Topics for today
- General introduction to NLP
  » Why study NLP?
  » Why is it hard?
- Handouts
  » Class description and syllabus
  » Student info sheet

Natural language and NLP
- “natural” language
  » Languages that people use to communicate with one another
- Ultimate goal
  » To build computer systems that perform as well at using natural language as humans do
- Immediate goal
  » To build computer systems that can process text and speech more intelligently

Dialogue systems
- Require both understanding and generation
  » Dave: Open the pod bay doors, HAL.
  » HAL: I'm sorry Dave, I'm afraid I can't do that.
  » Dave: What's the problem?
  » HAL: I think you know what the problem is just as well as I do.

Why study NLP?
- Useful applications…
  » E.g. information retrieval

  Topic: Advantages and disadvantages of using potassium hydroxide in any aspect of organic farming, especially…
Why study NLP?

- Useful applications…
  - E.g. question answering systems
    - How many calories are there in a Big Mac?
    - Who is the voice of Miss Piggy?
    - Who was the first American in space?
  - Retrieve not just relevant documents, but return the answer

\[ ? \rightarrow \text{answer + supporting text} \]

- Useful applications…
  - E.g. summarization

Why study NLP?

- Interdisciplinary…
  - Linguistics
    - models for language
  - Psychology and psycholinguistics
    - models of cognitive processes/ language
  - Mathematics
    - studies properties of formal models, methods of inference from these models
  - vs. NLP
    - Computational study of language use
      - Engineering: to enable effective human-machine communication
      - Scientific: to explore the nature of linguistic communication
  - Emphasis on computational, not cognitive plausibility
  - Models of language: optional

---

Bill Gates, 1997 “…now we’re betting the company on those natural interface technologies”
Why study NLP?

- Challenging...
  - AI-complete
    » To solve NLP, you’d need to solve all of the problems in AI
  - Turing test
    » Posits that engaging effectively in linguistic behavior is a sufficient condition for having achieved intelligence.
- …But little kids can “do” NLP…

Why is NLP such a difficult problem?

Ambiguity!!!! …at all levels of analysis

- Phonetics and phonology
  - Concerns how words are related to the sounds that realize them
  - Important for speech-based systems.
    » “I scream” vs. “ice cream”
    » “nominal egg”
  - Moral is:
    » It’s very hard to recognize speech.
    » It’s very hard to wreck a nice beach.
- Morphology
  - Concerns how words are constructed from sub-word units
  - Unionized
    » un-ionized in chemistry?

Why is NLP such a difficult problem?

Ambiguity!!!! …at all levels of analysis

- Syntax
  - Concerns sentence structure
  - Different syntactic structure implies different interpretation
    » Squad helps dog bite victim.
      〈[np squad] [vp helps [np dog] [inf-clause bite victim]]
    » Helicopter powered by human flies.
    » Visiting relatives can be trying.
- Semantics
  - Concerns what words mean and how these meanings combine to form sentence meanings.
    » Jack invited Mary to the Halloween ball.
    » dance vs. some big sphere with with Halloween decorations?
    » Visiting relatives can be trying.
    » Visiting museums can be trying.
    » Same set of possible syntactic structures for this sentence
    » But the meaning of museums makes only one of them plausible
Why is NLP such a difficult problem?

Ambiguity!!!! …at all levels of analysis 😊

- **Discourse**
  - Concerns how the immediately preceding sentences affect the interpretation of the next sentence
  - Merck & Co. formed a joint venture with Ache Group, of Brazil. It will be called Prodome Ltd.
  - Merck & Co. formed a joint venture with Ache Group, of Brazil. It will own 50% of the new company to be called Prodome Ltd.
  - Merck & Co. formed a joint venture with Ache Group, of Brazil. It had previously teamed up with Merck in two unsuccessful pharmaceutical ventures.

- **Pragmatics**
  - Concerns how sentences are used in different situations and how use affects the interpretation of the sentence.
    - "I just came from New York."
    - Would you like to go to New York today?
    - Would you like to go to Boston today?
    - Why do you seem so out of it?
    - Boy, you look tired.

---

**Syllabus**

- We’ll look at the problems that occur at all levels of natural language understanding…

- To the syllabus handout…