NLP Demo Example

- Small children, as each time step, each clean square has a 10% chance
  - assessed if the system gives the wrong answer 10% of the time?
- Murphy’s Law: 25% of the time the sticking action fails to clean the
  - vacuum environment.

Discuss possible agent programs for the following stochastic versions of
- vacuum cleaner to minimize the environment and score an agent’s
- for a dialogue system with speech recognition errors, develop a PES
  - level of performance measure and the utility function measure how well

Agent Discussion Points
- Last time: Environment specification and types. Agent Types

Review and Discussion

Natural Language Processing

History
- Can machines think?
- Models and algorithms
- The ambiguity problem
- Applications
- Knowledge of language
- Natural Language Processing (NLP)

Administration (email), Review and Discussion
What makes a computer application a language processing application?

Applications

The applications require the use of knowledge of language.

Knowledge of Language

To participate in such a conversation, HAL needs knowledge about many levels of language.

- Discourse: between utterance references
- Pragmatics: politeness and indirectness
- Semantics: meaning of words in isolation and compositionally
- Syntax: questions versus statements, word order and grouping
- Words: producing constructions, phrases

Example dialogue from 2001: A Space Odyssey

HAL: I'm sorry Dave, I'm afraid I can't do that.
Dave: Open the pod bay doors, HAL.
Some Current Application Scenarios

- Speech Synthesis 
  - See particular applications for phone numbers
- SpeechWorks (www.speechworks.com/demos/index.cfm) 
- CMU Communicator (http://speech.cmu.edu/communicator) 
- JUtter (www.jsri.as.medu/applications/jutter.shtml)

Spoken Dialogue Systems

- HAL
  - Babelfish (babelfish.altavista.com)
  - Machine Translation
    - Newsirisense (www.newsirenesense.com/index.cfm)
    - Newslester (www.columbia.edu/hp/newslester)
  - Summary
    - AnswerBus (mis.ims.avl.unimib.it/~zaffino/ab-new)
  - Question answering
    - ELIZA (www-ai.ijs.si/elnja/eliza.html)
  - Dialogue Systems

- Bell Labs Text-To-Speech (www.bell-labs.com/project/tts/)
- Speech Synthesis
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Possesses vast knowledge and is autonomous

Learn from experience

Customizes interaction to different individuals

Remembers the conversational history

Recognizes the user's goals, adopts them, and helps to achieve them

With personality

Decides how to respond and speaks reply

Recognizes, speaks, and understands language

Decomposing HAL

Lexical Semantics: The study of the meaning of words

Semantics: The meaning of words and phrases

- Many was met by Jane (passive)
- Jane met Many
- The textbook for the NLP class is great

Syntax: The structuring of words into larger phrases and sentences

- friendly, calls
- eat, larger

Phonology: Words and their composition form more basic units

Rule systems that govern their use

Phonetics and Phonology: Speech sounds, their production, and the
do your best within a single kind of knowledge (maybe several).

loosely coupled processing

inform the others

decisions that can be made easily based on one kind of knowledge can

rigidly coupled processing

pick the most likely of n choices.

How can the lexical, syntactic, and semantic ambiguities be resolved/disambiguated?

What if the sentence was spoken: „I made her duck...“

...?

| caused her to quickly lower her head or body |
| caused the (passer?) duck she came across to |
| caused her to wet her head with water |
| cooked wetmeal belonging to her |
| cooked wetmeal for her |

How many different interpretations does this sentence have?

“I made her duck...“
some example models

models and algorithms

algorithms

• dynamic programming
• state space search

• backtracking
• back tracing
• search
• problem solving
• branch and bound
• branch and cut
• greedy

models

• logicians
• mathematicians
• computer scientists
• linguists

• formalisms
• grammars
• parsers
• transducers
• recognizers
• automata
• logic
• computation
• verification