

Introduction to Artificial Intelligence

Department of Computer Science

Lecture 20

Communication

Announcements

The final exam is Monday, May 13 4-7PM in SERC
205

Review

Explanation-based learning

Reinforcement learning

Communication

Communication is an action, just like grab or move, but its effect is on the mental state of another agent.

- Goal: kill wumpus
- Method: other agent shoots wumpus
 - Subgoal: other agent sees wumpus
 - Method: other agent looks South
 - * subgoal: other agent thinks something interesting is to the south
 - Method: shout “Behind you”

What are the goals and methods in the other agent?

Speech Acts

- Inform
 - warn
 - answer
- Ask (a question)
- Promise
- Request (an action)
- Marry
- etc.

Steps in Communication

- Intention: Speaker (S) chooses to speak as a means to a goal
- Generation: choice of words
- Synthesis: saying or writing words
- Perception: Hearer (H) perceives the sounds
- Analysis: determine possible meanings
- Disambiguation: decide which possible meaning was meant
- Incorporation: H updates his knowledge base

Understanding

Understanding: Perception, Analysis, Disambiguation, Incorporation Key Issues:

- Many levels of structure / processing
- Much ambiguity

Levels

- morphological analysis (parts of words)
- lexical analysis (words)
- syntactic analysis (grammar, parsing)
- semantic analysis (surface meaning)
- pragmatic analysis (meaning in context)
- discourse analysis (structure over multiple statements, coherence)

morphological analysis

Parts of words that signal grammatical and other information

slithy toves

*****y *****s

|

|

|

"This is a plural"

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"this is an adjective"

Ambiguity:

Mary loves

lexical analysis

Structure: The lexicon: words, grammatical role(s), meaning(s)

Ambiguity: saw “I saw the saw.”

syntactic analysis

Grammar

English grammar is much more complex than any formal language.

You have to handle ungrammatical sentences.

Ambiguity: “Time flies like an arrow”

semantic analysis

Combine meanings of words \Rightarrow meaning of sentence

Ambiguity: You can fool some people all of the time.

Anaphora: pronouns, abstract nouns (“the hammer”),
etc.

pragmatic analysis

Using knowledge about the situation in which the sentence is said to disambiguate:

He works in the city.

Stop him! (said as a man runs by)

discourse analysis

How the successive sentences of a connected text are related

Coherence relations:

- enablement

I opened the door. I saw a crowd of angry people.

- evaluation

First I will describe the prerequisites. You must know how to program.

- causal

I saw a crowd of angry people. I slammed the door.

- explanation

I slammed the door. I was afraid they would attack me.

- elaboration

I was afraid they would attack me. I thought they might beat me up and take my gold.

Also applies to dialogues:

Signalling topic shift: “Getting back to what you mentioned earlier ...”

Disambiguation Requires Knowledge

Each level of structure provides constraints that help disambiguate

Other uses of Natural Language

Information retrieval of Natural Language documents
(e.g. web search)

word based / statistical approaches have been most
successful