Lecture 6

Dialogue Modelling topics
Hot Topics In Dialogue Research

- Discourse Structure
- Reference Resolution
- Mixed Initiative
- Grounding
- Tutorial Dialogue Systems
- Media Interpretation & Generation
- Embodied Conversational Agents
- Multiparty dialogue systems
- Dialogue Act Taxonomies
- Automatic Dialogue Act Tagging
- Adaptive dialogue management
Discourse Structure

- Discourse Segments
- Adjacency Pairs
- Initiative-Response units (Exchanges)
- Rhetorical Relations
- Games, Transactions
- Levels of Interaction
Reference Resolution: types of referring expressions

• names
• Pronouns
• Definite descriptions
• Indefinite reference
• Deixis
• Discourse deixis
• Bridging (dependent reference)
Reference Resolution Algorithms

• History List
• Centering
• Discourse Segment: Stack
• Discourse Segment: Cache
• Statistical Techniques
Initiative: Issues

- What is initiative?
- What are consequences of having initiative?
- What is Mixed-initiative?
  - How does one shift initiative?
  - When should one shift initiative?
  - Should systems reason about initiative?
$
\textbf{Views on initiative (control)}$

- **Any Contribution**
  - MI Planning
  - Turn (Donaldson, Hagen)

- **Type of Dialogue move**
  - Initiative/Response (Dahlback et al, Carletta et al, Ishizaki)
  - Patterns: command, question, assertion, prompt
    - (Whittaker, Stenton & Walker, Smith and Hipp)
  - Amount/type of information

- **Goal Interactions**
  - Whose goals are being addressed
  - Game Playing: Sente or Tempo - forcing moves of other
  - Obligations vs. Goal (Traum & Allen)

- **Multi-level concepts:**
  - Choice of speaker, task, outcome (Novick & Sutton)
  - Discourse vs Task (Chu-Carroll & Brown), Local vs. Global (Rich and Sidner)
  - Hierarchical (Whittaker&Walker)
Example: Chu-Carroll & Brown

1. Customer:
   • I need some money. How Much do I have in my 6-month CD?

2. T alternatives:
   A. T: no initiative
      • You Have $5000 in that CD.
   B. T: Dialogue initiative
      • You Have $5000 in that CD, but that CD will not mature for another 3 months.
   C. T: both dialogue and task initiative
      • You Have $5000 in that CD, but that CD will not mature for another 3 months. However you have $3000 in another CD that will mature next week.
Consequences of initiative

• Type of move generated
  – Prompt, query, proposal, evaluation,…

• Amount of information to express

• Amount & Type of reasoning
  – query, plan checking, intention recognition, plan generation

• Source of generation-reasoning
  – own vs other goals
Views on Mixed-initiative

• Contributions by multiple parties
• Changing initiative-holder mid-interaction
  – Fixed phases, or variable shift
• User providing more input than asked for
  – Middle level between system and user
• Ability to handle set of complex behaviors
  – Answer, ignore, over-answer, barge-in (Hagen)
Example: Narayanan et al

• System Initiative (SI)
  – System: “VPQ. Please say the name of the person.”
  – Acceptable Response from User: “Larry Rabiner.”

• Mixed Initiative (MI)
  – System: “VPQ. Please say the name of the person.”
  – Acceptable Response from User: “Larry Rabiner’s fax number, please.”

• User Initiative (UI)
  – System: “VPQ. What can I do for you?”
  – Acceptable Response from User: “I’d like the fax number for Larry Rabiner.”
How does one shift initiative?

- Types of Dialogue moves
  - prompts, repetitions, interruptions
- When dialogue phase changes
- Extra contributions
- Type of reasoning
- Discourse cues (e.g., silence)
When should one shift initiative?

- Expertise (Guinn)
  - Knows better what to say
  - Detects problems
- When user (sufficiently) understands task and interaction abilities
- e.g., tutorial domain
- When user gets stuck
Should Systems Reason about initiative?

• Pro:
  – finer control of interaction,
  – tuning to user preferences,
  – efficiency

• Con:
  – one more thing to reason about
  – Epiphenomenal aspects
Factors affecting initiative

• Individual or joint goals?
• Collaborative or competitive task?
• Distribution of knowledge/expertise
• Complexity of task
• Task-based roles
• Social roles
• Social projection (face)
Initiative in Group Tasks

• Much less studied
• Ishizaki & Kato 98
  – Equal #s of turns/characters
  – Unequal initiative patterns
• Choice of speaker more important aspect, even for responses.
• Computer mediated conferencing systems
  – Parallel initiatives
State of the Art: Initiative in Dialogue Systems

• Variable results on efficiency, depending on tasks, capabilities of systems

• Users don’t like system initiative
  – except when learning system

• Few systems can handle free-choice input or user-directed interaction
  – except for very circumscribed domains
Challenges

• Interruptible, interactive reasoning/performance (e.g., dialogue)
• How to understand user initiatives
• How to facilitate arbitrary timing of user initiatives
• How to present system initiatives
• When and how should initiative switch
# Grounding Acts

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<thead>
<tr>
<th>Label</th>
<th>Description</th>
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<tbody>
<tr>
<td>initiate</td>
<td>Begin new DU, content separate from previous uncompleted DUs</td>
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<td>continue</td>
<td>same agent adds related content to open DU</td>
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<td>acknowledge</td>
<td>Demonstrate or claim understanding of previous material by other agent</td>
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<td>repair</td>
<td>Correct (potential) misunderstanding of DU content</td>
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<td>Request Repair</td>
<td>Signal lack of understanding</td>
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<td>Request Ack</td>
<td>Signal for other to acknowledge</td>
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<tr>
<td>cancel</td>
<td>Stop work on DU, leaving it ungrounded and ungroundable</td>
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Grounding Automaton

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<tr>
<th>Next Act</th>
<th>In State</th>
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<td>S 1 2 3 4 F D</td>
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<td>initiate$^I$</td>
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<td>continue$^I$</td>
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<td>continue$^R$</td>
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Grounding Example

1. I: Move the boxcar to Corning
2. I: and load it with oranges
3. R: ok

(1)

(2) 3. I: and load it with oranges
4. R: ok

utt: Grounding Act
1. initI(1) 1
2. contI(1) 1
3. ackR(1) F

utt: Grounding Act
1. initI(1) 1
2. ackR(1) F
3. initI(2) F 1
4. ackR(2) F F

DU1
DU2
Styles of Response

1  Sys:  Where do you want to go?
2  User:  Boston.
3a  Sys:  When would you like to go?
3b  Tell me more about your travel plans.
3c  When would you like to go to Boston?
3d  Do you want to go to Boston?
3e  Did you say Boston?
3f  Boston?
3g  Boston or Austin?
3h  Where?
3i  Please Repeat.
Tutorial Dialogue Systems

- Tutoring System vs Dialogue System
- Task oriented (but different goal)
- Evaluation
- Interaction strategies
Multi-Modal systems

• Input: Fusion
  – Recognizers for each modality
  – Fusion of meaning from multiple modality components
  – Cross-media repair

• Output: synchronization
  – Which content to display by which modality?
  – Synchronization of modalities
  – One mode primary and others derived, or generated together?
ICT Mission Rehearsal Exercise (MRE) Project

- **VR Theatre**
  - 8’ 150° Curved Screen,
  - Multiple Projectors
  - 10-2 3-d spatialized sound

- **Bosnia Scenario** (Swartout et al ’01)
  - Human lieutenant (student) faces peacekeeping dilemmas
  - Artificial agents interact with user
    - Mentor (e.g., sergeant, front left)
    - Teammates (e.g., medic, front right)
    - Locals (e.g., mother, front center)
Aspects of MRE Dialogue

• Multimodal:
  – Face To Face (speech+gesture), Radio
  – Speaking modes (shouting, normal, whispering)

• Interleaved communication and action
  – Communication to support action (orders)
  – Actions to support communication (contact, turn-taking)
  – Actions as communication (acting on an order as grounding order)

• Multiple Interactors
  – Messages tailored for multiple addressees/overhearers

• Multiple Conversations
  – LT With base/other platoon about arrival time, medevac
  – LT With Sgt, Medic about local area/platoon orders
  – SGT with troops to carry out orders
Multiparty Dialogue issues

- Speaker ID
- Addressee ID
- Participant status
- Multiple conversations & threads
- Channel management
- Turn-taking
- Initiative
- Obligations
- Grounding
- Attention
- Evaluation
Addressee Identification

- Two-party:
  - Non-speaker

- Multi-party
  - Speech/Text
    - Vocatives
    - Content
    - Context
  - Multimodal
    - Gaze
    - Orientation
    - Gesture
Multi-party (speech or text)
Addressee Identification: Algorithm

1. If utterance specifies addressee
   • Vocative
   • not expecting short answer or clarification of person type
   ⇒ Addressee = specified addressee
2. Else If current utterance speaker is same as previous
   utterance speaker
   ⇒ Addressee = previous addressee
3. Else If previous speaker ≠ current speaker
   ⇒ Addressee = previous speaker
4. Else if (active) conversational participant in same
   conversation
   ⇒ Addressee = participant
5. Else ?
Channel management

- Two-Party
  - Who speaks when
- Multi-party
  - Which conversation is active
- Modality
  - Cross modality channels
  - Same modality channels
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