Towards Using Logical Reasoning for Assessing the Structure and State of a Human Debate

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Position

Researcher at DFKI Saarbrücken, Language Technology

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Research interests

Computational models of natural argument

Natural language processing, specifically generation

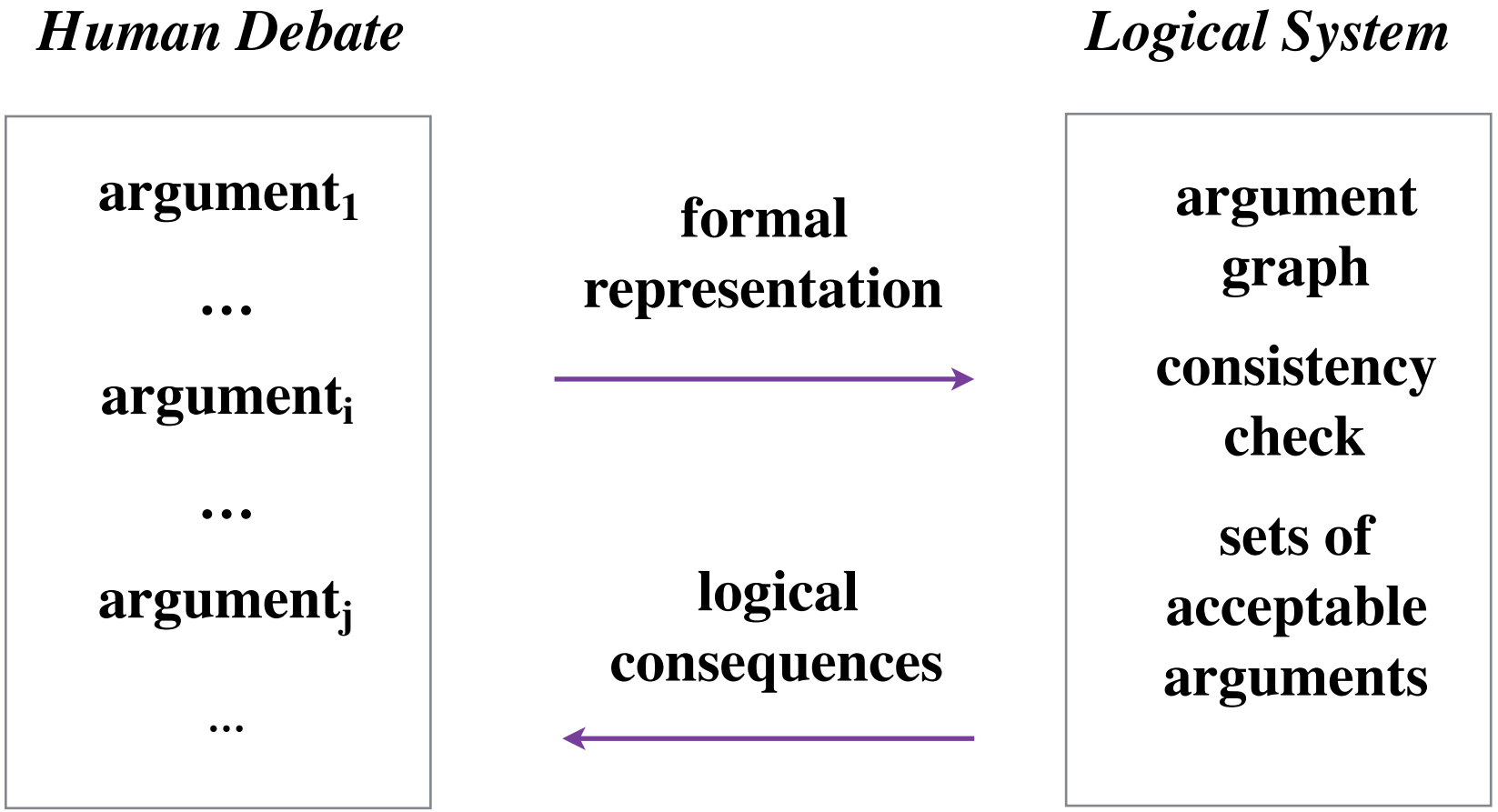
Dialog systems

Proof presentation

Intelligent tutoring systems

Game playing

The Vision
Logical Reasoning Supports a Human Debate



The Current Situation

Human Debate

Arguments raised incrementally

Role (*Support*, *Attack*) and place indicated by humans

Computational Models of Natural Argument

Logical models of argumentation, non-monotonic reasoning

Issues of arguing in natural language

Interaction Language <-> Logic

Very sparse, an exception is

A. Wyner, T. van Engers, and K. Bahreini.

“From policy-making statements to first-order logic“

Problems with Human-Based Approach

Limitations

Arguments in restricted English

Superficial exploitation of natural language only

Human interpretation on discourse level needed

Human assessments may be inaccurate

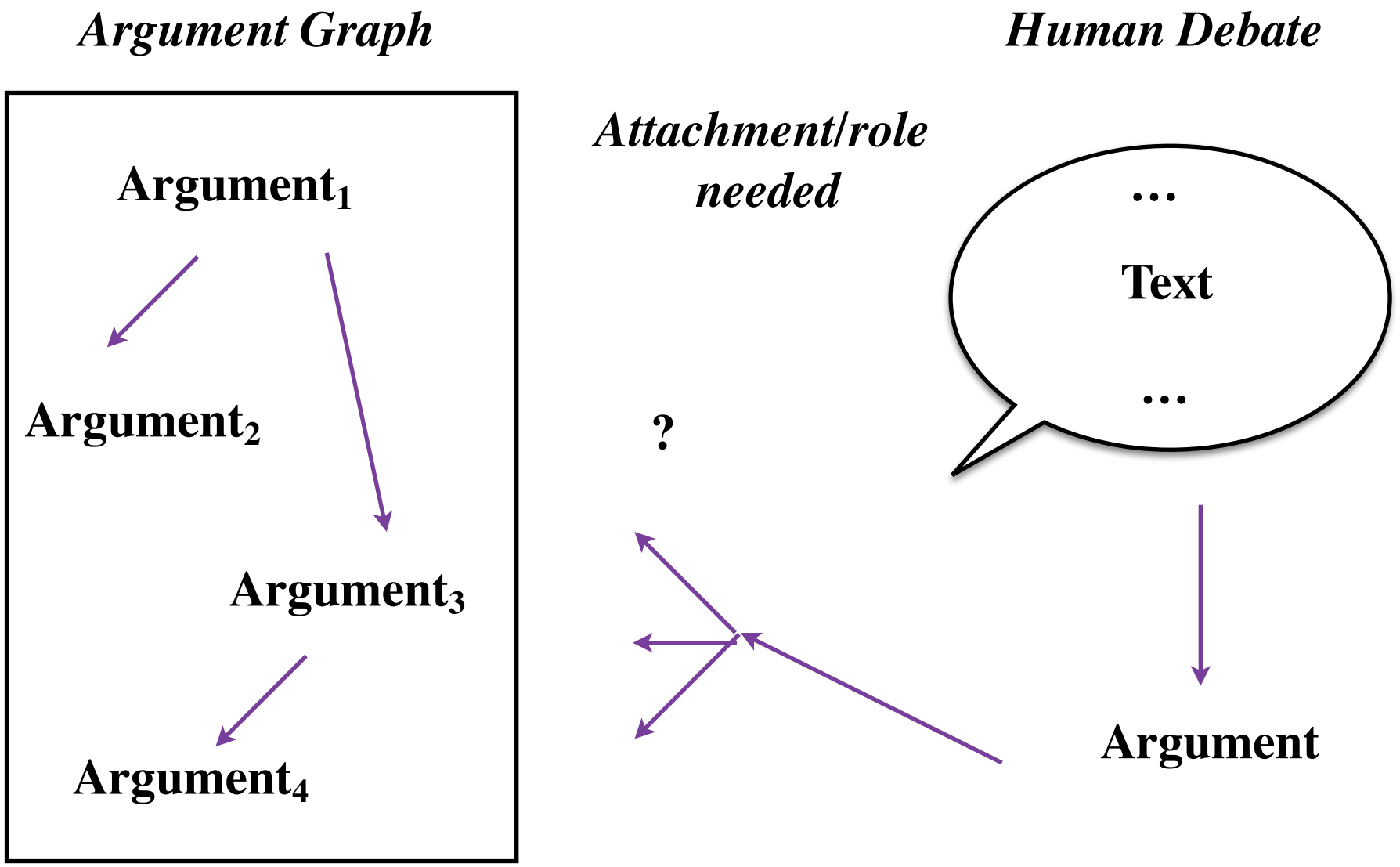
Not a proper argument, just a further description

Inexact place of an argument

Logical or world knowledge flaws

Logical representations may contain *redundancies* and *inaccuracies*

Accurate *role* and *attachment point* of an argument essential


Argument Graph
Argument1
Argument2
Argument3
Argument4
Attachment/role needed
?
Human Debate
…
Text
…
Argument

Linguistic Tools Supporting Automated Mapping

Discourse parser **(Nanyang Technological University)**

Rhetorical structure and relations between arguments

Richness of relations indicate *Support/Attack/Description*

Contrast* -> *Attack*; *Explanation* -> *Support

Structure built from assertions indicate dependencies

Limited quality - low use of discourse markers in debates

Textual entailment component **(AllenNLP's)**

High degree of inconsistency indicates *Attack*

High degree of consistency indicates *Support/Description*

The Example Debate Addressed (Wyner et al.)

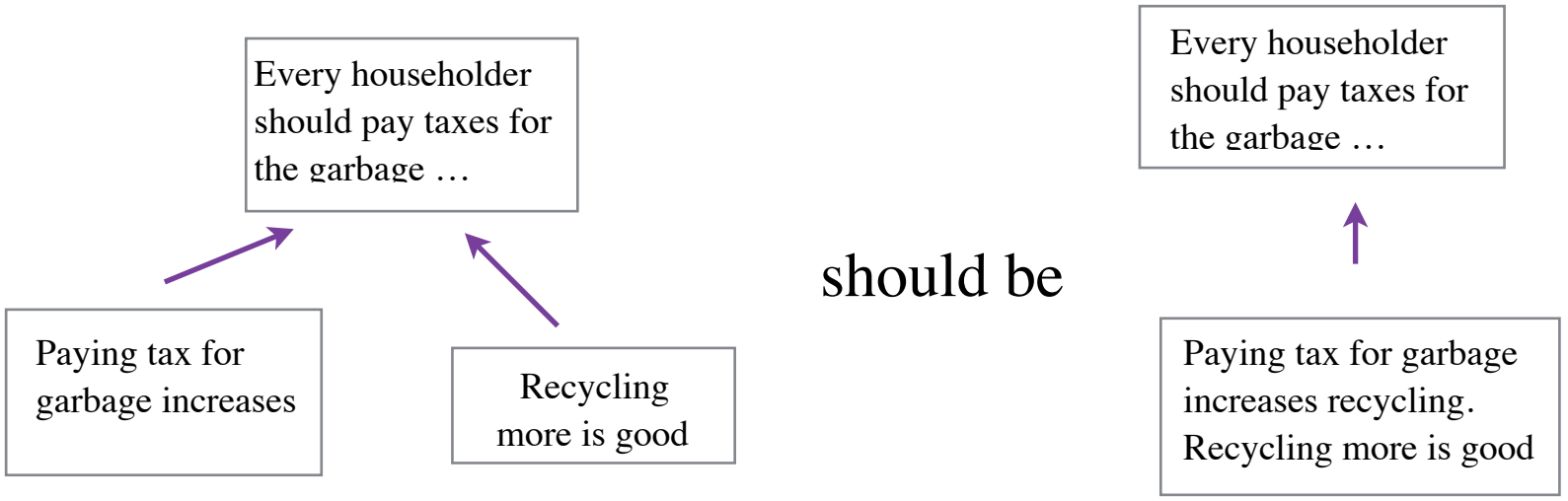
1. **Every householder should pay tax for the garbage which the householder throws away.**
2. **No householder should pay tax for the garbage which the householder throws away.**
3. **Paying tax for garbage increases recycling.**
4. **Recycling more is good.**
5. **Paying tax for garbage is unfair.**
6. **Every householder should be charged equally.**
7. **Every householder who takes benefits does not recycle.**
8. **Every householder who does not take benefits pays for every householder who does take benefits.**
9. **Professor Resicke says that recycling reduces the need for new garbage dumps.**
10. **A reduction of the need for new garbage dumps is good.**
11. **Professor Resicke is not objective.**
12. **Professor Resicke owns a recycling company.**
13. **A person who owns a recycling company earns money from recycling.**
14. **Supermarkets create garbage.**
15. **Supermarkets should pay tax.**
16. **Supermarkets pass the taxes for the garbage to the consumer.**

Example - „pseudo-argument“ - a Description

Evidence

Assessed as an *Elaboration* by the discourse parser

66 percent entailment for this pair of statements

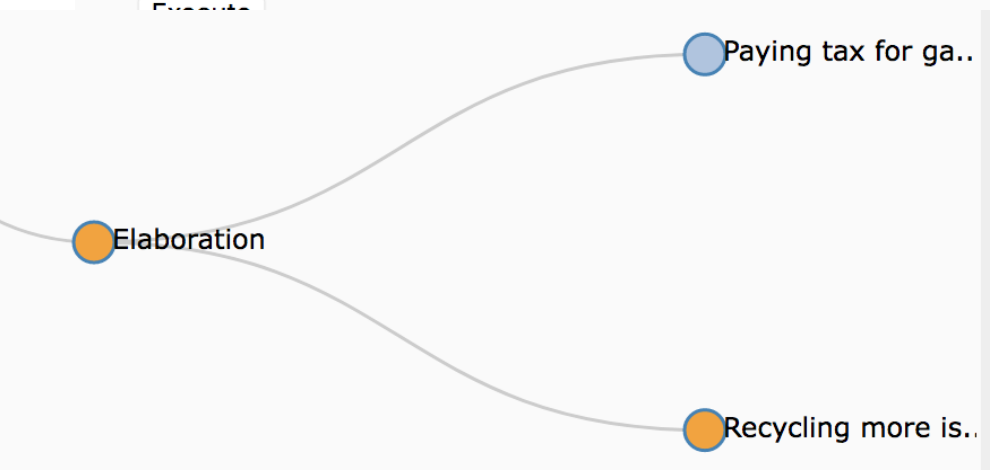


Rhetorical Analysis Demo

Enter your raw text here (currently only supports English):

```
Every householder should pay tax for the garbage
which the householder throws away.
Paying tax for garbage increases recycling.
Recycling more is good.
```

Perform discourse segmentation only
Perform discourse parsing (includes segmentation)



Satellite (leaf 2) (rel2par Elaboration) | Text: which the householder throws away .

Satellite (span 3 4) (rel2par Elaboration)

Nucleus (leaf 3) (rel2par span) | Text: Paying tax for garbage increases recycling .

Satellite (leaf 4) (rel2par Elaboration) | Text: Recycling more is good .

Textual Entailment

Premise

Paying tax for garbage increases recycling

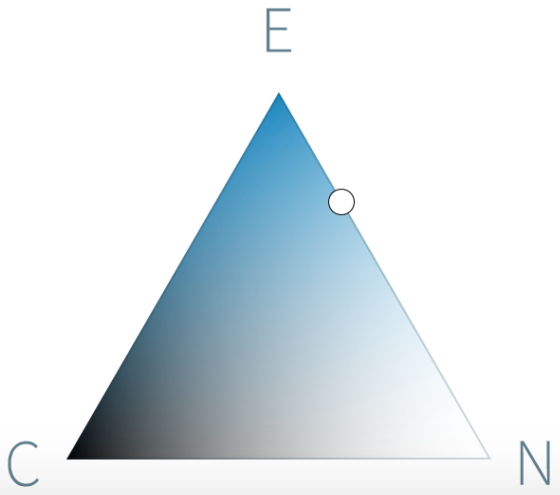
Hypothesis

Recycling more is good.

Run >

Summary

It is **somewhat likely** that the premise **entails** the hypothesis.

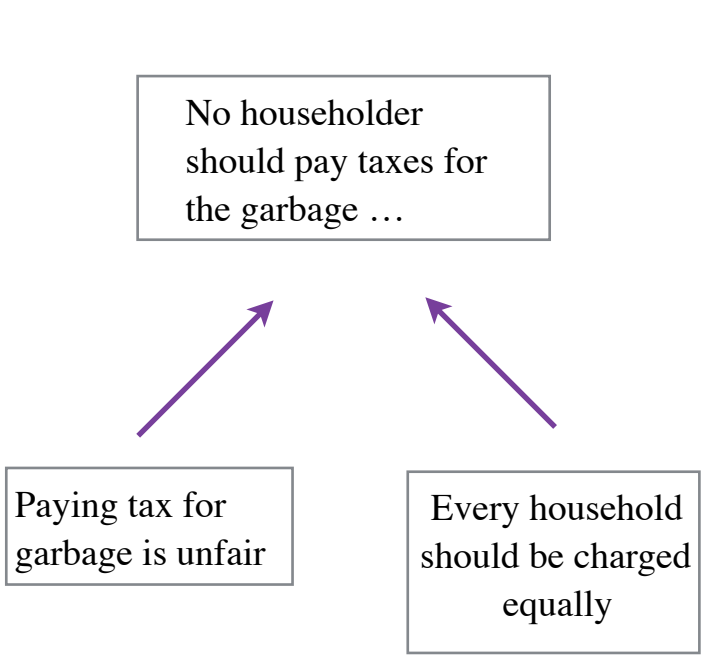


Judgment	Probability
Entailment	69.9%
Contradiction	0.5%
Neutral	29.6%

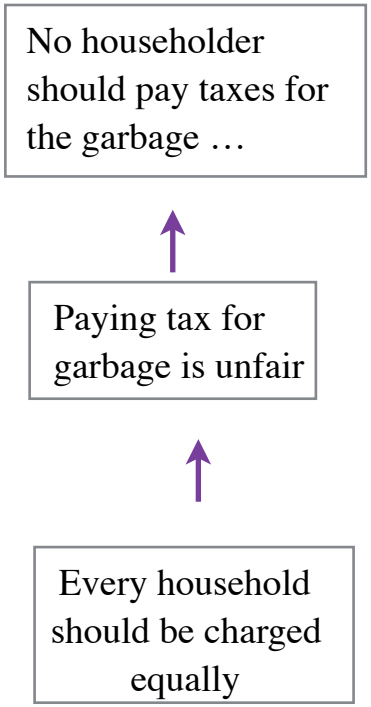
Example - more accurate structure

Evidence

Rhetorical structure indicates nested interpretation



should be

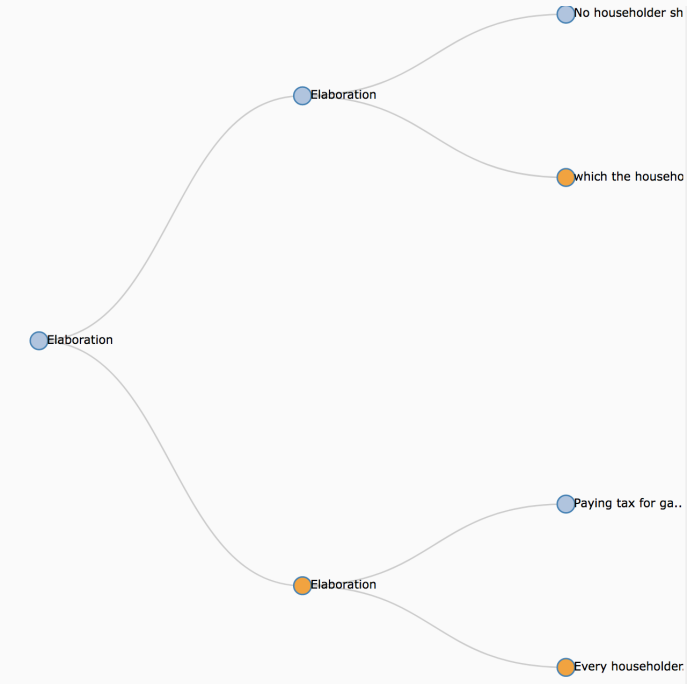


Rhetorical Analysis Demo

Enter your raw text here (currently only supports English):

```
No householder should pay tax for the garbage
which the householder throws away.
Paying tax for garbage is unfair.
Every householder should be charged equally.
```

Perform discourse segmentation only
Perform discourse parsing (includes segmentation)
Execute



Output in Textual format:

Root (span 1 4)

Nucleus (span 1 2) (rel2par span)

Nucleus (leaf 1) (rel2par span) | Text: No householder should pay tax for the garbage

Satellite (leaf 2) (rel2par Elaboration) | Text: which the householder throws away .

Satellite (span 3 4) (rel2par Elaboration)

Nucleus (leaf 3) (rel2par span) | Text: Paying tax for garbage is unfair .

Satellite (leaf 4) (rel2par Elaboration) | Text: Every householder should be charged equally .

Analysis of Natural Language Content

Current state

NL assertions mapped on (atomic) arguments

A*dvanced state*

Exploiting structured and prioritized arguments

Proposed strategy

Normalizing content specifications

Mapping onto knowledge representation repositories

(e.g. OpenCyc, the biggest)

Specific functionality

***Appeal to Expert Opinion* in the sample dialog (11) to (13)**

Challenging Dr. Resickes objectivity by personal interests

Future Research

Technical issues

Installation of linguistics tools

(demo versions seem to change, results are not reproducible)

Conceptual issues

Categorization for (typical) argumentative utterances

(„x is good/bad“, „x in/decreases“ …)

Systematic procedure for building an argumentation graph

Analyzing focused portions of the argumentative discourse

Limitations

Reasoning functionality, world knowledge, irony, …

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