

LING 120:
Language and Computers
Semester: Fall '17

Instructor: Sowmya Vajjala

Iowa State University, USA

30 October 2017

Today's topic

How are dialog systems and chat bots made?

(Materials from: Textbook, and "Speech and language processing" by Jurafsky and Martin (Chapters 29–30))

on Eliza - some comments from your responses

- ▶ "The bot mostly just tries to identify parts of your sentence and parrot them back to you in the form of a question. Which I suppose is the idea behind the stereotypical therapist"
- ▶ "However if you dig too deep, use sarcasm or modern slang it doesn't really understand so it'll ask very broad open questions."
- ▶ "This bot isn't very good at relying on context."
- ▶ "My overall evaluation of the program is that it does a decent job of fulfilling the role of a psychoanalyst, however, it is clearly built on a certain structure with only a handful of cases."

on Siri - some comments from your responses

- ▶ can interpret that 9 and nine are same, "having a meeting" is about scheduling etc, but cannot identify am vs pm.
- ▶ Cannot identify that "language and computers" is one entity, and hence shows two search results.
- ▶ Better with specific questions, but not at general talk
- ▶ Speech recognition is not perfect.

Summary of the responses

- ▶ Eliza seems to be bad at general chatting, but does some specific kinds of chats well.
- ▶ Siri is also good with certain things (doing specific tasks) but not good with conversations.
- ▶ Eliza is 50 years old. Siri is latest - yet, some issues persist.
- ▶ Does it mean these dialog systems are no good even now?

Summary of the responses

- ▶ Eliza seems to be bad at general chatting, but does some specific kinds of chats well.
- ▶ Siri is also good with certain things (doing specific tasks) but not good with conversations.
- ▶ Eliza is 50 years old. Siri is latest - yet, some issues persist.
- ▶ Does it mean these dialog systems are no good even now?
- ▶ Clearly, recent technological developments enabled chat bots that do specific tasks do well (morph.ai etc from last class)

What we should take care of when automating dialog-0

What are some of tasks that come to your mind if someone asks you to make something like Siri?

What we should take care of when automating dialog-1

- ▶ Study the purpose
- ▶ Understand the users
- ▶ What sort of interaction will happen? (text or speech or both?)
- ▶ Build simulations and prototypes (Wizard of Oz simulations)
- ▶ Iteratively test the design on real users and get feedback.

What we should take care of when automating dialog-2

- ▶ Starting a conversation (Who starts? User or System? How?)
- ▶ Understanding what the user said (question? request? general statement?)
- ▶ Formulating appropriate response
- ▶ Learning when to stop/how to stop the conversation
- ▶ Keeping track of the dialog

Types of Dialog Systems

- ▶ Rules and pattern-matching based (e.g., Eliza) - typically use regular expressions.
- ▶ Frame-based dialog agents (e.g., flight booking systems, LetsGo etc) - focused on specific tasks
- ▶ Retrieval based (e.g., FAQ bots) - they mine large datasets of human conversations to map from user to system response.
- ▶ Latest research in this direction uses something called sequence-to-sequence neural networks.

Rule-based: How does Eliza Work?

- ▶ As some of you already noticed, Eliza is based on matching keywords in your text.
- ▶ Its responses are based on a series of regular expressions.
- ▶ one version of Eliza, written in Python:
`https://github.com/jezhiggins/eliza.py`
- ▶ This will really work, sometimes. Some people also got attached to Eliza.

Rule-based: Parry

- ▶ another chat-bot with a psychology focus: to study schizophrenia.
- ▶ In addition to patterns, like Eliza, Parry has an additional variable: mental states. Certain topics change Parry's emotional state!
- ▶ Parry was known to pass a version of the "Turing Test" in 1972!!
- ▶ More at: <https://en.wikipedia.org/wiki/PARRY>
- ▶ Parry meets Eliza: <https://phrasee.co/parry-the-a-i-chatterbot-from-1972/>

Frame based dialog agents

- ▶ Dialog systems with very specific goals (e.g., LetsGo system we saw last week from CMU).
- ▶ All communication is seen as coming from a set of "frames" with vacant "slots" that need to be filled with "values" based on human responses.
- ▶ A frame for LetsGo could be looking for the vacant slots for: Origin, Destination, Departure time, Arrival time, Departure date, Bus number.
(<http://www.speech.cs.cmu.edu/letsgo/example.html>)
- ▶ Each slot can have a collection of questions, of which the system picks some to ask the user.

Frame based dialog agents

- ▶ May be there is a hierarchy in these slots (e.g., fill the bus number after filling other slots).
- ▶ System needs to keep track of conversation history (unlike Eliza).
- ▶ Other tasks: each time a user says something, system needs to determine what slot-filling template needs to be filled, what is next? etc.
- ▶ Language processing involved: POS tagging, named entity recognition, and so on.

Example structure of a frame based dialog

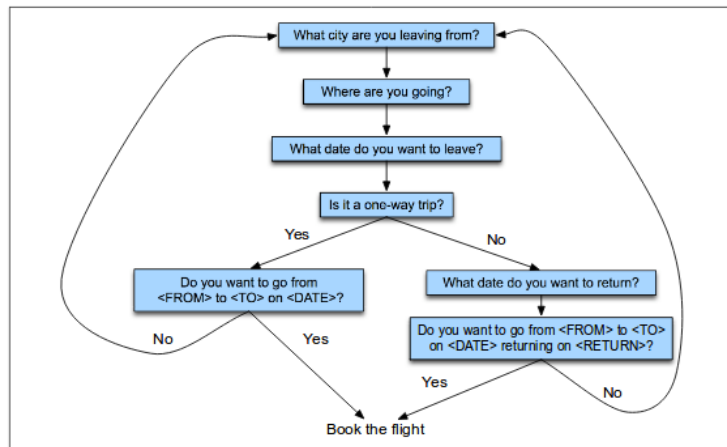


Figure 29.9 A simple finite-state automaton architecture for frame-based dialog.

Retrieval Based agents

- ▶ Instead of having specific patterns/rules, these rely on lots and lots of conversational, and question-answer data.
- ▶ Like rule-based bots, focus is on responding to current statement, not tracking the history.
- ▶ Bots can look online for answers to your questions (e.g., Siri) or in to their own pool of answers (morph.ai demos from last week)
- ▶ You can combine this with a little bit of pattern matching, to add some "personality" to the bot (Siri)

Dialog Acts - Understanding what user wants - Example 1

Tag	Example
THANK	<i>Thanks</i>
GREET	<i>Hello Dan</i>
INTRODUCE	<i>It's me again</i>
BYE	<i>Alright bye</i>
REQUEST-COMMENT	<i>How does that look?</i>
SUGGEST	<i>from thirteenth through seventeenth June</i>
REJECT	<i>No Friday I'm booked all day</i>
ACCEPT	<i>Saturday sounds fine</i>
REQUEST-SUGGEST	<i>What is a good day of the week for you?</i>
INIT	<i>I wanted to make an appointment with you</i>
GIVE_REASON	<i>Because I have meetings all afternoon</i>
FEEDBACK	<i>Okay</i>
DELIBERATE	<i>Let me check my calendar here</i>
CONFIRM	<i>Okay, that would be wonderful</i>
CLARIFY	<i>Okay, do you mean Tuesday the 23rd?</i>
DIGRESS	<i>[we could meet for lunch] and eat lots of ice cream</i>
MOTIVATE	<i>We should go to visit our subsidiary in Munich</i>
GARBAGE	<i>Oops, I-</i>

Figure 30.3 The 18 high-level dialog acts for a meeting scheduling task, from the Verbmobil-1 system (Jekat et al., 1995).

Dialog Acts - Understanding what user wants - Example 2

Utterance	Dialogue act
U: Hi, I am looking for somewhere to eat.	hello(task = find,type=restaurant)
S: You are looking for a restaurant. What type of food do you like?	confreq(type = restaurant, food)
U: I'd like an Italian somewhere near the museum.	inform(food = Italian, near=museum)
S: Roma is a nice Italian restaurant near the museum.	inform(name = "Roma", type = restaurant, food = Italian, near = museum)
U: Is it reasonably priced?	confirm(pricerange = moderate)
S: Yes, Roma is in the moderate price range.	affirm(name = "Roma", pricerange = moderate)
U: What is the phone number?	request(phone)
S: The number of Roma is 385456.	inform(name = "Roma", phone = "385456")
U: Ok, thank you goodbye.	bye()

Figure 30.5 A sample dialog from the HIS System of [Young et al. \(2010\)](#) using the dialog acts in Fig. 30.4.

Dialog Acts - Understanding what user wants - Example 3

QUERY DEPART.TIME	And what time would you like to leave [depart_city Pittsburgh]?
QUERY ARRIVE.CITY	And you're flying into what city?
QUERY ARRIVE.TIME	What time on [arrive_date May 5]?
INFORM FLIGHT	The flight departs [depart_airport PGH] at [depart_time 10 am] and arrives [arrive_city Seattle] at [arrive_time 12:05 their time].

General Links

- ▶ Humor:
`https://www.youtube.com/watch?v=Wnz1byTZsQY`
- ▶ Bot TA: `https://gizmodo.com/computer-science-students-fooled-by-artificially-intel`

Today's Exercise

To test if you actually read the book :) You can work in groups of 3 if you want.

3. **ALL:** We claimed that dialog can be seen as a game, and drew an analogy to basketball. How far does this analogy go? In this exercise, we want you to push the analogy as far as you can. You might want to consider some of the following concepts, most of which seem to us to have interesting equivalents:

- Playing as a team (and its converse, playing selfishly).
- Committing so many fouls that you get ejected.
- Doing sneaky fouls behind the referee's back.
- Man-to-man coverage and zone defense.
- Misdirection and disguise.
- Tactics and strategy.
- Alley-oops and slam dunks.
- Free throws.
- Working the referee.
- Running out the clock.

Write up your ideas about how some of these concepts map onto dialog (or think up new ones of your own and map them). You should give specific examples of how a dialog could match each situation. We do not promise that all our items make sense, since we intentionally put in a few strange ones to challenge your imaginations.