

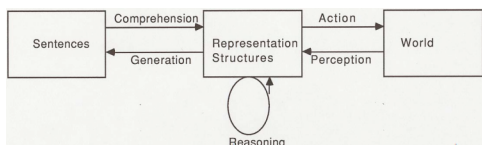
Lecture 15 Natural Language Processing

Chapter 7.4

Natural Language in Computing

- Natural-language interaction
- Natural-language queries and question answering
- Text-database searching
- Natural-language text generation
- Adventure games and instructional systems

General Model of Natural Language Processing



Steps in Computational Comprehension (Understanding)

1. LEXICAL ANALYSIS
2. SYNTACTIC ANALYSIS
3. SEMANTIC INTERPRETATION
4. PRAGMATIC ANALYSIS

1. LEXICAL ANALYSIS

- Search the Lexicon for syntactic categories for words
- Produces words bound to categories such as “noun” or “verb”

2. SYNTACTIC ANALYSIS

- Parse the word string using a grammar with word categories such as “noun” or “verb”
- Determines if string is well-formed, i.e. acceptable
- Produces parse tree(s) with words shown in categories

3. SEMANTIC INTERPRETATION

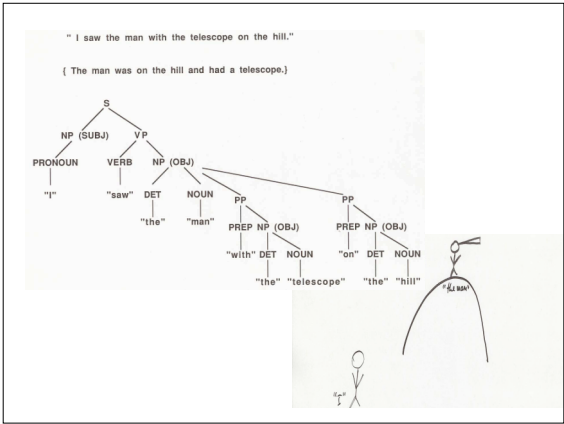
- Interpret the parse tree(s) with semantic rules about objects and actions
- Determines if string is well-formed
- Eliminates syntactically acceptable parses but semantically invalid
- Produces expressions of a logical form, i.e. first order predicate calculus

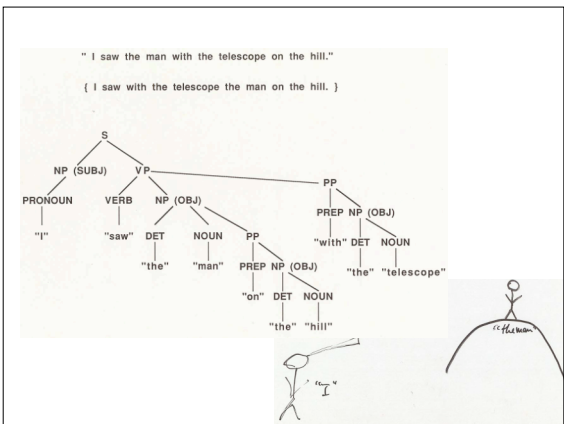
4. PRAGMATIC ANALYSIS

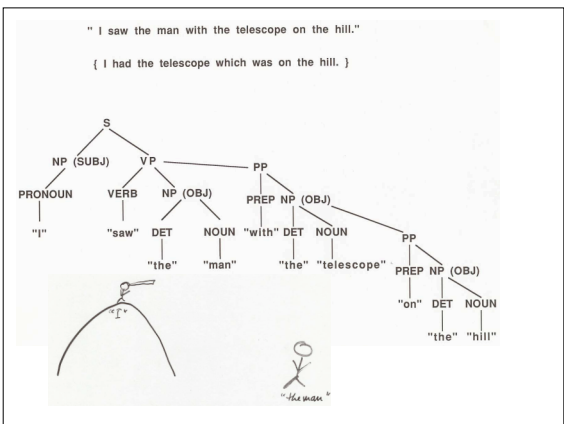
- Generate necessary inferences using context information, e.g. pronoun reference
- Eliminates semantically acceptable parses but pragmatically invalid
- Translate logical forms to database or knowledgebase actions or queries

Why is NLP so hard?

- Ambiguity
 - The same sentence can give multiple meanings
- Example: "I saw the man with the telescope on the hill."
- Capture differences in meaning by different parse trees



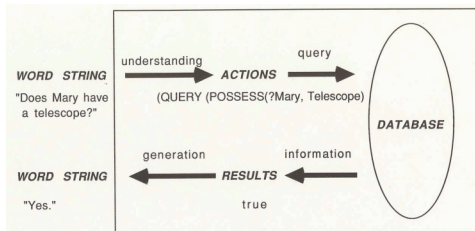




NLP is a GRAND CHALLENGE!

- Essentially unsolved problem: Computers cannot simulate human language except in limited circumstances
 - Language is based on human cognition and computers cannot think
 - Language is based on perception of the real world and computers cannot sense
 - Language is based on human social behavior and computers are not human

Example: NLP to Database



NLP to Database

- English translation to SQL query language and back
- Limited to single sentences
- "World" is the contents of the database
- Meaning is well-formed since relational databases are based on logic
- Generation easier than understanding
