Course: Common Sense Reasoning

13. Challenges in Natural Language Understanding

Martin Molina

Natural language understanding needs to infer meanings that are not explicit in the text

"Mary was invited to Jack's party.
She wondered if he would like a kite."

The reader uses common sense to infer that Jack is throwing the party for his birthday

[Minsky, 2000]

General natural language understanding requires world knowledge

[Ovchinnikova, 2012]

Ambiguity:

"John went to the bank to open an account"

[bank = financial institution; bank = wall of a river channel]

Bridging:

"We gave the bananas to the monkeys because they were hungry"

[they = bananas; they = monkeys]

Discourse relations:

"1 John woke up late today. 2 His alarm broke."

[Relation between 2 and 1= cause]

Implicit predicates:

"John finished the book" [John is the author; John is a reader]

Rhetorical figures (metaphor and metonymy):

"The White House supports the bill"

[White House = building; White house = the US president]

Textual entailment is an example of a natural language understanding problem

A: *Norway's most famous painting, "The Scream" by Edvard Munch, was recovered Saturday.*

B: *Edvard Munch painted "The Scream".*

A entails B? yes/no

Recognizing Textual Entailment (RTE) challenges have been defined from 2005 to 2013 (RTE-1, …, RTE-8)

RT8 website: `http://www.cs.york.ac.uk/semeval-2013/task7/`

The Winograd Scheme challenge is an example of a natural language understanding problem

Paul tried to call George on the phone, but he was not <available/successful>.

Who was not <available/successful>?

- *Answer* 0*: Paul*
- *Answer* 1*: George*

[Levesque, et al., 2011]

Web site for the contest:
`http://commonsensereasoning.org/winograd.html`

COPA is an example of a natural language understanding problem

Choice of Plausible Alternatives (COPA)

Forward causal reasoning

The man lost his balance on the ladder. What happened as a result?

- *He fell off the ladder.*
- *He climbed up the ladder.*

Backward causal reasoning

The man fell unconscious. What was the cause of this?

- *The assailant struck the man in the head.*
- *The assailant took the man's wallet.*

[Roemmele, et al., 2011]

Mueller applied event calculus to the story understanding problem

Text example

> Bogota, 15 Jan 90 – In an action that is unprecedented in Colombia's history of violence, unidentified persons kidnapped 31 people in the strife-torn banana-growing region of Uraba, the Antiouqia governor's office reported today. the incident took place in Puerto Bello, a village in Turbo municipality, 460 Km northwest of Bogota, where a group of heavily armed men forced the kidnapped villagers to climb into trucks and then took off for an unknown destination. Nothing is known thus far about the motive behind the kidnapping or the where abouts of the victims. Regional authorities who escaped being kidnapped took a census of the population and determined that a total of 31 people were kidnapped. Before fleeing, the commando group set fire to a grocery store and caused some damage in the small town …

[Mueller, 2004]

Questions can be answered automatically about the text

Q: Was Jairo Ortega present when the four explosive charges exploded?
A: Yes.
Q: Were the ten terrorists present when the dynamite sticks damaged the embassy facilities?
A: No.
Q: Were the rebel groups present when the bomb was ticking?
A: Some of the time.
Q: Who threatened Jose Roberto Reis?
A: The guerrillas.
Q: Who did the bullets injure?
A: Gustavo Leigh Guzman and Enrique Ruiz.
Q: What did the units shoot the paramilitary squad members with?
A: The rifle.

Event calculus was used to for knowledge representation and inference

- Techniques
  - Template-based information extraction
  - Scripts (e.g., kidnapping script)
  - Logic representation using event calculus
  - Logic inference event calculus
- This system was an experimental prototype
  - The used knowledge base is incomplete
  - Each particular domain requires specific scripts

Course “Common sense reasoning”.

Work citation in APA style:

> Molina, M. (2019). Common sense reasoning [Lecture slides]. OpenCourseWare, Universidad Politécnica de Madrid. Retrieved from http://ocw.upm.es/course