Notes for Meeting 20
Dialogue Processing

Language as Communication

Although most AI research on language has focused on sentence processing, human language:

- often concerns some form of extended discourse

- involves interaction among two or more agents

- supports communication among those agents

- helps one or more of the agents achieve their goals

These observations suggest different approaches to language than typically adopted.

The Nature of Dialogue

Many instances of human discourse involve dialogue between two or more participants who:

- alternate between utterances

- take on established roles

- establish and elaborate on "common ground"

- omit much of the important material

- infer missing content using knowledge

The ability to carry out extended dialogue is a distinguishing feature of human intelligence.

Uses of Dialogues

Humans carry out dialogues in many different settings and for many different reasons:

- obtaining / giving information

- giving / following commands

- teaching / learning material

- coordinating joint activity

Most dialogue systems specialize in one of these areas, but more general approaches are possible.

The Eliza System

In the mid-1960s, Joseph Weizenbaum developed Eliza, an interactive, text-based dialogue system that mimicked a Rogerian therapist.

This early program carried out dialogue in a constrained setting by:

- drawing on stored stimulus-response patterns

- accessing these structures by simple string matching

- resorting to conversational tactics to cover confusion

Eliza carried out only superficial conversations, but some users were convinced it was human.

Early AI researchers were critics of Eliza because it gave the illusion of understanding without inferring meanings.

Colby’s Parry system, which modeled a paranoid patient, had somewhat deeper capabilities, especially in later versions.

An Eliza Trace

  Men are all alike.
IN WHAT WAY?
  They’re always bugging us about something or other.
CAN YOU THINK OF A SPECIFIC EXAMPLE?
  Well, my boyfriend made me come here.
YOUR BOYFRIEND MADE YOU COME HERE
  He says I’m depressed much of the time.
I AM SORRY TO HEAR YOU ARE DEPRESSED
  It’s true. I am unhappy
DO YOU THINK COMING HERE WILL HELP YOU NOT TO BE UNHAPPY
  I need some help, that much seems certain.
WHAT WOULD IT MEAN TO YOU IF YOU GOT SOME HELP
  Perhaps I could learn to get along with my mother.
TELL ME MORE ABOUT YOUR FAMILY
  My mother takes care of me.
WHO ELSE IN YOUR FAMILY TAKES CARE OF YOU
  My father.
YOUR FATHER

  You are like my father in some ways.
WHAT RESEMBLANCE DO YOU SEE
  You are not very aggressive but I think you don’t want me to notice that.
WHAT MAKES YOU THINK I AM NOT VERY AGGRESSIVE
  You don’t argue with me.
WHY DO YOU THINK I DON’T ARGUE WITH YOU
  You are afraid of me.
DOES IT PLEASE YOU TO BELIEVE I AM AFRAID OF YOU
  My father is afraid of everybody.
WHAT ELSE COMES TO YOUR MIND WHEN YOU THINK OF YOUR FATHER
  Bullies.
DOES THAT HAVE ANYTHING TO DO WITH THE FACT THAT YOUR BOYFRIEND MADE YOU COME HERE

The Chatterbot Movement

In 1950, Alan Turing proposed a conversational test to determine whether a computer system is intelligent.

- Briefly, this involved carrying out an unconstrained dialogue with a human in text over a terminal.

- In 1990, the Loebner Prize inaugurated an annual competition among AI systems based on Turing’s test.

Because Eliza had been so compelling, the entries have typically been "chatterbots", the generic term for such systems.

These programs have become increasingly good at open conversation, but they have not revealed much about intelligence.

Sophistication of Dialogue Systems

Allen et al. (2001) propose five levels of sophistication for dialogue systems (above the level of chatterbots):

- Finite-state scripts
- Frame-based systems
- Context-based approaches
- Plan-based systems
- Agent-based approaches

They argue that increases in task complexity require more sophisticated and flexible methods.

The Destination Advisor

Thompson et al. (2004) describe the Destination Advisor, a frame-based conversational system that:

- asks the user directed questions about destinations

- uses answers to narrow choices in a database

- handles answers to questions it did not ask

- personalizes itself to individual users’ preferences

They report experiments with the system on a database on Bay area restaurants, showing dialogue time decreases with experience.

A Sample Dialogue about Restaurants

Inquirer: Where should I eat tonight?
Advisor: What type of cuisine would you like?
Inquirer: What types are there?
Advisor: Some examples are Chinese, Indian, and Mediterranean.
Inquirer: Oh, maybe Indian.
Advisor: What quality rating would you like?
Inquirer: I don’t care, as long as it’s cheap.
Advisor: What city do you prefer?
Inquirer: How about Berkeley?
Advisor: I know three cheap Chinese retaurants in Berkeley.
One is the Long Life Vegi House on 2129 University Avenue.
Does that sound alright t you?
Inquirer: Sure, that sounds fine.

Four Challenges in Practical Dialogue Systems

Allen et al. (2004) also outline four challenges one must address to build practical dialogue systems:

- parsing utterances using a grammars and speech acts

- integrating dialogue and performance on the task

- recognizing or understanding the speaker’s intent

- mixed-initiative control of the conversation

The described TRIPS, a practical dialogue system incorporates responses to these issues.

A Dialogue with the TRIPS System

One demonstration with TRIPS revolves around responding to a 911 call.

USR: We need to get the woman in Penfield to Strong.
SYS: OK
USR: What vehicles are available?
SYS: There are ambulances in Pittsford and Webster.
SYS: Do you know that Route 96 is blocked due to construction?
USR: Oh
USR: Let’s use the interstate instead.
SYS: OK. I’ll dispatch the crew.

This fragment illustrates a number of ways in which TRIPS combines knowledge about dialogue and the task domain.

Output from the TRIPS Parser

Utterance: We need to get the woman in Penfield to Strong.

Output from parser:

```
(assert :id sa11 :speaker usr :hearer sys
  :content (need :agent (pro we)
                 :theme (transport :object
                             (the ?w (and (type ?w woman)
                                          (at-loc ?w (name ?n Penfield))))
                                   :to-loc (name ?s Strong))))
```

Intended problem-solving act:

```
(initiated :who usr
  :what (create :id ps22 :agent usr
           :what (objective
                    :what (transport
                             :object (the ?w (and (type ?w woman)
                                                  (at-loc ?w Penfield)
                                                  (refers-to ?w wom1)))
                             :to-loc smh1))))
```

The Generality of Dialogue

It seems clear that dialogue is a knowledge-guided process, but Allen et al. make an important claim:

- The domain-independence hypothesis: Within the genre of practical dialogue, the bulk of complexity in language interpretation and dialogue management is independent of the task being performed.

This suggests that knowledge about dialogue is quite abstract and high level.

Such knowledge may take the form rules that relate the beliefs, goals, and intentions of participating agents.

This assumption seems especially appropriate for dialogues aimed at supporting joint activity among the agents.

Assignments for Meeting 21
Dialogue and Joint Activity

Read the article:

- Rich, C., Sidner, C., & Lesh, N. (2001). Collagen: Applying collaborative discourse theory to human-computer interaction. AI Magazine, 22, 15-25. [required]

- Begin work on the course project (due 11:59 PM on 5/4/2011) and bring questions about it to class.