way. Chatbot thinks like a human being and it

can be useful in various domains such as education, healthcare and general purpose use. It can be very fruitful for the physically challenged as well as the blind ones as the voice enabled Chatbot would help them to come up with it. Additionally as an educational Chatbot, it would be a mentor. For example it could be German language teaching Chatbot. Furthermore in healthcare industry it would be of vital importance solving the FAQ's for various diseases discussing about their symptoms, causes etc.

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