

Managing Uncertainty in Dialogue Information State for Real-Time Understanding of Multi-Human Meeting Dialogue

Alexander Gruenstein
Lawrence Cavedon
John Niekrasz
Dominic Widdows
Stanley Peters

STANFORD
UNIVERSITY



Center for the Study of Language and Information
Stanford University

<http://www-csli.stanford.edu/semlab/>

{alexgru, lcavedon, niekrasz, dwiddows, peters}
@csli.stanford.edu

Example Multimodal Dialogue

A: Let's look at the schedule. We have funding for five years.

B: OK. Well, we have three tasks. We'll call this task line demo, call this the sign off task line, and name this the system task line to chart when the systems need to be finished.

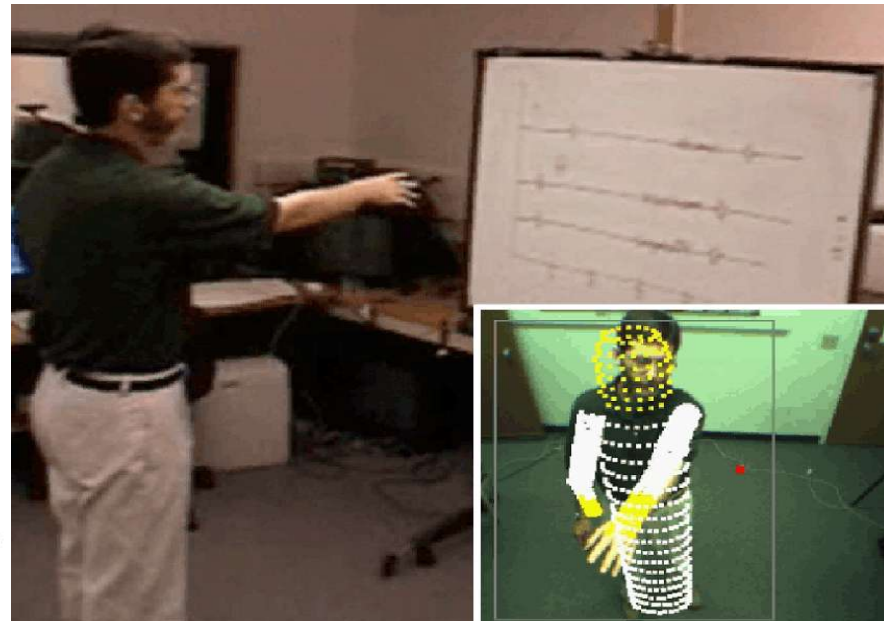
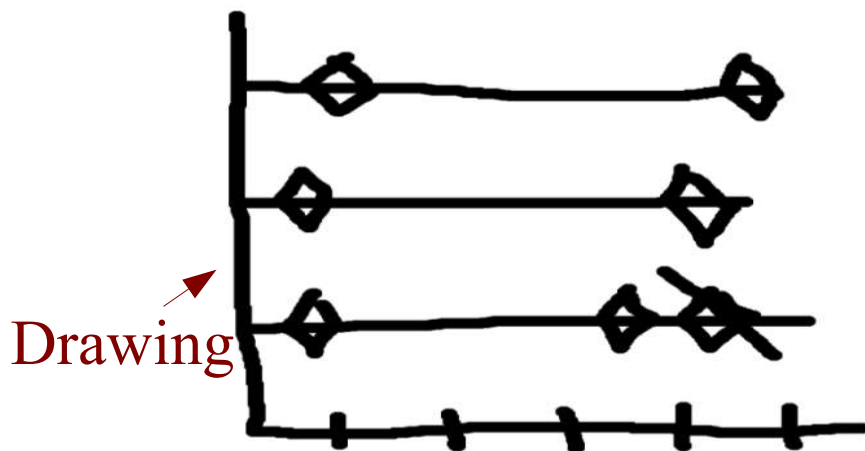
A: What are our demo needs?

B: Darpatech is at the end of month fifteen, and we've got final demonstrations at the end of year five.

A: When do the sign offs need to happen?

B: Six months before the demos. And we'll need the systems by then too.

A: That's a bit aggressive, let's move the system milestone to the end of year four.



Sources of Uncertainty/Ambiguity

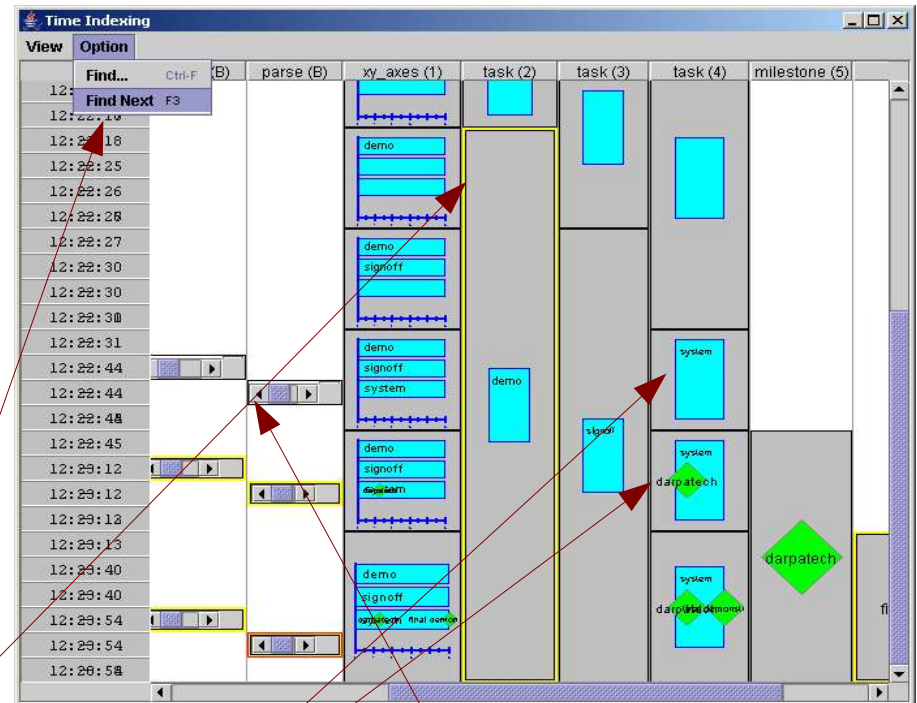
- Utterances can't always be interpreted until they are integrated with information from other modalities, however that information is not always immediately available.
- Human-human speech recognition is error-prone, multiple speech-rec hypotheses must be considered.
- The system shouldn't constantly interrupt to clarify among multiple possible interpretations. Instead it should try to resolve them by continuing to gather evidence.

System Output

History Viewer

- Future work includes dialogue enabling the viewer to answer questions such as:

- *Who decided to delay the system milestone?*
- *Why did we assign Jim to that task?*
- *What did the chart look like before Sally's modifications?*



Search feature that highlights results

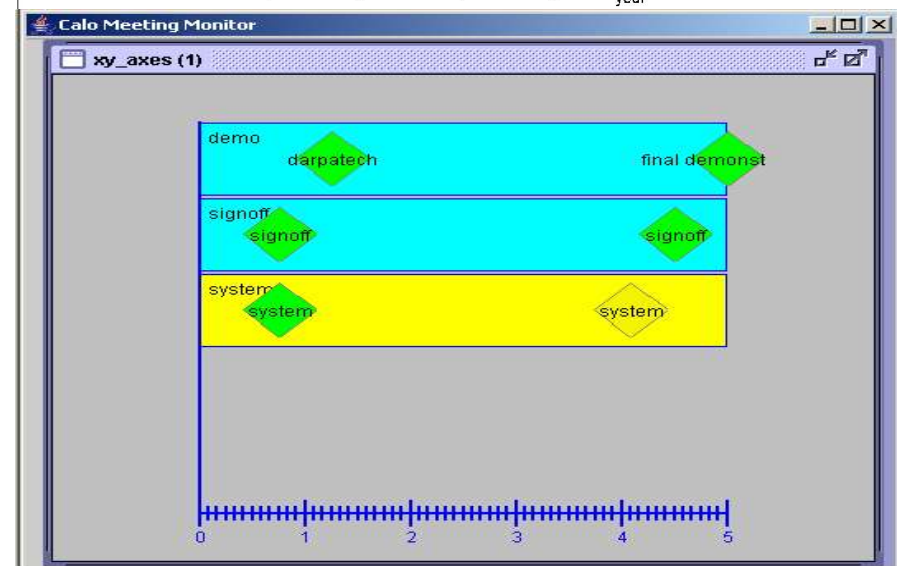
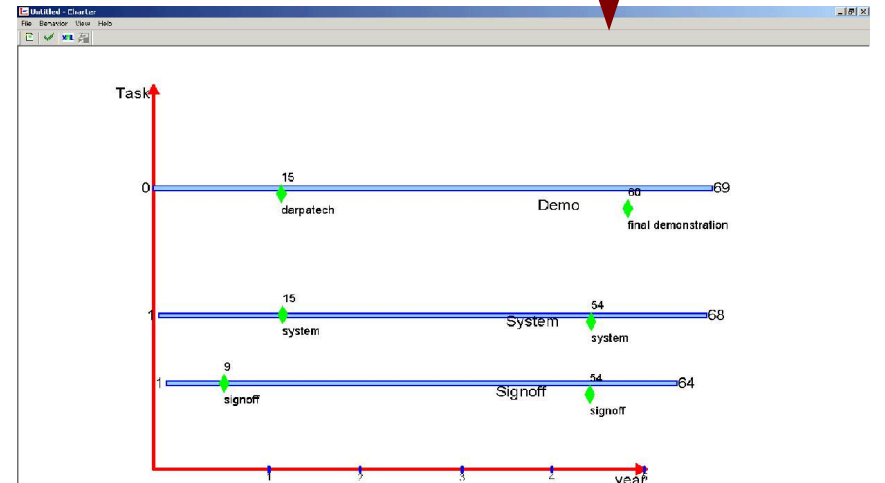
Chart history related temporally to utterance and parse history

System Output

Project Planning Charts

OGI Charter View

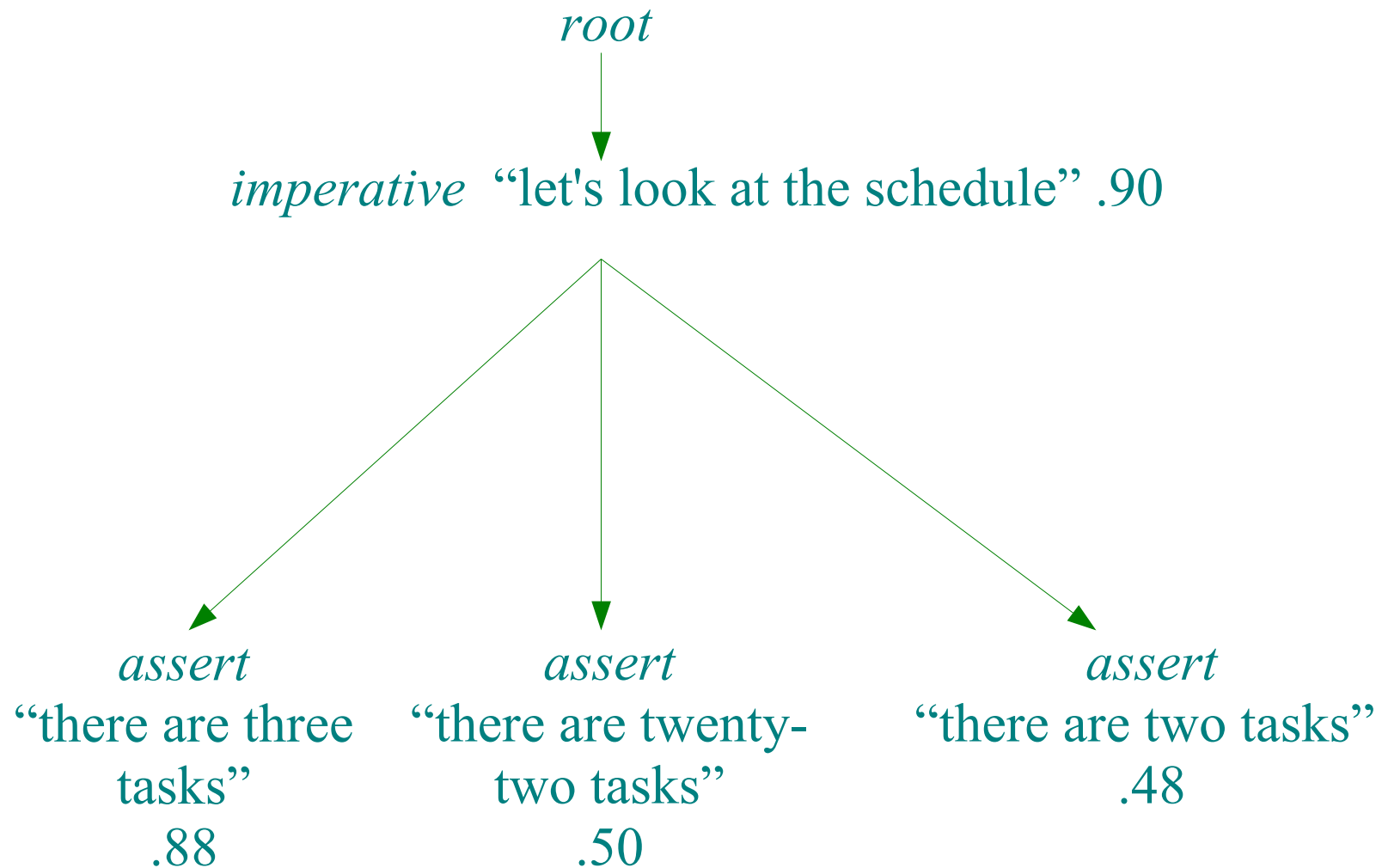
		Task Name	Duration	Start	Finish
1		<input type="checkbox"/> calo_project	#####	Mon 5/10/04	Fri 2/5/10
2		<input type="checkbox"/> signoff	#####	Tue 6/8/04	Mon 9/7/09
3		clone	#####	Tue 6/8/04	Mon 9/7/09
4		signoff	1 day?	Mon 2/7/05	Mon 2/7/05
5		signoff	1 day?	Thu 11/6/08	Thu 11/6/08
6		<input type="checkbox"/> system	#####	Mon 5/10/04	Fri 2/5/10
7		clone	#####	Tue 6/8/04	Wed 1/6/10
8		system	1 day?	Mon 2/7/05	Mon 2/7/05
9		system	1 day?	Thu 11/6/08	Thu 11/6/08
10		system	1 day?	Mon 8/8/05	Mon 8/8/05
11		<input type="checkbox"/> demo	#####	Mon 5/10/04	Fri 2/5/10
12		clone	#####	Mon 5/10/04	Fri 2/5/10
13		darpattech	1 day?	Mon 8/8/05	Mon 8/8/05
14		'final demonstrat	1 day?	Fri 5/8/09	Fri 5/8/09



MS Project document

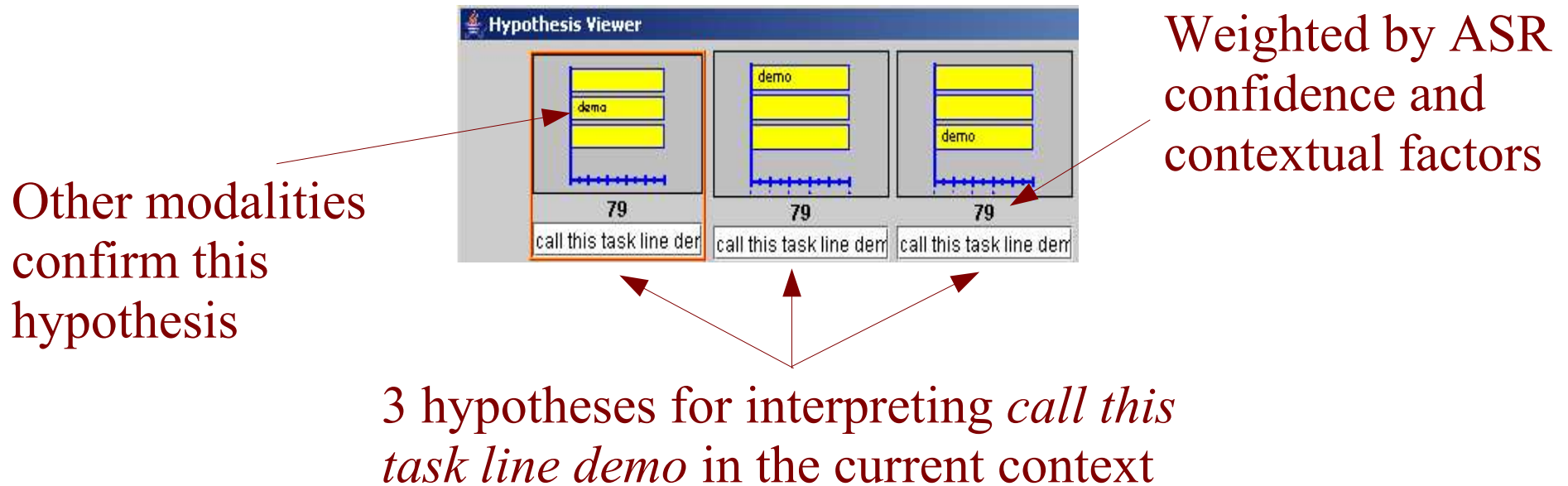
CSLI view

Multiple Weighted Dialogue Move Hypotheses

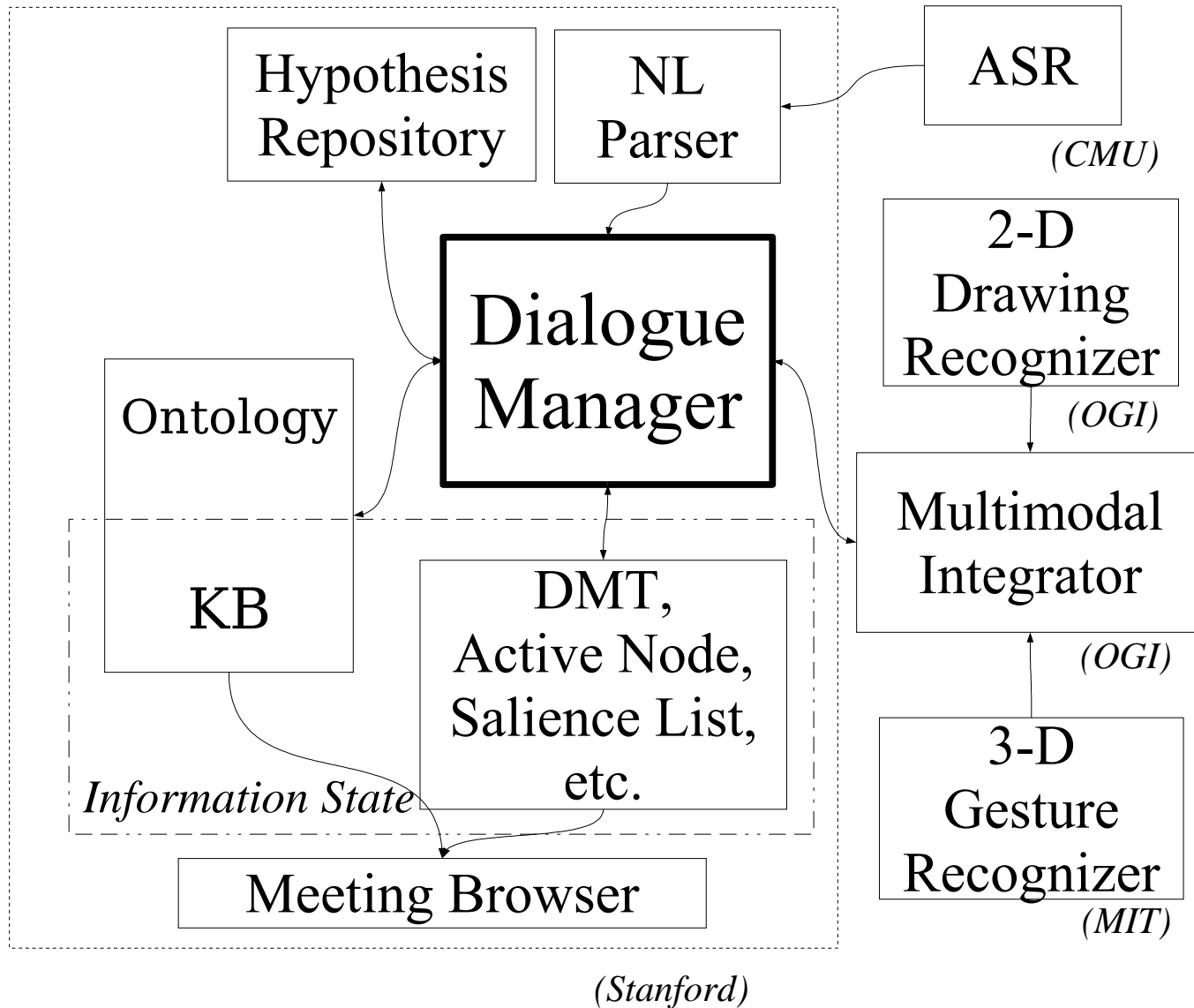


Hypothesis Representation

- Natural language interpretation hypotheses are represented as updates to the current *artifact under discussion*, which can be represented as updates to the *knowledge base* and visualized as below.
- Once confirmed or rejected by evidence from other modalities, corresponding Dialogue Move Tree nodes are *pruned*



Architecture



Current And Future Work

- Discourse segmentation by topic
- Recognition of meeting action items
- Relating an agenda to the actual discussion
- Long-term dialogue state hypotheses
- Probabilistic dialogue state models
- Ambiguity resolution using many sources (gesture, writing, prosody, lexicon, semantics, meeting context, artifact)