

# **Introduction to Computational Linguistics**

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# Two Approaches in CL

- Rule-Based Systems
  - Explicit encoding of linguistic knowledge
  - Usually consisting of a set of hand-crafted, grammatical rules
  - Easy to test and debug
  - Require considerable human effort
  - Often based on limited inspection of the data with an emphasis on prototypical examples
  - Often fail to reach sufficient domain coverage
  - Often lack sufficient robustness when input data are noisy

# Two Approaches in CL

- Data-Driven Systems
  - Implicit encoding of linguistic knowledge
  - Often using statistical methods or machine learning methods
  - Require less human effort
  - Are data-driven and require large-scale data sources
  - Achieve coverage directly proportional to the richness of the data source
  - Are more adaptive to noisy data

# Central Goal of the Field

- build psychologically adequate models of human language processing capabilities on the basis of knowledge about the way in which humans acquire, store, and process language.
- build functionally correct models of human language processing capabilities on the basis of knowledge about the world and about language elicited from people and stored in the system.

# Application Areas

- machine translation
- speech recognition
- speech synthesis
- man-machine interfaces

# Application Areas

- intelligent word processing: spelling correction, grammar correction
- document management
  - find relevant documents in collections
  - establish authorship of documents
  - catch plagiarism
  - extract information from documents
  - classify documents
  - summarize documents
  - summarize document collections

# A bit of Philosophy of Science

- **Theory:**

A set of statements that determine the format and semantics of descriptions of phenomena in the purview of the theory

- **Methodology:**

An effective theory comes with an explicit methodology for acquiring these descriptions

- **Application:**

A theory associated with a methodology can be applied to tasks for which the methodology is appropriate.

# Scientific Strategies

- **Method Oriented Approach:**

devise or import a tool, a procedure or a formalism, apply it to a task and develop it further. Then (optionally) see whether it works for additional tasks

- **Task oriented Approach:**

select a task; devise or import a method or several methods for its solution; integrate the methods as required to improve performance.



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- historically first application area, and for at least a decade the only application area, of computational linguistics
- requires all steps relevant to linguistic analysis of input sentences and linguistic generation of output sentences
- hence, machine translation is scientifically one of the most challenging and most comprehensive tasks in computational linguistics

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- **Literary Translation:**

- e.g. Translation of novels, poems, etc.

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- low-quality translation is tolerable

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- purely human translation for such tasks can be time-consuming, inconsistent, or tedious.



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- abundance of highly-trained human translators
- task rarely performed by machine translation