Computational Linguistics: *Usage and Meaning*

LINGUIST492B
Spring 2022

Administrata

HW4: Due 4/5

Reading: Jurafsky & Martin Ch 13 for Tuesday 4/5

All clipart from irasutoya.com

What is syntax?

→ The way words are arranged in a sentence and the relationships between them

→ The relationships between words determine sentence meaning:

The teacher saw the student with the binoculars

- Two possible meanings, two possible syntactic structures (what are they?)

→ Syntax determines possible word combinations independent of meaning:

Colorless green ideas sleep furiously (Chomsky)

All mimsy were the borogroves (Lewis Carroll, Jabberwocky)

What is syntax?

Source: Gaja Jarosz lecture notes

CFGs

→ Context Free Grammars define trees.

→ They go beyond finite state models of language (e.g. HMMs, n-grams) in one key way: **Constituency**

→ Constituency is the 'is a' relationship that characterizes phrases in a sentence:

Mary and John went to the movies.

They went to the movies.

→ Tree structure is useful for characterizing the structural relationship between elements in a sentence.

CFGs

- Formally, CFGs are a quadruple <N, Σ, R, S>:
- N is a set of non-terminals (constituent categories)
- Σ is a set of terminals (the words/vocabulary)
- R is a set of rewrite rules of the form A → β, ∪where A is a single non-terminal, and β is a string from (Σ∪N)*
- S is the start symbol.

Abstract example

- One grammar:

  S → S a | a

- Another:

  S → a S a | a X a

  X → b

  X → X c

- Structural ambiguity:

  S → a S | S b | a | b

  How many parses of *aab* ?

Constituency

→ How do we write / define rules?

→ Key concept is **constituency**

→ Constituents are groups of words that function as a unit.

→ They are given labels or names, and correspond to nonterminal units in our CFG. Examples: **Noun Phrase, Verb Phrase, Prepositional Phrase**

Toy natural language grammar

S → NP VP

VP → Verb

VP → VP NP

PP → Prep NP

NP → NP PP

NP → Det Noun

NP → They | Andrew | Amherst

Noun → student | chicken | monkey | book

Det → the | a

Verb → saw | ate | wrote

Prep → in | from | about

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Task 1: generate some sentences!

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Task 2: Parse *Andrew wrote about the student*

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Task 2: Parse *Andrew wrote the book*

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Task 2: Parse *Andrew wrote the book in Amherst*

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Task 3: Add a rule to create the other parse of *Andrew wrote the book in Amherst*

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Task 4: Why are these sentences problematic for our grammar?

Andrew likes them

*Andrew likes They

#The book ate

The monkey ate

*The student eat

The student eats

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Task 4: Why are these sentences problematic for our grammar?

Andrew likes them **(case)**

*Andrew likes They

#The book ate (**subcategorization)**

The monkey ate

*The student eat (**agreement**)

The student eats