Computational Models of Discourse and Dialogue
2012

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Computational Models of Discourse/Dialogue

- Natural Language Processing using different representations of context => Discourse Model
- Language that requires representations of context above the sentence or phrase to understand and extract the meaning
- Language that results from interaction of two or more people (dialogue)
- Language that requires inference using world knowledge to understand and extract meaning
My main goal for this class:

- Introduce you to some classic problems in discourse and dialogue modeling (readings and discussion)
- Provide you with some tools or ways of thinking about such models (homeworks, readings)
- Get you interested in a research problem and attempt to do some research in this area (project)
What is a dialogue model?

- A model is an abstraction of a thing, simplified or dimensionally reduced.
- A good model should be simpler but capture the essence of the real thing.
- A good dialogue model should be testable. It should make predictions. Its claims should be such that one should be able to prove whether or not it is correct.
- A good dialogue model should lead to results that are more generalizable.
Discourse & Dialogue Processing (circa 1988)

- Local vs. global structure
- Centering, Focusing (Joshi, Grosz, Sidner)
- Planning, Plan Recognition, Intentional Structure, Gricean intentions, Scripts (Hirschberg 85, Grosz & Sidner 86, Allen, Litman, Schank)
- Rhetorical Relations, (Mann & Thompson 88, Moore 89, Hobbs 79)
- Given-new, Turntaking, Grounding (Prince 81, Clark 89)
- Narrative, subjectivity, sentiment (Wiebe 88, Lehnert 81)
- Temporal reasoning, event semantics (Webber 88, Webber 90)
- Linguistic cues, cue words prosody (Hirschberg 88, Polanyi 84)
Dialogue Processing (circa 1988)

- Me 1989
  - Starting my Ph.D. with Aravind Joshi and Ellen Prince
  - Lots of infighting, little evidence
  - => Empirical Methods in Discourse
What kinds of classic problems?

- Anaphora resolution
- Inference of discourse relations within a speaker’s turn or across speakers or turns
- Adaptation of language production to the context or the conversational partner (including priming, personality, social factors)
- Predicting missing events or likely next events after hearing or reading about a sequence of events
Dialogue Structure

- What makes a text coherent?
- What are discourse structures?
- Theories of discourse structures
- Approaches to build discourse structures
Discourse Coherence

- Example:
  - (1) John hid Bill's car keys.
  - (2) He was drunk.
  
  - (1) John hid Bill's car keys.
  - (2) He likes junk food.
  
  - (1) George Bush supports big business.
  - (2) He's sure to veto House Bill 1711.

- Hearers try to find connections between utterances in a discourse.

- The possible connections between utterances can be specified as a set of coherence relations.
Coherence relations  (Hobbs, 1979)

- **Result:** S0 causes S1
  - John bought an Acura. His father went ballistic.
- **Explanation:** S1 causes S0.
  - John hid Bill’s car keys. He was drunk.
- **Parallel:** S0 and S1 are parallel.
  - John bought an Acura. Bill bought a BMW.
- **Elaboration:** S1 is an elaboration of S0.
  - John bought an Acura this weekend. He purchased it for $40 thousand dollars.
- …
## Anaphora resolution

### Five common types of referring expression

<table>
<thead>
<tr>
<th>Type</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indefinite noun phrase</td>
<td>I saw a Ford Escort today.</td>
</tr>
<tr>
<td>Definite noun phrase</td>
<td>I saw a Ford Escort today. The Escort was white.</td>
</tr>
<tr>
<td>Pronoun</td>
<td>I saw a Ford Escort today. It was white.</td>
</tr>
<tr>
<td>Demonstratives</td>
<td>I like this better than that.</td>
</tr>
<tr>
<td>One-anaphora</td>
<td>I saw 6 Ford Escort today. Now I want one.</td>
</tr>
</tbody>
</table>

### Three types of referring expression that complicate the reference resolution

<table>
<thead>
<tr>
<th>Type</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inferrables</td>
<td>I almost bought a Ford Escort, but a door had a dent.</td>
</tr>
<tr>
<td>Discontinuous Sets</td>
<td>John and Mary love their Escorts. They often drive them.</td>
</tr>
<tr>
<td>Generics</td>
<td>I saw 6 Ford Escorts today. They are the coolest cars.</td>
</tr>
</tbody>
</table>
Event anaphora resolution, Discourse Deixis

- Hardly any work has been done in the last 25 years
  - Webber 1988, Byron 2005
  - Recent interest with CoNLL competitions
  - Tons of it in the forums data

<table>
<thead>
<tr>
<th>Stance</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOR</td>
<td>Studies have shown that using the death penalty saves 4 to 13 lives per execution. That alone makes killing murderers worthwhile.</td>
</tr>
<tr>
<td>AGAINST</td>
<td>What studies? I have never seen ANY evidence that capital punishment acts as a deterrent to crime. I have not seen any evidence that it is “just” either.</td>
</tr>
<tr>
<td>FOR</td>
<td>When Texas and Florida were executing people one after the other in the late 90's, the murder rates in both states plunged, like Rosie O’donnel off a diet...</td>
</tr>
<tr>
<td>AGAINST</td>
<td>That’s your evidence? What happened to those studies? In the late 90s a LOT of things were different than the periods preceding and following the one you mention. We have no way to determine what of those contributed to a lower murder rate, if indeed there was one. You have to prove a cause and effect relationship and you have failed.</td>
</tr>
</tbody>
</table>
Inference of discourse relations

- within a speaker’s turn or across speakers or turns
  - Intentional or rhetorical, narrative structure etc
Discourse structure

S1: John took a train to Bill’s car dealership.
S2: He needed to buy a car.
S3: The company he works for now isn’t near any public transportation.
S4: He also wanted to talk to Bill about their softball leagues.
Discourse structure

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Discourse parsing

- Explanation (e1)
  - S1 (e1)
  - Parallel (e2;e4)
    - Explanation (e2)
    - S4 (e4)
      - S2(e2)
      - S3(e3)
Recent research on two topics

- Discourse Structure of Online Forums
  - Argumentation and Debate
  - Conversation in Social Media
  - Highly emotional, biased, lots of social language

- Structure of Narrative and Story
  - Understanding and generating story structures
  - Plot units, inferring and using
  - Narrative Schemas, script-like knowledge of what types of events tend to occur together

- Juxtapose theoretical accounts with state of the art computational models. Explore what types of data current tools (kind of) work for and when they don’t.
Why these topics?

- Massive amounts of user generated content now online
  - New opportunities for discourse and dialogue modeling
  - Interplay with ‘social media’, lots of startups, computational advertising

- Mechanical Turk (crowd sourcing) as a way to get training data quickly and cheaply

- New kinds of narrative applications and computational interest in narrative
  - Interactive Narrative Systems and Games
  - Subjectivity and Sentiment in film, stories, user generated data and in dialogue (much work comes at it from monologic, text processing perspective)
  - Even newspaper stories have narrative structure, narrative structure can help with ‘classic problems’ in discourse/dialogue
Persuasion in Social Media

- Persuasion and argumentation in social media websites and forums

![Firefox vs. Internet Explorer](image)

**Add an Argument**

459 It has a cute logo ... oh and Extensions... err Add-Ons

Add an Argument

52 There's more Browsers than the IE? Firefox is an Animal and the Opera isn't about the internet

Vote

NATURAL LANGUAGE AND DIALOGUE SYSTEMS LAB
NLDS Social Media Dialogue Data

- Data collected in the last two years in collaboration with Anand’s SemLab and FoxTree’s Lab
- [Convinceme.net](http://Convinceme.net)
- [4forums.org](http://4forums.org)
Using Mechanical Turk to get labels

- http://pcon.soe.ucsc.edu/mturk_external/123/123.php?
pag Eid=1597&assignmentId=ASSIGNMENT_ID_NOT_AVAILABLE&hitId=IHN BWKACQBSEV0YDIOYSBWMIC0YNIP

pag Eid=1398&assignmentId=ASSIGNMENT_ID_NOT_AVAILABLE&hitId=1CEJFP6T9BRSEF7QNPYEV9U37T7Y6W
FADE IN:

EXT. PERU - HIGH JUNGLE - DAY

The dense, lush rain forests of the eastern slopes of the Andes, the place known as "The Eyebrow of the Jungle". Ragged, jutting canyon walls are half-hidden by the thick mist.

The MAIN TITLE is followed by this:

PERU
1936

A narrow trail across the green face of the canyon. A group of men make their way along it. At the head of the party is an American, INDIANA JONES. He wears a short leather jacket, a flapped holster, and a brimmed felt hat with a weird feather stuck in the band. Behind him come two Spanish Peruvians, SANTIPO and BARRANCA. Bringing up the rear are five Yagua INDIANS. They act as porters and are wrangling the two heavily-packed llamas. The Indians become increasingly nervous. They speak to each other in bursts of Quechua. The American, who is known to his friends as Indy, glances back at them.
Scene from *Annie Hall*: Lobby of Sports Club

**ALVY:** Uh ... you-you wanna lift?

**ANNIE:** Turning and aiming her thumb over her shoulder
Oh, why-uh ... y-y-you gotta car?

**ALVY:** No, um ... I was gonna take a cab.

**ANNIE:** Laughing  Oh, no, I have a car.

**ALVY:** You have a car?

Annie smiles, hands folded in front of her
So ... Clears his throat. I don’t understand why ... if you have a car, so then-then wh-why did you say “Do you have a car?” ... like you wanted a lift?
Scene from *Pulp Fiction: Jack Rabbit Slim’s*

**Vincent:** What do you think about what happened to Antwan?
**Mia:** Who’s Antwan?
**Vincent:** Tony Rocky Horror.
**Mia:** He fell out of a window.
**Vincent:** That’s one way to say it. Another way is, he was thrown out. Another way is, he was thrown out by Marsellus. And even another way is he was thrown out of a window by Marsellus because of you.
**Mia:** Is that a fact?
**Vincent:** No it’s not, it’s just what I heard.
**Mia:** Who told you this?
**Vincent:** They.
*Mia and Vincent smile.*
**Mia:** They talk a lot, don’t they?
**Vincent:** They certainly do.
What about the scene & action descriptions?

THE RETREAT - INTERCUTTING INDI AND SATIPO

The sanctuary has begun to rumble and shake in response to the mysterious mechanism. Just as Indy goes out the door, a rock shakes loose from the wall and rolls onto the tiles floor. Immediately, a noisy torrent of poison darts fills the room.

IN THE FOYER

Satipo swings across the pit. He makes it just as the whip comes undone from the beam, leaving Indy without an escape. Satipo, extremely nervous, regards the whip a moment then turns back to face Indy, who has run up to the far side of the pit.

SATIPO

No time to argue. Throw me the idol,
I throw you the whip.

Indy hesitates, eyeing the rumbling walls.

SATIPO

You have no choice! Hurry!

Indy concurs with that assessment. He tosses the idol across the pit to Satipo. Satipo stuffs it in the front pocket of his jacket, gives Indy a look, then drops the whip on the floor and runs.

SATIPO

Adios, amigo!

Indy grimaces. He had a feeling this might happen. He looks
Some interesting research problems that this data could be used for:

- Event anaphora (abstract anaphora) in the forums data
- Inferring story schemas (film data)
- Coreference resolution (both data sets)
- Argument structure in dialogue
  - Disagreement
  - Agreement
  - Concession, Contrast
What are people interested in? What is your background. What kind of projects?