CS 533
Natural Language Processing
Lecture 1 - January 27, 2003
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Outline
Administrative
Language and information
Collaborative conversation

Contact info
My web site
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Class web site
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Office hours: Wednesday 3-5.

Materials
Additional tutorial and systems readings.

Syllabus
1. Architectures for dialogue.
3. Applications.

Syllabus
1. Architectures for dialogue.
   3. Feb 10. Language and the world.
Syllabus

1. Architectures for dialogue.
   4. Apr 7. Building resources from data.

Applications.

3. Apr 28. Translation, information extraction.

Requirements

Short weekly homework.
Writing
Data analysis
Programming

Final project.
Writing
Data analysis
Programming

Language and Information

Tasks you might know about
Retrieve web pages that match a query (or scientific articles relevant to a research question, or news articles on a given topic).
Decide if an email message is spam (or a job ad, or a talk announcement, or related to class).
Highlight parts of a document that let somebody know if they want to read it (or what the thesis of the document is, or what its point of view is).

These are information tasks
Language is written by people for people.
Computer system helps users manage language.

Linguistic knowledge tends not to be important in information tasks.

These tasks can often be solved with a vector-space or “bag of words” model of language.

To reason about a text, list all of the words in it and how often they occur there.
Example.
I want a man who knows what love is all about. You are generous, kind, thoughtful. People who are not like you admit to being useless and inferior. You have ruined me for other men. I yearn for you. I have no feelings whatsoever when we’re apart. I can be forever happy. Will you let me be yours? - Gloria.

This model does not capture meaning.
I want a man who knows what love is. All about you are generous, kind, thoughtful people, who are not like you. Admit to being useless and inferior. You have ruined me. For other men, I yearn. For you, I have no feelings whatsoever. When we’re apart, I can be forever happy. Will you let me be? Yours, Gloria.

In information tasks, topic not content is what matters.
Language is written by people for people. Computer system helps users manage language.

Retrieve web pages that match a query
Reuse of words from the query shows what the web page is about. More important than content is quality — you want to get a good web page, which means link analysis, anchor text, etc.
Language and information

Decide if an email message is spam
Again, the words are a great clue – one way
(Nigeria, free, xxx,…)
or the other
(Matthew, publication, due,…)

Displaying important sentences.
I yearn for you.
For you, I have no feelings whatsoever.

In this class, we will be looking at tasks where meaning does matter
Dialogue

Language is created by people for machines or by machines for people.
Computer system helps users in some real-world task.

Collaborative conversation
Sources:
Clark, Using Language, Chapter 1.
Stone, Communicative Intentions.

II. Language as Joint Activity

Utterances are real-world actions taken publicly and collaboratively.

Meaning is the product of this collaboration.
[e.g., Grice 57; Searle 69; Lewis 79; Thomson 90; Clark 96]

Understanding real-world action

attributing mental state, intention or commitment,
linking action to context and goals.
[e.g., Pollack 90]
**In this view, understanding is**

Attributing *commitment* linking action

*Pass the cake mix.*

to context, e.g.,

*is a cake mix.*

and goals, e.g.,

*Get for use in cooking.*

[e.g., Hanna & Tanenhaus 01]

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**Real-world teamwork**

Hey! I'll tell the key to find the door with it.

engages with agents' inferred commitments.

[e.g., Cohen & Levesque 90]
Implementing NLG as coordination on interpretation

Construct a grammatical utterance that achieves desired effects that links with context so as to be understood.

Stone & Doran, ACL, 1997
Stone & Webber, INLG, 1998
Stone, INLG, 2000
Cassell, Stone & Van, INLG, 2000
Stone, Bleam, Doran & Palmer, TAG, 2000
and
Stone, Donan, Webber, Bleam & Palmer,
Micropnning with communicative intentions,
In submission to Computational Intelligence

Collaborative (dialogue) agents

This class is about the algorithms and data structures you can use in this architecture

Algorithms:
- Plan recognition
- Deliberation
- Coordinated execution

Data structures:
- Representations of communicative intentions
- Representations of task and discourse context

Task-oriented Dialogue

- Interlocutors talk something through

A: So are we all set?
B: The vegetables are still too crunchy.
A: The zucchini there?
B: Yeah, the zucchini...
A: OK, I’ll take care of it.

Links to Real-world Collaboration

- Reference and attention
  - each subtask involves key objects
  - interlocutors’ talk about those objects reflects progress through the task

[Grosz, 1977; Scher, 1983; Webber, 1987]
Reference and Attention
A: So are we all set?
B: The vegetables are still too crunchy.
A: The zucchini there?
B: Yeah, the zucchini...
A: OK, I'll take care of it.

Links to Real-world Collaboration
• Dialogue structure
  – each subtask involves key steps of action and coordination
  – subtasks can structure the dialogue itself into segments with a common purpose

Discourse Structure
Proceed with task
Identify next subtask
A: So are we all set?
B: The vegetables are still too crunchy.
A: The zucchini there?
B: Yeah, the zucchini...
Plan next subtask
A: OK, I'll take care of it.

Links to Real-world Collaboration
• Individual utterances make progress
  – achieving the task requires specific steps
  – steps can often be mapped to high-level speech acts achieved by utterances

Speech Acts in Discourse
Proceed with task
Identify next subtask
A: YNQ: So are we all set?
B: YNQ Ans: The vegetables are still too crunchy.
A: CLQ: The zucchini there?
B: CLQ Ans: Yeah, the zucchini...
Plan next subtask
A: Commit: OK, I'll take care of it.

A Rich Functional Organization
Proceed with task
Identify next subtask
A: YNQ: So are we all set?
B: YNQ Ans: The vegetables are still too crunchy.
A: CLQ: The zucchini there?
B: CLQ Ans: Yeah, the zucchini...
Plan next subtask
A: Commit: OK, I'll take care of it.

Mediated by Specific Intentions

Proceed with task
Identify next subtask
A: YNQ: So are we all set?

here the dialogue is intended to continue with an answer on whether A+B are done-cooking as of 6:30pm

Yet Made up of Complex Linguistic Structures

With Very Abstract Meanings

So are we all set?

At the current time does the group containing the speaker have the property they require to be ready for the upcoming event?

Problem of Interpretation

• The hearer observes some actions – meaningful elements in the utterance in a dependency tree
  • and asks – what could the speaker have been trying to achieve with them?

Semantics as a Constraint

• Speaker makes presuppositions – schematic form suggested by grammar

Context as a Constraint

• Speaker makes presuppositions – specific instances found in context (or added)
More of These Constraints

More of These Constraints

g is group containing speaker

A+B is group containing speaker

e is upcoming event;
p is property required for g to be ready for e

dinner is upcoming event;
done-cooking is property required for A+B to be ready for dinner

Suggests a Specific Intention

A Further Constraint

• Linking specific intent to broader goals in dialogue

Theoretical Statement

• Hearer has a plan-recognition problem
  Cf [Grice, 1957; Thomason, 1990]

• Plan is a representation laying out
  • actions to do
  • assumptions about how actions cause change
  • assumptions about what the world will be like
  • to show how to achieve intended effects.
  Cf [Bratman, 1987; Pollack, 1990]

Actions to Do
Assumptions About Change

Assumptions About World

Intended Effects

Result of Interpretation

Flexible Framework

Production

• The speaker starts with a desired effect
  – in the ongoing dialogue

  • and asks
  – how could I use an utterance in context to contribute to achieving this effect?
Start with Goal

Add Elements One by One

Add Elements One by One

Add Elements One by One

Until Plan Can Be Recognized