

CHATBOTS: AN INTELLIGENT AGENT FOR ENTERPRISE PROFESSIONALS

Dr. Nitika Arora
Assistant Professor of Computer Science
S.U.S Govt .College Matak Majri, Indri

Chatbots are computer programs that interact with users using natural languages. This technology started in the 1960's; the aim was to see if chatbot systems could fool users that they were real humans. However, chatbot systems are not only built to mimic human conversation, and entertain users. In this paper, we investigate other applications where Chatbots could be useful such as education, information retrieval, business, and e-commerce. Arrange of Chatbots with useful applications, including several based on the ALICE/AIML architecture, are presented in this paper.

1 Introduction

The need of conversational agents has become acute with the widespread use of personal machines with the wish to communicate and the desire of their makers to provide natural language interfaces (Wilks, 1999)

Just as people use language for human communication, people want to use their language to communicate with computers. Zadrozny et al. (2000) agreed that the best way to facilitate Human Computer Interaction (HCI) is by allowing users "to express their interest, wishes, or queries directly and naturally, by speaking, typing, and pointing".

This was the driver behind the development of chatbots. A chatbot system is a soft-ware program that interacts with users using natural language. Different terms have been used for a chatbot such as: machine conversation system, virtual agent, dialogue system, and chatterbot. The purpose of a chatbot system is to simulate a human conversation; the chatbot architecture integrates a language model and computation algorithms.

Initially, developers built and used chatbots for fun, and used simple key word matching techniques to find a match of a user input, such as ELIZA (Weizenbaum, 1966, 1967). The seventies and eighties, 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 ALICE (2007). With the improvement of data-mining and machine-learning techniques.

2 The ALICE Chatbot System

A.L.I.C.E. (Artificial Intelligence Foundation, 2007; Abu Shawar and Atwell, 2003a; Wallace, 2003) is the Artificial Linguistic Internet Computer Entity, which was first implemented by Wallace in 1995. Alice's knowledge about English conversation patterns is stored in AIML files. AIML, or Artificial Intelligence Mark-up Language, is a derivative of Extensible Mark-up Language (XML). It was developed by Wallace and the Alicebot free software community from 1995 onwards to enable people to input dialogue pattern knowledge into chatbots based on the A.L.I.C.E. open-source software technology.

AIML consists of data objects called AIML Objects, which are made up of units called topics and categories. The topic is an optional top-level element, has a name attribute and a set of categories related to that topic. Categories are the basic unit of knowledge in AIML is used in generating the ALICE chatbot answer. The format of AIML is as follows:

```
<aiml version="1.0">
<topic name="the topic">
<category>
<pattern>PATTERN</pattern>
<that>THAT</that>
```

```
<template>Template</template>
</category>
</topic>
</aiml>
```

The `<that>` tag is optional and means that the current pattern depends on a previous chatbot output. The AIML pattern is simple, consisting only of words, spaces, and the wildcard symbols `_` and `*`. The words may consist of letters and numerals, but no other characters. Words are separated by a single space, and the wildcard characters function like words. The pattern language is case invariant. The idea of the pattern matching technique is based on finding the best, longest, pattern match.

Types of ALICE/AIML Categories

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

- a. Atomic categories: are those with patterns that do not have wildcard symbols, `_` and

e.g.:

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

In the above category, if the user inputs '10 dollars', then ALICE answers 'WOW, that is cheap'.

- b. Default categories: are those with patterns having wildcard symbols `*` or `_`. The wildcard symbols match any input but they differ in their alphabetical order. Assuming the previous input 10 Dollars, 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:

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

So ALICE answers 'It is ten'.

Recursive categories: are those with templates having `<srail>` 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.

Symbolic reduction

```
<category>
<pattern>DO YOU KNOW WHAT THE * IS</pattern>
<template>
<srail>What is <star/></srail>
</template>
</category>
```

In this example `<srail>` is used to reduce the input to simpler form "what is *".

Divide and conquer

```
<category>
<pattern>YES* </pattern>
<template>
<srail>YES</srail>
<sr/>
```

```
<template>  
</category>
```

The input is partitioned into two parts, “yes” and the second part; *is matched with the <sr/> tag.
<sr/>=<srai><star/></srai>

Synonyms

```
<category>  
<pattern>HALO</pattern>  
<template>  
<srai>Hello</srai>  
</template>  
</category>
```

The input is mapped to another form, which has the same meaning.

3 A Chatbot as a Tool of Entertainment

The initial aim of building chatbot systems was to mimic human conversation and amuse users. The first attempt at building chatbots was ELIZA, which was created in the 60's by Joseph Weizenbaum to emulate a psychotherapist in clinical treatment (Weizenbaum, 1966, 1967). The idea was simple and based on keyword matching. The input is inspected for the presence of a keyword. If such a word is found, the sentence is mapped according to a rule associated with the keyword; if not, a connected free remark, or under certain condition an earlier transformation, is retrieved. For example, if the input includes the keyword “mother”, ELIZA can respond “Tell me more about your family”. This rule is inspired by the theory that mother and family are central to psychological problems, so a therapist should encourage the patient to open up about their family; but the ELIZA program does not really ‘understand’ this psychological strategy, it merely matches the keyword and regurgitates a standard response. To keep the conversation going, ELIZA has to produce responses which encourage the patient to reflect and introspect, and this is done mechanistically using some fixed phrases if no keyword match is found such as “Very interesting. Please go on.”, or “Can you think of a special example?”. Figure 1 shows an example of chatting with ELIZA. When ELIZA was released, at least some users believed that they were talking to a real therapist, and spent hours talking about their problems.

```
Human: Men are all alike. ELIZA: In what way?  
  
Human: They're always bugging us about something. ELIZA: Can you think of a special example?  
  
Human: Well, my boyfriend made me come here. ELIZA: Your boyfriend made you come here?  
  
Human: He says I'm depressed much of the time.  
  
ELIZA: I'm sorry to hear that you are depressed much of the time. Human: It's true. I'm unhappy.  
  
ELIZA: Do you think coming here will help you not to be unhappy? Human: I need some help, that much seems certain.
```

Figure 1: A sample of conversation with ELIZA (Jurafsky and Martin, 2000)

Even though ELIZA was not able to understand, and a user can realise after a while of chatting that many ELIZA responses are extracted from users input, it was the inspiration for many modern chatbots which aim mainly to fool users that they are talking to another human as applied in the “imitation game” (Turing Test, Turing, 1950).

After ELIZA, a lot of chatbots or human-computer dialogue systems have been developed either to simulate

different fictional or real personalities using different algorithms of pattern matching, such as simple keyword-matching in ELIZA, or more linguistically-sophisticated models such as using Markov Models like MegaHAL (Hutchens and Alder,1998).

Another example used in this field is ALICE, the chatbot engine we used in our research, which was built basically to entertain users and talk to them as a real person. ALICE won the Loebner prize (2003) competition three times in 2000, 2001, and 2004. The Loebner competition is the way used nowadays to judge how much a chatbot could convince a user that it is a real human by chatting for 10 minutes. Figure 3 shows an example of chatting with ALICE. In fact this conversation seems good, however if you try to chat more, you will probably figure out that:

- ALICE does not save the history of conversation.
- ALICE does not truly understand what you said; it gives you the responses from the knowledge domain stored in her “brain”.

These are also the most common drawbacks in almost all chatbots.

4 A Chatbot as a Tool to Learn and Practice a Language

We used our Java program described in section 3, to read a Corpus of Spoken Afrikaans (Korpus Gesproke Afrikaans) (van Rooy, 2003) and to convert it to the AIML format files. Since the corpus does not cover topics like greetings, some manual atomic categories we readded for this purpose and the default ones were generated by the program

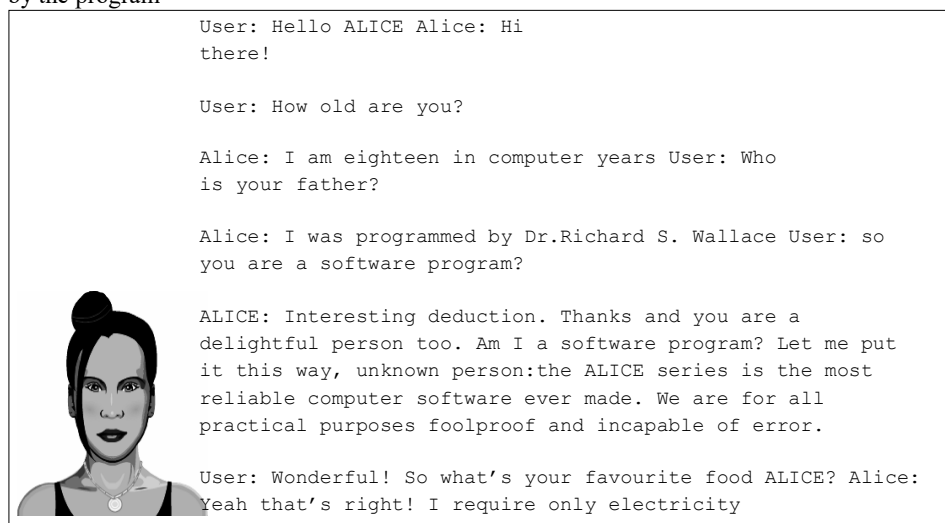


Figure 2: A sample of chatting with ALICE

automatically. As a result two Afrikaans chatbots were generated: Afrikaana (2002), which speaks just Afrikaans, and a bilingual version speaking English and Afrikaans, named AVRA (2002); this was inspired by our observation that the Korpus Gesproke Afrikaans actually includes some English, as Afrikaans speakers are generally bilingual and switch between languages comfortably. We mounted prototypes of the chatbots on websites using Pandorabot service, and encouraged open-ended testing and feedback from remote users in South Africa. Unfortunately, users found that many responses were not related to the topic or nonsense. The reasons behind most of the users' feedback can be related to three issues. Firstly the dialogue corpus context does not cover a wide range of domains, so Afrikaana can only “talk about” the domain of the training corpus. Secondly, the repeated approach that we used to solve the problem of determining the pattern and the template in case of more than two speakers may lead to incoherent transcripts: if the training corpus does not have straightforward equivalents of “user” and “chatbot” then it can be non-trivial to model turn-taking correctly in Machine-Learnt AIML (Abu Shawar and Atwell, 2005b).

A sample of chatting done in this experiment is shown in figure 3.

Figure 3 : A sample of chatting between a student in China and ALICE (from Jia (2004b))

```
User: you are a computer?  
  
Alice: What if I was a person pretending to be a  
computer? User: I can not believe it  
  
Alice: Why can't you do  
believe? User: Your answer is  
not like a human  
  
Alice: I am still now young and will learn more.
```

Analysis of all dialogues generated and feedback from students revealed that: 1256 users chatted with Alice, 88% of them chatted only once and did not come back to the site; the duration of chatting was short; 17% made positive comments such as: “you are so nice”, “you are clever”, etc, and 24% evaluated it negatively. In this respect, Jia concluded that the failure of this experiment is down to the pattern matching technique used in Alice which is based on key-word matching without any attempt to understand what is said. The topics of chatting covered every aspect in our daily life, for example: study, emotion, life, computer, free time, travel/world and job. 11.39% of students talk about English study, and exams, and 13% mentioned love, mostly students younger than 30 years old dealt with Alice as a friend rather than as a teacher, and told her some private emotional problems and experiences. Jia (2004b) concluded that “the conversational chatbot should not only work as a teacher or learning partner with rich special knowledge, but also as a dear friend who may enjoy the joy and suffer the pain of the users”. After that Jia (2004a) developed an intelligent Web-Based teaching system for foreign language learning which consists of: natural language mark-up language that labels grammar elements; natural language object model in Java which represents the grammatical elements; natural language database; a communication response mechanism which considers the discourse context, the world model and the personality of the users and of the system itself.

5 A Chatbot as Information Retrieval Tool

A chatbot could be a useful tool in education, for example to practise language as illustrated in section 5. Knill et al. (2004) found that using a chatbot to answer questions will help the teacher to see where students have problems, what questions students ask, and the generated logs file could be accessed to gauge student learning, and students weaknesses. The authors developed the Sofia chatbot to assist in teaching Mathematics. The Sofia chatbot has the ability to chat with users and at the same time to chat with other mathematical agents such as Pari and Mathematica to help in solving Algebra problems. The “brain” of the bot contains text files mainly focussing on maths and other common knowledge to make Sophia friendly to use. Sophia was trained with some jokes, and is familiar with movies in which maths plays a role. Sophia was used at Harvard Mathematics department. Results showed that teachers can use a chatbot to look for problems as students use it to solve problems.

Information Retrieval researchers recognize that techniques to answer questions from document-sets have wide applications, beyond education; see for example the overview of question-answering in restricted domains (Molla and Vicedo, 2007). In a similar application, we used a range of different retrained versions of ALICE to retrieve answers for questions in a range of topics (Abu Shawar et al., 2005; Abu Shawar and Atwell, 2005a,c). We adapted the Java program to the FAQ (Frequently Asked Questions) in the School of Computing (SoC) at University of Leeds, producing the FAQchat system. Earlier systems were built to answer questions specifically about the Unix operating system, e.g. Wilensky et al. (1988), Cliff and Atwell (1987); but the SoC FAQ also covers other topics including teaching and research resources, how to book a room, even “what is doughnuts?” (Friday morning staff meeting with an incentive to turn up...) An FAQ has the advantage over other corpus training sets in that there are clear equivalents of “user” (Question) and “chatbot” (Answer) which simplifies modelling of turn-taking (Abu Shawar and Atwell, 2005b). The results returned from FAQchat are similar to ones generated by search engines such as Google, where the outcomes are links to exact or nearest match web pages. Because of this similarity an interface was built which accepts users input and produce two answers, one is generated from the FAQchat and the other is generated from Google after filtering it to the FAQ of SoC. An

evaluation sheet was prepared which contains 15 information-seeking tasks or questions on a range of different topics related to the FAQ database. 21 members of the staff and students tried chatting with the interface as shown in figure 4; the following is a summary of the feedback we obtained:

- Most staff and students preferred using the FAQ chat for two main reasons:
 1. The ability to give direct answers sometimes while Google only gives links.
 2. The number of links returned by the FAQchat is less than those returned by Google for some questions, which saves time browsing/searching.
- Users who preferred Google justified their preference for two reasons:
 1. Prior familiarity with using Google.
 2. FAQchat seemed harder to steer with carefully chosen keywords, but more often did well on the first try. This happens because FAQchat gives answers if the keyword matches a significant word. The same will occur if you re-formulate the question and the FAQchat matches the same word. However Google may give different answers in this case.

a. Direct answer generated by FAQchat using the FAQ of the school of computing at University of Leeds
Human: How can I remove a job from the printer?

FAQchat:

If you want to remove a job from the printer queue then find out the job number using the `lpq` command, and in a UNIX shell type:

```
%lprm -P printername job_no
```

You can only remove jobs that you have sent to the printer yourself - apart from Support that is. For more information look at:

[How do I remove a job from the printer queue?\(Printing\)](#)

b. Related links generated by FAQchat
Human: How can I delete a job from a printer?

FAQchat: You may find your answer in the following links:
How do I check the printer queue?(Printing)

How do I remove a job from the printer queue? (Printing)
How do I check my printer credits?(Printing)

How do I use the printer from a Windows machine? (Other [Windows information](#))

Figure 4: Answers generated by FAQchat

Figure 5 presents a sample of conversation with the Happy Assistant System taken from Chai and Lin(2001).

U: I am looking for a notebook for my consulting business
S: Please describe your financial constraints.

In this stage a list of most popular ones is displayed
U: not important thing performance is essential

S: are you looking for something that is top of the line?
U: Yes, absolutely

S: I have found something for you.

The target notebook is displayed for the user. And beneath it a summary of the users request displayed to explain why this product is displayed.

Figure 5: A sample of chatting with the Happy Assistant system

Conclusion

We have surveyed several chatbot systems which succeed 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, Chatterbots for foreign language instruction, and teaching Chatterbots in general.” (Wallace et al., 2003). However, in the education domain Knill et al. (2004) concluded that “the teacher is the backbone in the teaching process. Technology like computer algebra systems, multimedia presentations or ‘chatbots’ can serve as amplifiers but not replace a good guide”. In general, the aim of chatbot designers should be: to build tools that help people, facilitate their work, and their interaction with computers using natural language; but not to replace the human role totally, or imitate human conversation perfectly. Finally, as Colby (1999) states, “We need not take human-human conversation as the gold standard for conversational exchanges. If one had a perfect simulation of a human conversant, then it would be human-human conversation and not human-computer conversation with its sometimes odd but pertinent properties.”

References

- [1.] Abu Shawar, B. and Atwell, E. (2002). A comparison between alice and elizabeth chatbot systems. Research Report 2002.19, University of Leeds – School of Computing, Leeds.
- [2.] Abu Shawar, B. and Atwell, E. (2003a). Using dialogue corpora to retrain a chatbot system. In Archer, D., Rayson, P., Wilson, A., and McEnery, T., editors, Proceedings of the Corpus Linguistics 2003 conference (CL2003). Lancaster University, UK, pages 681–690.
- [3.] Abu Shawar, B. and Atwell, E. (2005b). Die Modellierung von Turn-taking in einem korpus-basierten Chatbot / Modelling turn-taking in a corpus-trained chatbot. In Fisseni, B., Schmitz, H.-C., Schroder, B., and Wagner, P., editors, Sprachtechnologie, mobile Kommunikation und linguistische Ressourcen, pages 549–561. Peter Lang Verlag, Frankfurt/Main.
- [4.] Afrikaana (2002). Published online: <http://www.pandorabots.com/pandora/talk?botid=eba8f4dc9e3406b8>.
- [5.] Artificial Intelligence Foundation (2007). The A. L. I. C. E. Artificial Intelligence Foundation. Published online: <http://www.alicebot.org> oder <http://alicebot.franz.com/>.
- [6.] Atwell, E. (1996). Comparative evaluation of grammatical annotation models. In Sutcliffe, R., Koch, H.-D., and McElligott, A., editors, Industrial Parsing of Technical Manuals, pages 25–46. Rodopi, Amsterdam.
- [7.] AVRA (2002). Published online: <http://www.pandorabots.com/pandora/talk?botid=daf612c52e3406bb>.
- [8.] Batacharia, B., Levy, D., A., R. C., Krotov, and Wilks, Y. (1999). CONVERSE: a conversational companion. In Wilks, Y., editor, Machine conversations, pages 205–215. Kluwer, Boston/ Dordrecht/ London.
- [9.] Braun, A. (2003). Chatbots in der Kundenkommunikation (Chatbots in customer communication). Springer, Berlin.
- [10.] Chai, J., Horvath, V., Nicolov, N., Stys-Budzikowska, M., Kambhatla, N., and Zadrozny, W. (2000). Natural language sales assistant - a web-based dialog system for online sales. In Proceedings of thirteenth annual conference on innovative applications of artificial intelligence, 2000.
- [11.] Chantarotwong, B. (2005). The learning chatbot. Final year project. Published online: <http://courses.ischool.berkeley.edu/i256/f06/projects/bonniejc.pdf>.
- [12.] Cliff, D. and Atwell, E. (1987). Leeds unix knowledge expert: a domain-dependent expert system generated with domain-independent tools. BCS-SGES: British Computer Society Specialist Group on Expert Systems journal, 19:49–51.
- [13.] Fryer, L. and Carpenter, R. (2006). Emerging technologies bots as language learning tools. Language Learning & Technology, 10(3):8–14.
- [14.] Gibbs, G., Cameron, C., Kemenade, R., Teal, A., and Phillips, D. (2004). Using a chatbot conversation to enhance the learning of social theory. Published online: <http://www.hud.ac.uk/hhs/dbs/psysoc/research/SSCRG/chatbot.htm>.
- [15.] HEXBOT (2004). Hexbot chatbot website. Published online: <http://www.hexbot.com/>.
- [16.] Hutchens, J. (1996). How to pass the turing test by cheating. Research Report TR97-05, University of Western Australia – School of Electrical, Electronic and Computer Engineering, Perth.
- [17.] Hutchens, T. and Alder, M. (1998). Introducing MegaHAL. Published online: <http://cnts.uia.ac.be/conl198/pdf/271274hu.pdf>.
- [18.] Jia, J. (2004a). CSIEC (computer simulator in educational communication): An intelligent web-based teaching system for

- foreign language learning. In Kommers, P. and Richards, G., ed- itors, Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunica- tions 2004, pages 4147–4152, Chesapeake, VA. AACEpress.
- [19.] Kerfoot, B. P., Baker, H., Jackson, T. L., Hulbert, W. C., Federman, D. D., Oates, R. D., and DeWolf, W. C. (2006). A multi-institutional randomized controlled trial of adjuvant web-based teaching to medical students. *Academic Medicine*, 81(3):224–230.
- [21.] Knill, O., Carlsson, J., Chi, A., and Lezama, M (2004) An artificial in- telligence experiment in collegemath education. Preprint available at <http://www.math.harvard.edu/~knill/preprints/sofia.pdf>.
- [22.] Loebner, H. (2003). Home page of the loebner prize-the first turing test. Published online: <http://www.loebner.net/Prize/loebner-prize.html>.
- [23.] Mann, W. (2002) Dialogdiversitycorpus. Published online: <http://www-rcf.usc.edu/~billmann/diversity/DDivers-site.htm>.
- [24.] van Rooy, B. (2003). Transkripsiehandleiding van die Korpus Gesproke Afrikaans. [Transcription Manual of the Corpus Spoken Afrikaans.]. Potchefstroom University, Potchefstroom.
- [25.] Wallace, R. (2003). The Elements of AIML Style. A.L.I.C.E. Artificial Intelligence Foundation, Inc.
- [26.] Wallace, R., Tomabechei, H., and Aimless, D. (2003). Chatterbots go native: Considerations for an eco-system fostering the development of artificial life forms in a human world. Published online: <http://www.pandorabots.com/pandora/pics/chatterbotsgonative.doc>.