Automatic Reasoning

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Setting

- From Cyc
  - Fred saw the plane flying over Zurich.
  - Fred saw the mountains flying over Zurich.

Setting

- Dificulty of NLP
- Levels of NLP processing
- Research areas related to NLP
- Setting
- Outline of the Seminar

Difficulty of NLP

- Language is dinamic!
- More than 5000 languages!
- ... and 6000 millions of people!
- Complexity: several and complex levels of processing
- Ambiguity!
- Incomplete knowledge, fuzy, ...
- Requires World Knowledge!
- Within a social interaction system!

Levels of NLP processing (1)

- Phonetic: relating sounds with words
- Morphologic: building words: puño, empuñar, ...
- Syntactic: building sentences with words and the role they play:
  - E.on comprará Endesa / Endesa será adquirida por E.on
- Semantic: denoting meaning from words and sentences
  - Zapatos de piel de señora
- Pragmatic: ... in a contex
  - Me dás hora? Tienes hora? ... in the street / in the dentist

Levels of NLP processing (2)

- Discourse:
  - Él le dijo después que lo pusiera encima.
- World knowledge: how to manage (and acquire)
  - Lucy in the sky with diamonds
  - Clever & Smart
  - GM drives to make Saturn a star again
  - Son para verte mejor- dijo el lobo imitando la voz de la abuela.
- Generation: how to generate correct sounds
  - 16/02/2007 => dieciseis de febrero del dos mil siete

Levels of NLP processing (3)

Different types of ambiguity:

- Lexical ambiguity
- Sintactic ambiguity
- Semantic ambiguity
- Reference

Levels of NLP processing (4)

Lexical ambiguity (examples):

- Mi amigo Juan Mesa se mesa la barba al lado de la mesa.
- El cura recibió una cura completa.

- From Financial Times
  - US officials has expected Basra to fall early
  - Music sales will fall by up to 15% this year
  - No missiles have fallen and ...

Levels of NLP processing (5)

Sense 10

fall -- (be captured; "The cities fell to the enemy")

=> yield -- (cease opposition; stop fighting)

Sense 2

descend, fall, go down, come down -- (move downward but not necessarily all the way; "The temperature is going down"; "The barometer is falling"; "Real estate prices are coming down")

=> travel, go, move, locomote -- (change location; ...)

Sense 1

fall -- (descend in free fall under the influence of gravity; "The branch fell from the tree"; "The unfortunate hiker fell into a crevasse")

=> travel, go, move, locomote -- (change location; ...)

Levels of NLP processing (6)

Sintactic ambiguity (examples):

- La vendedora de periódicos del barrio.
- El policia observó al sospechoso con unos prismáticos.

Different meanings depending on parsing!

Levels of NLP processing (6)

Semantic ambiguity (examples):

- Para el cumpleaños les daré un pastel a los niños
  - One for all? One to one?

Reference ambiguity (examples):

- Él le dijo después que lo pusiera encima.
  - Who? To whom? After what? What? Where?

Levels of NLP processing (6)

Multidisciplinar research area:

- Linguistics: Study of language
- Psciolinguistics: how people comunicate.
- Computer Science: computer models (algortihms) for NLP
- Phylosophy: semantics, meaning, understanding
- Logics: formal reasoning mechanisms
- Artificial Intelligence: techniques, knowledge representation, etc.
- Statistics: probabilistic models of language.
- Machine Learning: learning rules and models
- Linguistics Engineering: implementation of large and comples NLP systems

Setting

- From NLP to NLU
- Large-scale Semantic Processing dealing with concepts (senses) rather than words
- Two complementary problems:

- Acquisition bottleneck
  - Autonomous large-scale knowledge acquisition systems
- Ambiguity
  - Highly accurate and robust semantic systems

Setting

- This course focuses on:
  - the semantic components used NLP applications:
    - ontologies and
    - large-scale knowledge-bases.
  - automatic acquisition of knowledge.
  - methods for reasoning about the implicitly/explicitly knowledge represented into the large-scale knowledge bases.

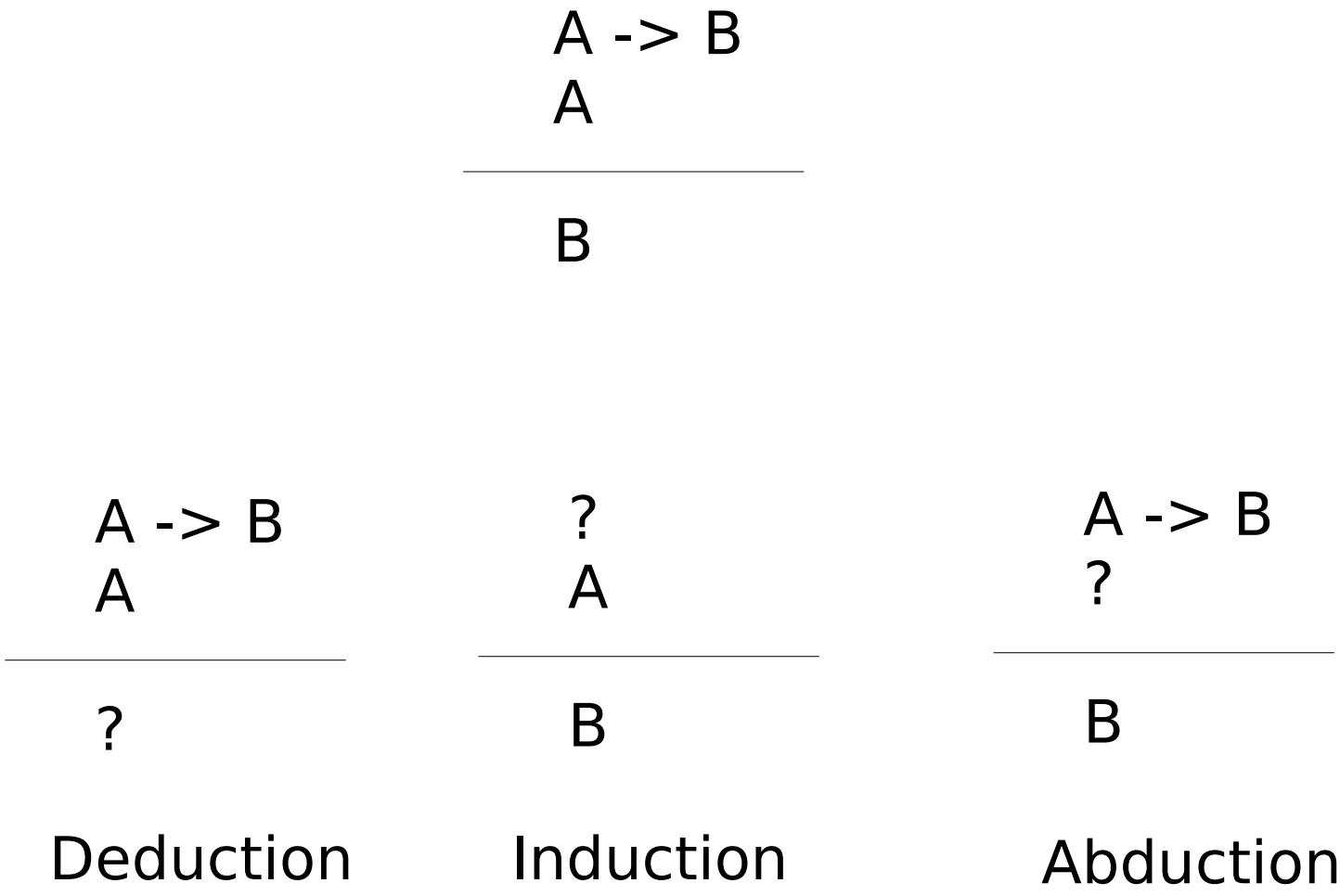
Outline

- Introduction
- Ontologies and Large-scale KB (German)
- Deductive reasoning (Paqui)
- Inductive reasoning (Montse)
- Abductive reasoning (German)
- Conclusions

Outline

$$\frac{A \rightarrow B \quad A}{B}$$

Outline



Outline

- Introduction
- Words & Works
- Ontologies:
  - SUMO ontology
- Large-scale Knowledge Bases:
  - WordNet & EuroWordNet
  - ThoughtTreasure, ConceptNet, MindNet, ...
  - Framenet, VerbNet, PropBank, ...
- WordNet extensions:
  - eXtended WordNet, Meaning project, Omega ...
- Reasoning
  - Yago/Naga, Know, Kyoto, ...