Part of speech tags

CS 585, Fall 2017

Introduction to Natural Language Processing

http://people.cs.umass.edu/~brenocon/inlp2017

Brendan O'Connor
College of Information and Computer Sciences
University of Massachusetts Amherst

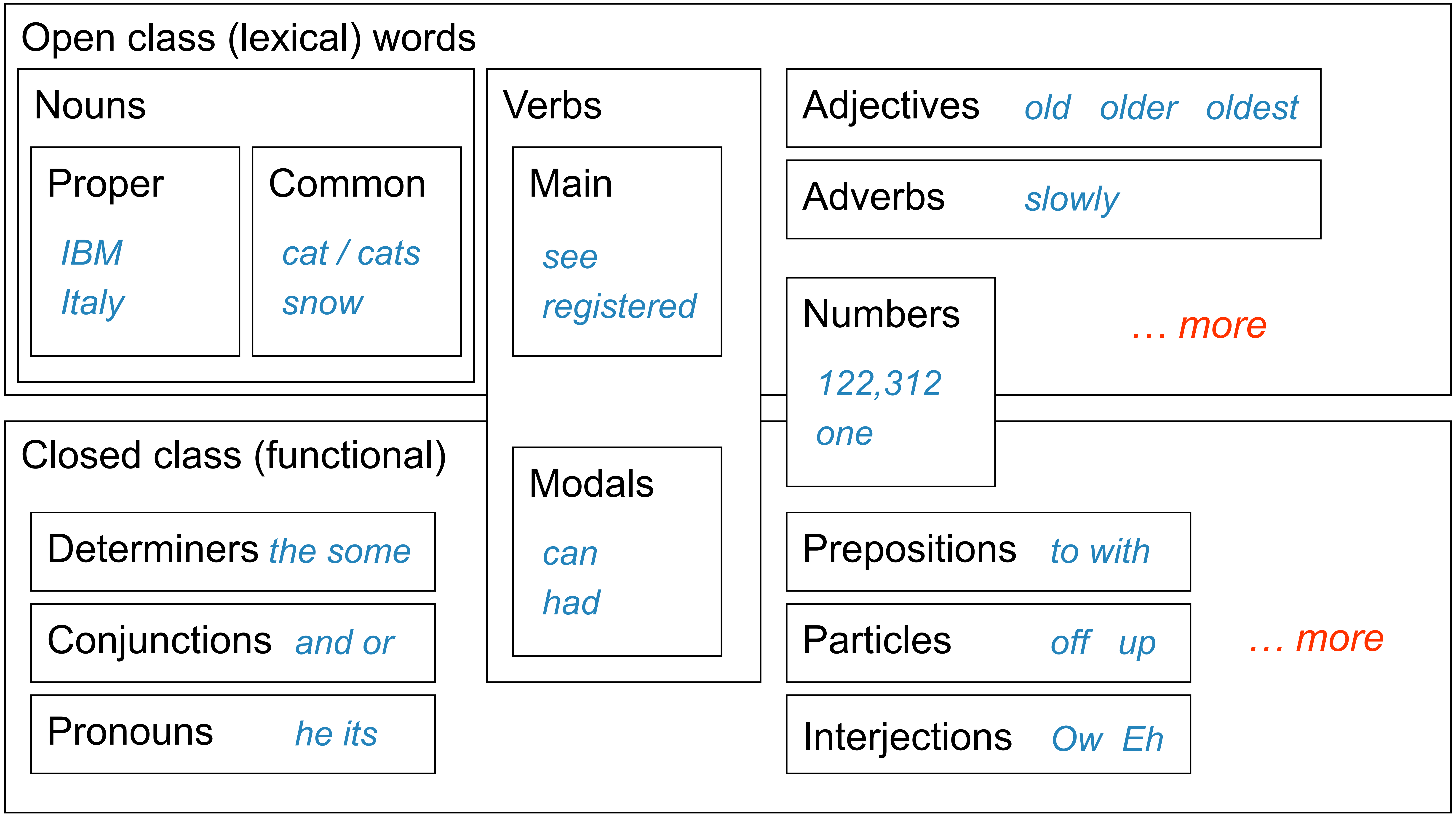
What's a part-of-speech (POS)?

- Syntax = how words compose to form larger meaning-bearing units
- POS = syntactic categories for words
  - You could substitute words within a class and have a syntactically valid sentence.
  - Give information how words can combine.

  - I saw the <u>dog</u>
  - I saw the <u>cat</u>
  - I saw the {<u>table</u>, <u>sky</u>, <u>dream</u>, <u>school</u>, <u>anger</u>, ...}

Schoolhouse Rock: Conjunction Junction
https://www.youtube.com/watch?v=ODGA7ssL-6g&index=1&list=PL6795522EAD6CE2F7

Open vs closed classes



slide credit: Chris Manning

Many tagging standards

- Penn Treebank (45 tags) ... *the most common one*
- Coarse tagsets: 12 to 20 (e.g. Petrov 2012, Gimpel 2011)
- UD project: coarse tags, but fine-grained grammatical features
  - http://universaldependencies.org/u/pos/index.html
    http://universaldependencies.org/u/feat/index.html

Why do we want POS?

- Useful for many syntactic and other NLP tasks.
  - Phrase identification (“chunking”)
  - Named entity recognition (names = proper nouns... or are they?)
  - Syntactic/semantic dependency parsing
  - Sentiment
- Either as features or heuristic filtering
- Esp. useful when not much training data

POS patterns: sentiment

- Turney (2002): identify bigram phrases, from unlabeled corpus, useful for sentiment analysis.

Table 1. Patterns of tags for extracting two-word phrases from reviews.

	First Word	Second Word	Third Word (Not Extracted)
1.	JJ	NN or NNS	anything
2.	RB, RBR, or RBS	JJ	not NN nor NNS
3.	JJ	JJ	not NN nor NNS
4.	NN or NNS	JJ	not NN nor NNS
5.	RB, RBR, or RBS	VB, VBD, VBN, or VBG	anything

(plus co-occurrence information)

POS patterns: sentiment

- Turney (2002): identify bigram phrases, from unlabeled corpus, useful for sentiment analysis.

Table 1. Patterns of tags for extracting two-word phrases from reviews.

	First Word	Second Word	Third Word (Not Extracted)
1.	JJ	NN or NNS	anything
2.	RB, RBR, or RBS	JJ	not NN nor NNS
3.	JJ	JJ	not NN nor NNS
4.	NN or NNS	JJ	not NN nor NNS
5.	RB, RBR, or RBS	VB, VBD, VBN, or VBG	anything

Table 2. An example of the processing of a review that the author has classified as *recommended*.[6]

Extracted Phrase	Part-of-Speech Tags	Semantic Orientation
online experience	JJ NN	2.253
low fees	JJ NNS	0.333
local branch	JJ NN	0.421
small part	JJ NN	0.053
online service	JJ NN	2.780
printable version	JJ NN	-0.705
direct deposit	JJ NN	1.288
well other	RB JJ	0.237
inconveniently located	RB VBN	-1.541
other bank	JJ NN	-0.850
true service	JJ NN	-0.732

(plus co-occurrence information)

POS patterns: simple noun phrases

- Quick and dirty noun phrase identification
  http://brenocon.com/JustesonKatz1995.pdf
  http://brenocon.com/handler2016phrases.pdf

Grammatical structure: Candidate strings are those multi-word noun phrases that are specified by the regular expression $((A \mid N)^+ \mid ((A \mid N)^*(NP)^?)(A \mid N)^*)N$,

Tag Pattern	Example
A N	*linear function*
N N	*regression coefficients*
A A N	*Gaussian random variable*
A N N	*cumulative distribution function*
N A N	*mean squared error*
N N N	*class probability function*
N P N	*degrees of freedom*

Table 5.2 Part of speech tag patterns for collocation filtering. These patterns were used by Justeson and Katz to identify likely collocations among frequently occurring word sequences.

POS Tagging: lexical ambiguity

Can we just use a tag dictionary
(one tag per word type)?

Types:		WSJ	Brown
Unambiguous	(1 tag)	44,432 (**86%**)	45,799 (**85%**)
Ambiguous	(2+ tags)	7,025 (**14%**)	8,050 (**15%**)

Most words types are unambiguous ...

POS Tagging: lexical ambiguity

Can we just use a tag dictionary
(one tag per word type)?

Types:		WSJ		Brown	
Unambiguous	(1 tag)	44,432	(**86%**)	45,799	(**85%**)
Ambiguous	(2+ tags)	7,025	(**14%**)	8,050	(**15%**)

Tokens:					
Unambiguous	(1 tag)	577,421	(**45%**)	384,349	(**33%**)
Ambiguous	(2+ tags)	711,780	(**55%**)	786,646	(**67%**)

Most words types are unambiguous ...

But not so for *tokens*!

POS Tagging: lexical ambiguity

Can we just use a tag dictionary (one tag per word type)?

		WSJ		Brown	
Types:					
Unambiguous	(1 tag)	44,432	(**86%**)	45,799	(**85%**)
Ambiguous	(2+ tags)	7,025	(**14%**)	8,050	(**15%**)
Tokens:					
Unambiguous	(1 tag)	577,421	(**45%**)	384,349	(**33%**)
Ambiguous	(2+ tags)	711,780	(**55%**)	786,646	(**67%**)

Most words types are unambiguous ...

But not so for *tokens*!

- Ambiguous wordtypes tend to be the common ones.
  - I know **that** he is honest = IN (relativizer)
  - Yes, **that** play was nice = DT (determiner)
  - You can't go **that** far = RB (adverb)

POS Tagging: baseline

- Baseline: most frequent tag. 92.7% accuracy
  - Simple baselines are very important to run!

POS Tagging: baseline

- Baseline: most frequent tag. 92.7% accuracy
  - Simple baselines are very important to run!

- Why so high?
  - Many ambiguous words have a skewed distribution of tags
  - Credit for easy things like punctuation, "the", "a", etc.

POS Tagging: baseline

- Baseline: most frequent tag. 92.7% accuracy
  - Simple baselines are very important to run!
- Why so high?
  - Many ambiguous words have a skewed distribution of tags
  - Credit for easy things like punctuation, “the”, “a”, etc.
- Is this actually that high?
  - I get 0.918 accuracy for token tagging
  - ...but, 0.186 whole-sentence accuracy (!)

POS tagging can be hard for humans, too

- Mrs/NNP Shaefer/NNP never/RB got/VBD **around/RP** to/TO joining/VBG
- All/DT we/PRP gotta/VBN do/VB is/VBZ go/VB **around/IN** the/DT corner/NN
- Chateau/NNP Petrus/NNP costs/VBZ **around/RB** $/$ 250/CD

Need careful guidelines (and do annotators always follow them?)
PTB POS guidelines, Santorini (1990)

4 Confusing parts of speech

This section discusses parts of speech that are easily confused and gives guidelines on how to tag such cases.

CD or JJ

Number-number combinations should be tagged as adjectives (JJ) if they have the same distribution as adjectives.

EXAMPLES: a 50–3/JJ victory (cf. a handy/JJ victory)

Hyphenated fractions ***one-half***, ***three-fourths***, ***seven-eighths***, ***one-and-a-half***, ***seven-and-three-eighths*** should be tagged as adjectives (JJ) when they are prenominal modifiers, but as adverbs (RB) if they could be replaced by ***double*** or ***twice***.

EXAMPLES:	one-half/JJ cup;	cf. a full/JJ cup
	one-half/RB the amount;	cf. twice/RB the amount; double/RB the amount

Some other lexical ambiguities

- Prepositions versus verb particles
  - turn into/P a monster
  - take out/T the trash
  - check it out/T, what's going on/T, shout out/T

Test:
turn slowly into a monster
*take slowly out the trash

Careful annotator guidelines are necessary to define what to do in many cases.

- http://repository.upenn.edu/cgi/viewcontent.cgi?article=1603&context=cis_reports
- http://www.ark.cs.cmu.edu/TweetNLP/annot_guidelines.pdf

Some other lexical ambiguities

- Prepositions versus verb particles
  - turn into/P a monster
  - take out/T the trash
  - check it out/T, what's going on/T, shout out/T

Test:
turn slowly into a monster
*take slowly out the trash

- this,that -- pronouns versus determiners
  - i just orgasmed over this/O
  - this/D wind is serious

Careful annotator guidelines are necessary to define what to do in many cases.

- http://repository.upenn.edu/cgi/viewcontent.cgi?article=1603&context=cis_reports
- http://www.ark.cs.cmu.edu/TweetNLP/annot_guidelines.pdf

How to build a POS tagger?

- Key sources of information:
  - 1. The word itself
  - 2. Word-internal characters
  - 3. POS tags of surrounding words: syntactic context
- Approach: supervised learning (text => tags)
  - Today/Thursday: with the Hidden Markov Model
  - Next week: Conditional Random Field (arbitrary features)