

Word Sense Disambiguation

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UIC CS 421

What is word sense disambiguation?

- **Word sense disambiguation:** The task of automatically selecting the correct sense for a given word



bank



How can you perform word sense disambiguation?

- Depends on your:
 - Task
 - Domain
 - Size of word and sense sets
- Popular sense-tagged corpora:
 - SemCor:
<https://www.sketchengine.eu/semcor-annotated-corpus/>
 - Senseval Corpora:
<https://web.eecs.umich.edu/~mihalcea/senseval/senseval3/tasks.html>
 - Certain SemEval corpora:
<http://alt.qcri.org/semeval2015/task13/>

Word Sense Disambiguation

Given a word, what is its correct sense?

I love my new purple face mask!



WordNet Search - 3.1

- [WordNet home page](#) - [Glossary](#) - [Help](#)

Word to search for:

Display Options:

Key: "S:" = Show Synset (semantic) relations, "W:" = Show Word (lexical) relations

Display options for sense: (frequency) {offset} <lexical filename > [lexical file number] (gloss) "an example sentence"

Display options for word: word#sense number (sense key)

Noun

- (1){03730361} <noun.artifact>[06] [S:](#) (n) **mask#1 (mask%1:06:00::)** (a covering to disguise or conceal the face)
- (1){01051399} <noun.act>[04] [S:](#) (n) **mask#2 (mask%1:04:00::)** (activity that tries to conceal something) *"no mask could conceal his ignorance"; "they moved in under a mask of friendship"*
- {08270371} <noun.group>[14] [S:](#) (n) [masquerade#1 \(masquerade%1:14:00::\)](#), [masquerade party#1 \(masquerade_party%1:14:00::\)](#), [masque#1 \(masque%1:14:00::\)](#), **mask#3 (mask%1:14:00::)** (a party of guests wearing costumes and masks)
- {03730526} <noun.artifact>[06] [S:](#) (n) **mask#4 (mask%1:06:01::)** (a protective covering worn over the face)

Verb

- (1){02152033} <verb.perception>[39] [S:](#) (v) [dissemble#2 \(dissemble%2:39:00::\)](#), [cloak#1 \(cloak%2:39:00::\)](#), **mask#1 (mask%2:39:00::)** (hide under a false appearance) *"He masked his disappointment"*
- (1){01361031} <verb.contact>[35] [S:](#) (v) **mask#2 (mask%2:35:00::)** (put a mask on or cover with a mask) *"Mask the children for Halloween"*
- {02163017} <verb.perception>[39] [S:](#) (v) [disguise#1 \(disguise%2:39:00::\)](#), **mask#3 (mask%2:39:01::)** (make unrecognizable) *"The herb masks the garlic taste"; "We disguised our faces before robbing the bank"*
- {01361558} <verb.contact>[35] [S:](#) (v) **mask#4 (mask%2:35:02::)** (cover with a sauce) *"mask the meat"*
- {01361440} <verb.contact>[35] [S:](#) (v) **mask#5 (mask%2:35:01::)**, [block out#3 \(block_out%2:35:00::\)](#) (shield from light)

WSD Baselines

- **Most frequent sense**
 - Given a new word, assign the most frequent sense to it based on counts from a training corpus
- **One sense per discourse**
 - Given a new word, if an instance of the same word has already been assigned a sense earlier in the current discourse (by selecting the most frequent sense or applying some other method), assign that same sense

More Sophisticated WSD

- To train:
 - Extract a contextual embedding for each word in a sense-labeled training set
 - For a given word sense c , average the contextual embeddings of all instances of that sense c_i :
 - $v_s = \frac{1}{n} \sum_i c_i$
- To test:
 - Compute a contextual embedding t_i for the target word
 - Select the sense embedding v_s associated with that target word that has the highest cosine similarity with t_i

Feature-Based WSD

- Common features:
 - **Part-of-speech tags** for words before and after the target word
 - **N-grams** before and after the target word
 - **Weighted average of embeddings** for words before and after the target word

Lesk Algorithm

- Classic, powerful, **knowledge-based approach**
- Intuition: Given the glosses for all possible senses of a word, the gloss that shares the most words with the immediate context of the target word corresponds to the correct sense

Simplified Lesk Algorithm

```
best_sense ← most frequent sense for word
max_overlap ← 0
context ← set of words in sentence
for each sense in senses of word do:
    signature ← set of words in the gloss and examples of sense
    overlap ← compute_overlap(signature, context)
    if overlap > max_overlap then:
        max_overlap ← overlap
        best_sense ← sense
return best_sense
```

Case Example: Simplified Lesk Algorithm

The **bank** can guarantee deposits will eventually cover future tuition costs because it invests in adjustable-rate mortgage securities.

bank ¹	Gloss	A financial institution that accepts deposits and channels the money into lending activities
	Examples	“he cashed a check at the bank,” “that bank holds the mortgage on my home”
bank ²	Gloss	Sloping land (especially the slope beside a body of water)
	Examples	“they pulled the canoe up on the bank,” “he sat on the bank of the river and watched the currents

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