SWE1017

Natural Language Processing

Venue:AB2-205   Topic: Lexical Semantics

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Lexical Semantics

Lexical semantics covers theories of the classification and decomposition of word meaning, the differences and similarities in lexical semantic structure between different languages, and the relationship of word meaning to sentence meaning and syntax.

Lexical semantics explores

❑ Whether the meaning of a lexical unit is established by looking at its neighborhood in the semantic net , or if the meaning is already locally contained in the lexical unit.

Another topic that is explored is the mapping of words to concepts.

Lexeme and Lexicon

Lexeme: A lexeme is the minimal unit of language which has a semantic interpretation and embodies a distinct cultural concept.

Lexicon: Finite list of Lexeme.

Orthographic form & Phonological form to refer to the appropriate form part of lexeme.

Sense is one of the meanings of a word.

Relationships among Lexemes & senses

❑ Homonymy

❑ Polysemy

❑ Synonymy

❑ Antonymy

❑ Hypernomy

❑ Hyponomy

❑ Meronomy

Homonymy

A **homonym** is, in the strict sense, one of a group of words that share the same spelling or pronunciation but may have different meanings.

❏ Lexemes that share a form
  ▪ Phonological, orthographic or both

❏ But have unrelated, distinct meanings

Homonymy

Example:
- ❑ Bat (wooden stick-like thing) vs Bat (flying scary mammal thing)
- ❑ Bank (financial institution) vs Bank (riverside)

- ❑ Homophones:

  - ▪ Write and Right

  - ▪ Piece and Peace

Homonymy causes problems for NLP applications

Text-to-Speech
- ❑ Same orthographic form but different phonological form
  - ❑ bass vs bass

Information retrieval
- ❑ Different meanings same orthographic form
  - ❑ QUERY: bat care

Machine Translation

Speech recognition

Polysemy

The **bank** is constructed from red brick.

I withdrew the money from the **bank** .

Are those the same sense?

Which sense of bank is this?
 ❑ Is it distinct from (homonymous with) the river **bank** sense?

A single lexeme with multiple related meanings (bank the building, bank the financial institution)

Polysemy

❑ Verbs tend more to polysemy

❑ Distinguishing polysemy from homonymy.

❑ Example: Consider the verb got

"procure" (*I got the tickets*),

"become" (*she got scared*),

"understand" (*I got it*) .

Synonyms

Word that have the same meaning in some or all contexts.

- ❑ couch / sofa
- ❑ big / large
- ❑ automobile / car
- ❑ vomit / throw up
- ❑ Water / H_2O

Two lexemes are synonyms if they can be successfully substituted for each other in all situations

Synonymy is a relation between senses rather than words

Consider the words *big* and *large*

Are they synonyms?

❑ How **big** is that plane?

❑ Would I be flying on a **large** or small plane?

How about here:

❑ Miss Nelson, for instance, became a kind of big sister to Benjamin.

❑ ?Miss Nelson, for instance, became a kind of large sister to Benjamin.

Why?

❑ big has a sense that means being older, or grown up

❑ large lacks this sense

Antonyms

Senses that are opposites with respect to one feature of their meaning

Otherwise, they are very similar!

- ❑ dark / light
- ❑ short / long
- ❑ hot / cold
- ❑ up / down
- ❑ in / out

More formally: antonyms can

- ❑ Define a binary opposition or at opposite ends of a scale (long/short, fast/slow)
- ❑ Be reversives: rise/fall, up/down

Hyponymy

One sense is a **hyponym** of another if the first sense is more specific, denoting a subclass of the other

- ❑ *car* is a hyponym of *vehicle*
- ❑ *dog* is a hyponym of *animal*
- ❑ *mango* is a hyponym of *fruit*

Conversely

- ❑ vehicle is a hypernym/superordinate of car
- ❑ animal is a hypernym of dog
- ❑ fruit is a hypernym of mango

Hypernymy more formally

superordinate	vehicle	fruit	furniture	mammal
hyponym	car	mango	chair	dog

Extensional:
- ❑ The class denoted by the superordinate
- ❑ extensionally includes the class denoted by the hyponym

Entailment:
- ❑ A sense A is a hyponym of sense B if being an A entails being a B

Hyponymy is usually transitive
- ❑ A hypo B and B hypo C entails A hypo C

Meronomy

A meronomy or partonomy is a type of hierarchy that deals with part–whole relationships.

relation between two concepts (classes) or objects (instances) – 'whole' and 'part'

class-level

: every instance of the whole includes one or more instances of the part

instance-level

: the whole instance includes the part instance

Meronomy

A wife has a husband.

A husband is a part of a wife.

A sound has a pitch and a volume.

A volume is a part of a sound.

Changing nappies is part of being a mother.

Being a mother has changing nappies.

A book has pages.

A page is a part of a book

Meronomy

Cars have parts: engine, headlight, wheel

❑ Engines have parts: crankcase, carburetor

❑ Headlights have parts: headlight bulb, reflector

A meronomy is a partial ordering of concept types by the part–whole relation

Meronomy

Axioms:

Transitive – "Parts of parts are parts of the whole" – if A is part of B and B is part of C, then A is part of C.

Reflexive – "Everything is part of itself" – A is part of A.

Antisymmetric – "Nothing is a part of its parts" – if A is part of B and A != B then B is not part of A.

END