Natural Language Processing

- The Turing Test

- Eliza

- State of the art Conversational Agent

The Turing Test: Background

- Participating in a natural language conversation is hard:
  - ambiguity
  - vagueness
  - context
  - real world knowledge
  - .....
- Language use is intertwined with general human cognitive abilities
- Ability to process language as people do will signal the arrival of truly intelligent machines

The Turing Test

- Aim is to answer the question

  Q1: "Can a machine think?"

- But what do we mean by "think"? and "machine"?

- Turing chose to replace Q1 by Q2

  Q2: "Are there imaginable digital computers which would do well in the [Turing Test]?"

  Q3: "Can machines do what we (as thinking entities) can do?"

- Turing argues Q3 draws "a fairly sharp line between the physical and intellectual capacities of a man."

The Imitation Game and the Turing Test

- Party game in which a man (A) and a woman (B) go into separate rooms, and guests (or an interrogator) (C) try to tell them apart by writing a series of questions and reading the typewritten answers sent back

- Both the man (A) and the woman (B) aim to convince the guests (C) that they are the other

- Replace A or B by a computer

- If this does not significantly change the interrogator's success rate, the computer would have to be judged intelligent

Turing Test

- A person Q is connected to two others, A and B, through computer networking
- Q interacts verbally (by typing) with A and B
- One of A/B is another human, the other is a computer program
- A and B will both try to convince Q that they are the human
- The test is whether Q can correctly detect which is the computer program
- If Q cannot, the program has passed the Turing test.

Imitating Communication: Eliza

- Joseph Weizenbaum (1964): fancy linguistic analysis not needed to give the appearance of intelligent conversation
  - simple pattern matching produces responses to typed input
  - people have been fooled by Eliza and similar programs
  - program is very simple but surprisingly deceptive.
- Example: dialogue that supposedly took place between a sales executive who wanted to use the computer and Eliza

Sample Dialogue

SE: Do you think that I can use the computer this morning?

EI: Why do you ask?

SE: I might be able to make some additional telecomp sales.

EI: Why aren't you sure?

SE: My prospective customers have never seen a demonstration of the system.

EI: Does this mean very much to you?

SE: Of course it does.

EI: You seem very positive about that.

SE: This is ridiculous.

EI: What do you mean this is ridiculous.

SE: Is there any reason why I can't use the computer now?

EI: Tell me more about your prospective customers

SE: Please dial me up on 491-1850

Eliza fools the SE

- Supposedly, the SE telephoned the operator he thought he had been talking to, and the exchange went something like this:

  SE: Why are you being so snotty to me?

  Op: What do you mean, why am I being so snotty to you?

  rest censored...

- Sales Executive (SE) believed he was talking to a computer operator!

- Did not realise that he was, in fact, on-line to Eliza

- Seems that Eliza could fool people into believing that they were talking to another person

Imitating Communication: Eliza

- Weizenbaum very carefully choose the domain so Eliza could demonstrate its power

- Eliza imitates a Rogerian Psychotherapist

  ‣ clinician draws patients out to get them to talk about themselves and their problems, without being directive.

- Eliza uses simple pattern matching to carry on limited form of conversation.

- Seems to "Pass the Turing Test!" *(McCorduck, 1979, pp. 225-226)*

- Eliza Demo:

  http://www.lpa.co.uk/pws_dem4.htm

Eliza: Weizenbaum (1966)

User: You are like my father in some ways.

ELIZA: What resemblance do you see?

User: You are not very aggressive but I think you don't want me to notice that.

ELIZA: What makes you think I am not aggressive?

User: You don't argue with me

ELIZA: Why do you think I don't argue with you?

User: You are afraid of me

ELIZA: Does it please you to believe I am afraid of you?

How Eliza works

- Simple pattern matching with if-then rules:
  - ‣ stores a set of "key words" and "key phrases"
  - ‣ tries to match these to input sentence
  - ‣ if there's a match, perform simple transformation on sentence to provide response

- Example

  Rule: IF input = "I am X"

  THEN output = "How long have you been X?"

  input: "I am sick"

  matches: "I am X" where X = "sick"

  response: *How long have you been sick?*

- Large set of if-then (a.k.a. stimulus-response) rules used

How Eliza works

set stimulus = input
set output = " "
until match is found or no more rules in list
    if stimulus matches if-part of rule
        then substitute values from stimulus for variables in then-part of rule, and
                set output = filled-in pattern
if output = " ", then output = *"Tell me more."*
print output

Sample Rule: IF input = "I am X"

THEN output = "How long have you been X?"

Cascade of substitutions

Example:

Input: I am sick of you
        Rule: IF input = "I am X"
                THEN output = "How long have you been X?"
Output: *How long have you been sick of you?*

But this isn't what we want!

So, Eliza first changes all instances of 2nd person singular pronouns to 1st person singular pronouns, and 1st person singular pronouns to 2nd person singular pronouns, e.g.,

    you --> me
    my --> your
    I'm --> You are

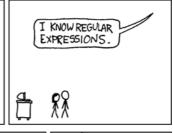Output: *How long have you been sick of me?*
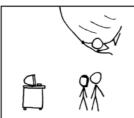
You could write Eliza!

Eliza-style regular expressions

Step 1: replace first person with second person references

```
s/\bI('m| am)\b /YOU ARE/g
s/\bmy\b /YOUR/g
S/\bmine\b /YOURS/g
```

Step 2: use additional regular expressions to generate replies

```
s/.* YOU ARE (depressed|sad) .*/I AM SORRY TO HEAR YOU ARE $1/
s/.* YOU ARE (depressed|sad) .*/WHY DO YOU THINK YOU ARE $1/
s/.* all .*/IN WHAT WAY/
s/.* always .*/CAN YOU THINK OF A SPECIFIC EXAMPLE/
```

Step 3: substitutions are assigned a rank and applied in order

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Back to Eliza

User: Men are all alike

ELIZA: IN WHAT WAY

User: They're always bugging us about something or other

ELIZA: CAN YOU THINK OF A SPECIFIC EXAMPLE?

User: Well, my boyfriend made me come here

ELIZA: YOUR BOYFRIEND MADE YOU COME HERE

User: He says I'm depressed much of the time

ELIZA: DO YOU THINK YOU ARE DEPRESSED MUCH OF THE TIME

Criticisms of Eliza

- Eliza uses key word/phrase matching

- Uses a prescribed set of rules; so is inflexible

- Lack of memory: no relation between the current response and any previous stimulus or response

- There is no knowledge of the structure or meaning of the input

  ‣ garbage in, garbage out!

- The program has no world knowledge

What's new in 2011?

http://cleverbot.com/

http://fwd.channel5.com/gadget-show/videos/
challenge/real-vs-tech-full-challenge

http://www.cleverbot.com/cleverthem

http://www.youtube.com/watch?
v=NwZcHdbYXCg&feature=watch_response

Where to find more Info

- About the Turing test and Loebner Prize
  - wikipedia
  - Turing, A.M. (1950). *Computing machinery and intelligence.* Mind, 59, 433-460. Available at: *http://www.loebner.net/Prizef/TuringArticle.html*
- About Eliza
  - Boden, M. (1987), *AI and Natural Man.* Chapters 5 and 6, 1st Edition (Harvester Press, 1987) or 2nd Edition (MIT Press)
  - Also in Jurafsky and Martin Chap 2.
- About regular expression syntax
  - *http://www.learn-javascript-tutorial.com RegularExpressions.cfm#h1.2*
  - Jurafsky and Martin, *Speech and Language Processing 2nd ed.,* Pearson Education Inc, 2009. Chapters 1 and 2.
- How Cleverbot works
  - http://www.youtube.com/user/aimlinstructor#p/c/0/SxAV3k7Ej10

- http://www.youtube.com/user/aimlinstructor#p/c/0/SxAV3k7Ej10
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