

CS674 Natural Language Processing

- Last week
 - Introduction and history
- Next two lectures
 - Word sense disambiguation
 - » Background from linguistics
 - ◆ Lexical semantics
 - » On-line resources
 - » Computational approaches
- Then...WSD research paper lecture

Semantic analysis

- Assigning meanings to linguistic utterances
- **Compositional semantics**: we can derive the meaning of the whole sentence from the meanings of the parts.
 - Max ate a green apple.
- Relies on knowing:
 - the meaning of individual words
 - how the meanings of individual words combine to form the meaning of groups of words
 - how it all fits in with syntactic analysis

Caveats

- Problems with a compositional approach
 - a former congressman
 - a toy elephant
 - kicked the bucket

Introduction to lexical semantics

- Lexical semantics is the study of
 - the systematic meaning-related connections among words and
 - the internal meaning-related structure of each word
- Lexeme
 - an individual entry in the lexicon
 - a pairing of a particular orthographic and phonological form with some form of symbolic meaning representation
- Sense: the lexeme's meaning component
- Lexicon: a finite list of lexemes

Dictionary entries

- right *adj.* located nearer the right hand esp. being on the right when facing the same direction as the observer.
- left *adj.* located nearer to this side of the body than the right.
- red *n.* the color of blood or a ruby.
- blood *n.* the red liquid that circulates in the heart, arteries and veins of animals.

Lexical semantic relations: homonymy

- Homonyms: *words that have the same form and unrelated meanings*
 - Instead, a **bank**¹ can hold the investments in a custodial account in the client's name.
 - But as agriculture burgeons on the east **bank**², the river will shrink even more.
- Homophones: distinct lexemes with a shared pronunciation
 - E.g. *would* and *wood*, *see* and *sea*.
- Homographs: identical orthographic forms, different pronunciations, and unrelated meanings
 - The expert angler from Dora, Mo., was fly-casting for **bass** rather than the traditional trout.
 - The curtain rises to the sound of angry dogs baying and ominous **bass** chords sounding.

Lexical semantic relations: polysemy

- Polysemy: the phenomenon of multiple related meanings within a single lexeme
 - Example: While some **banks** furnish blood only to hospitals, others are much less restrictive.
 - New sense, e.g. **bank**³?
 - Polysemy allows us to associate a lexeme with a set of related senses.
- Distinguishing homonymy from polysemy is not always easy. Decision is based on:
 - Etymology: history of the lexemes in question
 - Intuition of native speakers

Polysemous lexemes

- For any given single lexeme we would like to be able to answer the following questions:
 - What distinct senses does it have?
 - How are these senses related?
 - How can they be reliably distinguished?
- Answers dictate how well semantic analyzers, search engines, NL generators, and MT systems perform their tasks.

Polysemous lexemes

- For any given single lexeme we would like to be able to answer the following questions:
 - What distinct senses does it have?
 - » generally rely on lexicographers
 - How are these senses related?
 - » relatively little work in this area
 - How can they be reliably distinguished?
 - » this is the task of **word sense disambiguation**

Word sense disambiguation

- Given a *fixed* set of senses associated with a lexical item, determine which of them applies to a particular instance of the lexical item
- Two fundamental approaches
 - WSD occurs during semantic analysis as a side-effect of the elimination of ill-formed semantic representations
 - Stand-alone approach
 - » WSD is performed independent of, and prior to, compositional semantic analysis
 - » Makes minimal assumptions about what information will be available from other NLP processes
 - » Applicable in large-scale practical applications