Part of Speech Tagging
Lecture #3a

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Part of Speech

- a category to which a word is assigned in accordance with its syntactic functions.
- Also known as : **POS**, **Word Classes**, or **Syntactic Categories**
- **Ex :**
  - **Nouns**: people, animals, concepts, things
  - **Verbs**: expresses action in the sentence
  - **Adjectives**: describe properties of nouns

- **Give information about a word and its neighbors**

- Ex : Nouns are likely to be preceded by determiners and adjectives, while verbs are by nouns

Part of Speech

- Dionysius Thrax dari Alexandria (100 B.C.) define 8 PoS :
  - Noun
  - Verb
  - Pronoun
  - Preposition
  - Adverb
  - Conjunction
  - Participle
  - Article

Part of Speech : Now

- 45 from Penn Treebank dataset
- 87 from Brown Corpus
- 146 from C7 tagset

PoS Tag Examples

Number	Tag	Description
1.	CC	Coordinating conjunction
2.	CD	Cardinal number
3.	DT	Determiner
4.	EX	Existential *there*
5.	FW	Foreign word
6.	IN	Preposition or subordinating conjunction
7.	JJ	Adjective
8.	JJR	Adjective, comparative
9.	JJS	Adjective, superlative
10.	LS	List item marker
11.	MD	Modal
12.	NN	Noun, singular or mass
13.	NNS	Noun, plural
14.	NNP	Proper noun, singular
15.	NNPS	Proper noun, plural
16.	PDT	Predeterminer
17.	POS	Possessive ending
18.	PRP	Personal pronoun
19.	PRP$	Possessive pronoun
20.	RB	Adverb
21.	RBR	Adverb, comparative
22.	RBS	Adverb, superlative
23.	RP	Particle
24.	SYM	Symbol
25.	TO	*to*
26.	UH	Interjection
27.	VB	Verb, base form
28.	VBD	Verb, past tense
29.	VBG	Verb, gerund or present participle
30.	VBN	Verb, past participle
31.	VBP	Verb, non-3rd person singular present
32.	VBZ	Verb, 3rd person singular present
33.	WDT	Wh-determiner
34.	WP	Wh-pronoun
35.	WP$	Possessive wh-pronoun
36.	WRB	Wh-adverb

POS Examples

- Noun : book/books, nature, Germany, Sony
- Verb : eat, wrote
- Auxiliary : can, should, have
- Adjective : new, newer, newest
- Adverb : well, urgently
- Numbers : 872, two, first
- Article/Determiner : the, some
- Conjunction : and, or
- Pronoun : he, my
- Preposition : to, in
- Particle : off, up
- Interjection : Ow, Eh

Closed vs. Open Class Words

- Closed class: relatively fixed set
  - Prepositions: of, in, by, …
  - Auxiliaries: may, can, will, had, been, …
  - Pronouns: I, you, she, mine, his, them, …
  - Usually function words (short common words which play a role in grammar)
- Open class: productive
  - Nouns, Verbs, Adjectives, Adverbs
    - Nouns (Proper Nouns) -> Telkom University, Mukidi
    - Verbs -> Please **email** me the invitation

Applications : Grammatical Checking

- He went to a restaurant yesterday
- She goes to a bookstore today

- What is the difference between using Language Modeling and POSTag information?

Applications : Information Extraction

- help to find named entities (people, organization)

Applications : Machine Translation

- Give me a **round** figure. [adjective]
- Shall we play another **round** of cards? [noun]
- He had a look **round** before he kept going. [adverb]
- They walked **round** the tree. [preposition]
- The floor function **rounds** down. [verb]

Applications : Paraphrasing and Summarization

- The **well** was drilled fifty meters deep
- All is **well** with us
- The
  so [conjunction]
  spring [noun]
  grow [verb]
  okay [adjective]
  successfully [adverb]
  anyway [interjection]
  was drilled fifty meters deep
- All is
  so [conjunction]
  spring [noun]
  grow [verb]
  okay [adjective]
  successfully [adverb]
  anyway [interjection]
  with us

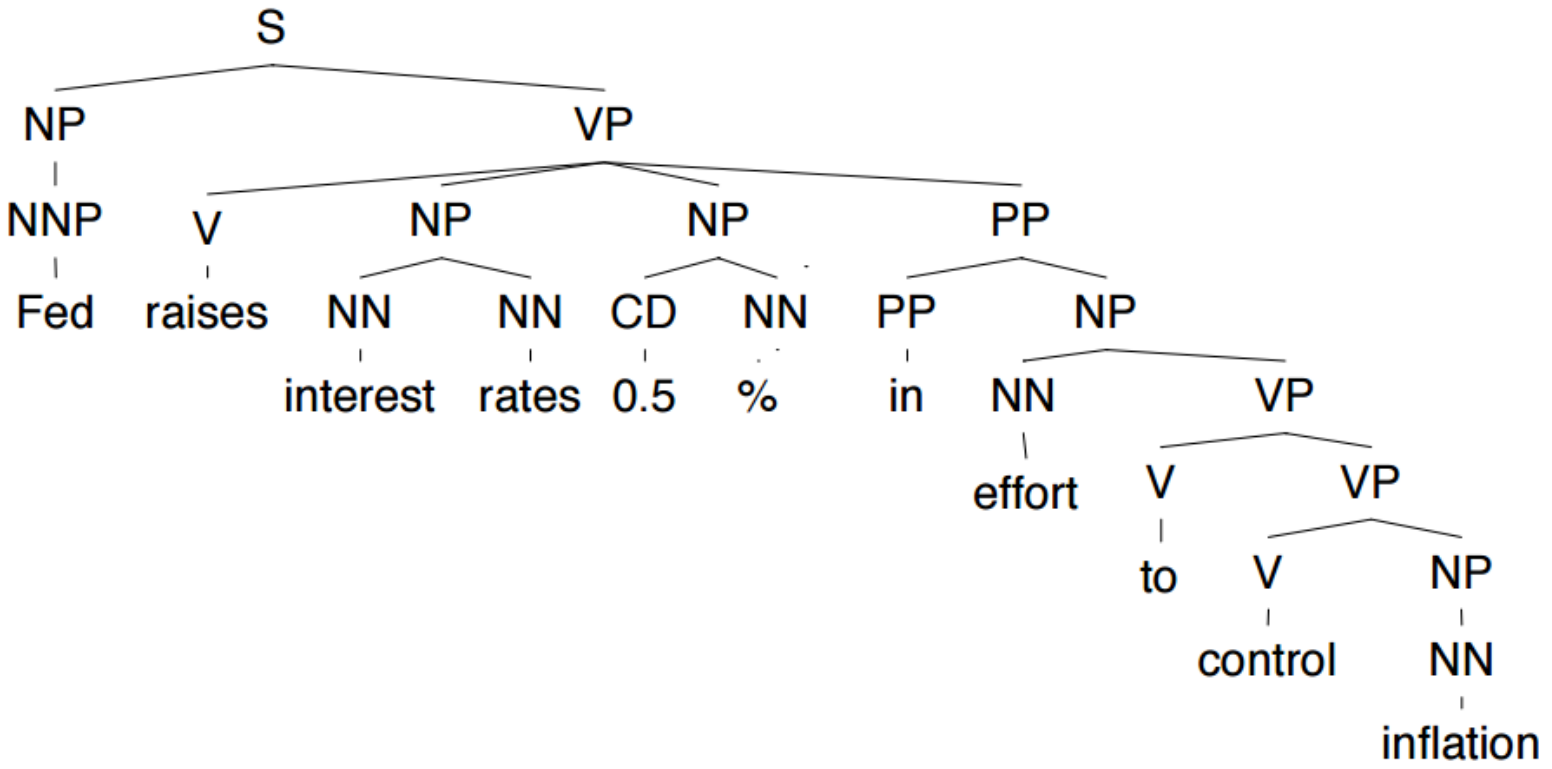
Applications : Speech Synthesis

- They **live/verb** in Bandung
- Opening PON is **live/adj** on TV

- Eggs have a high protein **content/Noun**
- She was **content/Verb** to step down after four years as CEO

Applications : Parsing

- Fed raises **interest** rates 0.5% in effort to control inflation



PoS Tagging

The process of assigning a part of speech to each word in a text

Challenge: words often have more than one POS AMBIGUITIES DETECTED

- earnings growth took a **back/JJ** seat
- a small building in the **back/NN**
- a clear majority of senators **back/VBP** the bill
- Dave began to **back/VB** toward the door
- enable the country to buy **back/RP** about debt
- I was twenty-one **back/RB** then

Tagging Task

- Time flies like an arrow → Time/N flies/V like/Prep an/Det arrow/N
- Fruit flies like a banana → Fruit/N flies/N like/V a/DET banana/N

- Pemerintah/NNP kota/NNP Delhi/NNP mengerahkan/VB monyet/NN untuk/SC mengusir/VB monyet-monyet/NN lain/JJ yang/SC berbadan/VB lebih/RB kecil/JJ dari/IN arena/NN Pesta Olahraga/NNP Persemakmuran/NNP ./Z

Distribution of Ambiguities

- 45-tags Brown corpus (word types)
- Unambiguous (1 tag): 38,857
- Ambiguous: 8,844
  - 2 tags: 6,731
  - 3 tags: 1,621
  - 4 tags: 357
  - 5 tags: 90
  - 6 tags: 32
  - 7 tags: 6 (well, set, round, open, fit, down)
  - 8 tags: 4 ('s, half, back, a)
  - 9 tags: 3 (that, more, in)

Approaches

Approach :

- Rule Based
- Statistical/Stochastic

Degree of Supervision :

- Supervised : Training corpus is tagged by humans
- Unsupervised : Training corpus isn’t tagged
- Partly Supervised : e.g. Training corpus isn’t tagged, but we have dictionary giving possible tags for each word

Rule-Based Tagging

- Typically…start with a dictionary of words and possible tags
- Assign all possible tags to words using the dictionary
- Write rules by hand to *selectively remove* tags
- Stop when each word has exactly one (presumably correct) tag

Rule Based Tagging : Example

- Assign All Possible POS to Each Word

			NN		
			RB		
	VBN		JJ		VB
PRP	VBD	TO	VB	DT	NN
She	**promised**	**to**	**back**	**the**	**bill**

Rule Based Tagging : Example

- Apply Rules Eliminating Some POS

E.g., *Eliminate VBN if VBD is an option when VBN|VBD follows "<start> PRP"*

			NN		
			RB		
	~~VBN~~		JJ		VB
PRP	VBD	TO	VB	DT	NN
She	**promised**	**to**	**back**	**the**	**bill**

How Hard is PoS Tagging ?

- Many words have only one POS tag (e.g. is, Mary, very, smallest)
- Others have a single ***most likely*** tag (e.g. dog -> photographers seemed to dog her every step ???)
- Using state-of-the-art automated method, how many tags are correct?
  - About 97% currently
- But baseline is already 90%
- Baseline is performance of simplest possible method:
  - Tag every word with its most frequent tag
  - Tag unknown words as nouns

Improving Language Model

- Tags also tend to *co-occur* regularly with other tags (e.g. Det, N)
- In addition to conditional probabilities of words $P(w_1|w_{n-1})$, we can look at POS likelihoods ($P(t_1|t_{n-1})$) to disambiguate sentences and to assess sentence likelihoods