Computation and Linguistic Analysis

L445/L545

Dept. of Linguistics, Indiana University
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Computation and Linguistic Analysis

From a practical perspective, computational linguistics provides the computational means to deal with spoken & written natural language:

▶ information extraction & text mining
▶ automatic translation
▶ message generation
▶ dialogue interaction
▶ sentiment analysis
▶ . . .

From a linguistic perspective, computational linguistics provides a possibility to:

▶ formalize & computationally test linguistic theories
▶ obtain example data relevant to linguistic theorizing
Why study CL?

In other words: Why are you here?

- Human language is interesting and challenging
  - NLP offers insight into properties of language
  - Combines different thinking: ling, CS, psych, math, etc.
- Language is the medium of the web
- CL analysis can help in communication
- The field is ambitious yet practical
  - e.g., Machine Translation (MT) is enormously difficult, but MT is useful (e.g., webpage translations)
This course will focus more on so-called **symbolic CL**, or theory-driven computational linguistics

- When possible, we will connect the material to theoretical insights
- Although we’ll touch on some statistical methods, those are largely left for L645
General themes

This course will focus on what we need to know in order to represent language

- i.e., a focus on the underlying machinery more than the applications
- If you know how to use FSAs for morphology, you can learn how to use them for information extraction

Some themes that will recur this semester:

- Language is highly ambiguous
- Language can be modeled as a formal system
- Much language knowledge can be encoded by hand
- Language processing must be efficient
Course emphasis

In dealing with language this semester, we will emphasize the following three aspects:

▶ Data structures & models
▶ Formalisms for expressing grammars using these data structures
▶ Algorithms for processing with those grammars
  ▶ Syntactic parsing will be of great emphasis
What you need to know (1)

As we focus on theory, it helps to know about the following:

- **Morphology**: what are the components of words?
- **Syntax**: what are the relevant types of constructions in language?
  - Arguments/Adjuncts, Control/raising, UDCs, Anaphora
- **Semantics**: how do word meanings compositionally form sentential meanings?
What you need to know (2)

We will treat language as a formal system, meaning:

- Language is a set of strings
- A language model recognizes or generates a set of strings

I want you to be comfortable with the idea of representing things formally (mathematically)

- We will deal with set theory