A Brief Resume of Rule-based Chatbots: Eliza

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1 Introduction

There are mainly two types of architectures for chatbots. The first one is the rule-based architecture, which was used on early chatbots like Eliza and Parry. The other architecture is based on large chat corpora like using information retrieval and neural network encoder-decoder, and they were invented and implemented in later years.

This paper aims at making a brief resume of the first invented rule-based chatbot: Eliza, according to the slides of Dan Jurafsky during his course of CS124.

2 Concepts

Eliza was created by Dr. Joseph Weizenbaum in 1966, and she was initially designed to offer clinical therapy. There are some snippets of Dr.Weizenbaum's secretary's conversation with Eliza, and we can see from it that Eliza was able to continue the conversation in a tricky way. It did not express its "opinions", but slowly guided the speaker to actively talk about their thoughts.

This trick ELIZA designed is called **Person-centered therapy**, it was developed by Carl Rogers in the 1940s, based on the idea that the client knows what is best, and that the therapist's role is to facilitate an environment in which the client can bring about positive change.

ELIZA thus played the role of a Rogerian psychologist, who drew the patient out by reflecting patients' statements back at them. Usually, chatbot trying to pass the Turing test will choose some such domain which assuming itself to have some conversational goal.

2.1 Eliza Rules

There are several basic rules that Eliza applied, the most common one is that it will transform "You" and "I" from the client's previous sentence.

On top of that, ELIZA starts its process of responding to an input by a user by first examining the text input for a "keyword," which is a word designated as important by the acting ELIZA script. It assigns to each keyword a precedence number, or a RANK, designed by the programmer.

When Eliza had to respond, it will find this "keyword" w in the sentence with the highest keyword rank. If such word w exists, it will check each rule for w in ranked order, and then choose the first rule that matches the sentence and apply the transform to it as response. But if it fails to find the word w, it will apply "NONE" transform or grab an action of the memory queue.

More precisely, Dan Jurafsky gave an example in his slides, where the client said: I know everybody laughed at me. In this case, there two keywords with two corresponding transformation rules.

- (I *) − > (You say you 2)

  Eliza: You say you know everybody laughed at you.

- Words like everybody/ always are probably referring to some specific event or person.

  Eliza: Who in particular are you thinking of?

And if there is no keyword in the sentence, Eliza will give a response from the "NONE" transform rule such as: "Please go on.", "That's very interesting" or "I see," etc., to let the client continue the chat and repeat the process.

3 Memory

A good chatbot should remember the things the person is talking to before, and mention them sometimes when necessary in the conversation. Eliza also has such characteristics.

For instance, whenever "MY" is the highest keyword in the client's previous sentence, it will use the rules:

(MEMORY MY

      (0 YOUR 0 = LETS DISCUSS FURTHER WHY YOUR 3)

      (0 YOUR 0 = EARLIER YOU SAID YOUR 3)

where the 3 here is the constituent in pattern.

Eliza will choose randomly a transform on the MEMORY list and apply the previous rule to the sentence, and then store the keyword on the stack.

4 Other Eliza stuff

The author of the slides also demonstrates some specific settings for Eliza. Such as rules defining the classes of words. Besides, it's not allowed to reuse transforms in the same conversation. So every time one transform associated with a pattern was used, they will increment a counter for that rule, and next time when encountering the same pattern, they will use the next ranked transform.

5 Ethical Implications

As a chat object of people, the data it collected involved people's privacy issues. Some people became deeply emotionally engaged with the program, such as Dr.Weizenbaum's secretary. She asked him to leave the room when she talked with ELIZA because she thought it was a very private conversation.

Moreover, when Dr.Weizenbaum suggested that he might want to store all the ELIZA conversations for later analysis, people became very dissatisfied because it had privacy implications problems.

6 Conclusion

To sum up, as a rule-based chat robot invented in 1966, ELIZA's breakthroughs and contributions are huge and inspiring at that time. And it can act as a therapist to guide people to actively communicate while responding fluently. The final privacy issue also shows that many people started a more in-depth chat with ELIZA. Even though we now have stronger algorithms and calculation speeds for creating more powerful chatbots, the concepts of ELIZA is still worth learning from.