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?

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

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

Grounding Automaton

Next Act	In State						
	S	1	2	3	4	F	D
initiate^I	1						
continue^I		1			4		
continue^R			2	3			
repair^I		1	1	1	4	1	
repair^R		3	2	3	3	3	
ReqRepair^I			4	4	4	4	
ReqRepair^R		2	2	2	2	2	
ack^I				F	1	F	
ack^R		F	F			F	
ReqAck^I		1				1	
ReqAck^R				3		3	
cancel^I		D	D	D	D	D	
cancel^R			1	1		D	

Grounding Example

(1)

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

(2)

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

(3)

utt:	Grounding Act	DU1
1:	$\text{init}^{\text{I}}(1)$	1
2:	$\text{cont}^{\text{I}}(1)$	1
3:	$\text{ack}^{\text{R}}(1)$	F

(4)

utt:	Grounding Act	DU1	DU2
1:	$\text{init}^{\text{I}}(1)$	1	
2:	$\text{ack}^{\text{R}}(1)$	F	
3:	$\text{init}^{\text{I}}(2)$	F	1
4:	$\text{ack}^{\text{R}}(2)$	F	F

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

Ft Rucker Helicopter Mission Simulation

1397	12:00:12	12:00:13	43	P02	DO	dragonops ,
1398	12:00:13	12:00:17	42	R06	R07	+ didn't call for the: uh fifteen+ fifteen minute uh ops normal .
1399	12:00:13	12:00:13	43	P02	DO	*predator zero two* ,
1400	12:00:15	12:00:15	43	DO-W	P02	predator zero two ?
1401	12:00:15	12:00:16	43	DO-W	P02	*this is dragonops* .
1402	12:00:16	12:00:16	43	DO-W	P02	over , /
1403	12:00:17	12:00:17	42	R06	R07	over ,
1404	12:00:17	12:00:19	43	P02	DO	predator zero one and zero two are alpha at this time ,
1405	12:00:18	12:00:19	45	A06	R07	rogue zero seven .
1406	12:00:19	12:00:20	45	A06	R07	*anvil zero six* ,
1407	12:00:27	12:00:28	43	DO-W	P02	i have you alpha at fourteen hundred .
1408	12:00:28	12:00:29	43	DO-W	P02	over ,
1409	12:00:30	12:00:31	43	P02	DO	*predator zero two* .
1410	12:00:31	12:00:31	43	P02	DO	roger .
1411	12:00:34	12:00:35	8	R07-A	R07-B	okay:: .
1412	12:00:35	12:00:38	8	R07-A	R07-B	i only see uh / five vehicles . //
1413	12:00:39	12:00:45	8	R07-A	R07-B	confirm with anvil that the only+ his convoy has gone from sixteen vehicles to five vehicles .
1414	12:00:42	12:00:43	43	DO-W	P02	predator zero two ,
1415	12:00:42	12:00:43	45	A06	R07	rogue zero seven: .
1416	12:00:43	12:00:44	43	DO-W	P02	*this is dragonops* .