Argument Mining: an overview

Text Mining 10th Nov, 2021

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slides adjusted from Chris Reed and Henning Wachsmuth

Argument Mining

- Automatic identification and extraction of structure of reasoning from text

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> **Bob.** *LOL ... everyone knows that practical experience is what does the trick.*

> **Alice.** *Good point! Anyway, in doubt I would always prefer to have one!*

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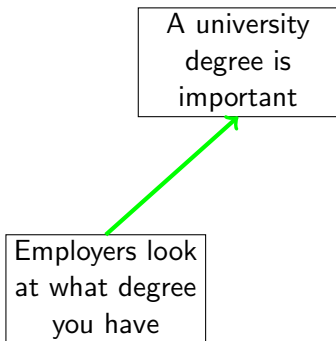
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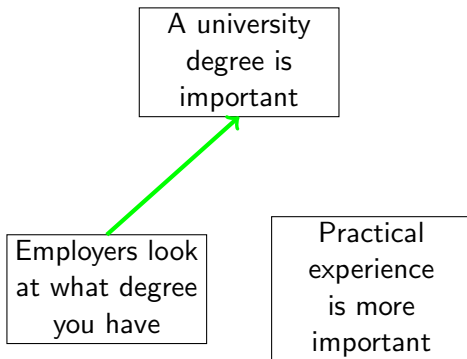- Automatic identification and extraction of structure of reasoning from text

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Practical experience is more important

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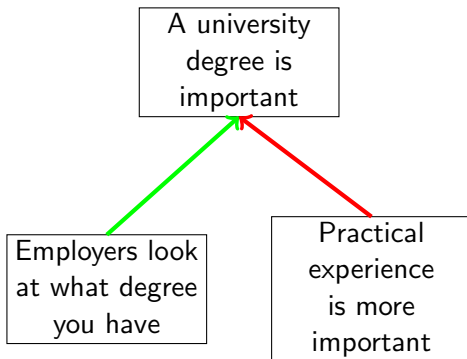

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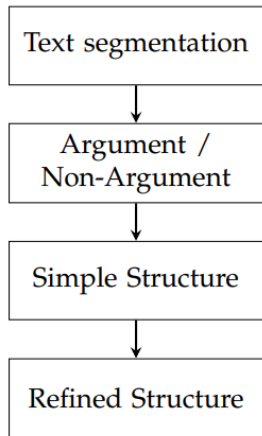Alice. *Good point! Anyway, in doubt I would always prefer to have one!*

Why bother?

- Writing support
- Tracking debates
- Decision making & conflict resolution
- Argument search
- Even further downstream applications, such as fallacy detection, deep reasoning understanding, XAI applications.

Standard pipeline

- Manual & automatic analysis
- Further down = more complex
- Not shown: tasks may further inform each other

```
┌─────────────────────┐
│  Text segmentation  │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│     Argument /      │
│    Non-Argument     │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│  Simple Structure   │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│  Refined Structure  │
└─────────────────────┘
```

Text Segmentation

- Segment text into distinct units
  - Elementary/Argumentative Discourse Units (EDUs/ADUs)
  - Sentences?
  - Turns of talk?
  - "*Non-overlapping spans of text corresponding to the atomic units of discourse*"

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Another example

Products X and Y because of their toxicity are not allowed in this building

Argument detection

- Argumentativeness vs. non-argumentativeness
- Intrinsic vs. extrinsic (contextual) properties
- Identify role of unit
  - premise/conclusion
  - claim/evidence
  - testimony/common ground/anecdote/assumption
- Relation to sentiment analysis

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Simple Structure

- Identify relations between argument units
- Support and attack
- Again, leverage other NLP tasks
  - Stance classification, Semantic textual similarity, Natural Language Inference

Example

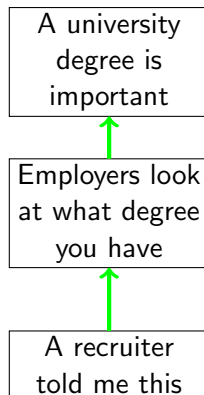> Premise *People know video game violence is fake*
> **support/attack**
> Claim: *Youth playing violent games exhibit more aggression*

Refined Structure

- Argumentation schemes
- Enthymemes (missing pieces)

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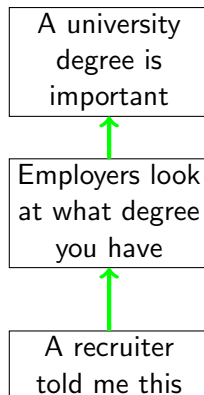Employers look
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Argument from Expert Opinion
E is an expert in domain D
E claims that P
therefore, P is true

Critical Questions: Is E biased?
Is E trustworthy?
Is P in the domain of D?
...

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↑

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Challenges

- Theory != real world
  - Rhetoric
  - Idioms
  - Paraphrasing
  - Sarcasm
- So much contextual information (world knowledge)
- Reasoning alone does not give the full picture

Data & annotation

Size	Component Detection		RP
	Sent. Clas.	BD	
402 essays	✓	✓	✓
112 short texts	✓		✓
55 topics	✓		
58 topics, 547 articles	✓		
33 topics, 586 articles	✓		
11,800 discussions			
524 documents	✓		
445 documents		✓	
260 pairs			✓
4,713 tweets		✓	✓
660 arguments	✓		
7 judgments	✓	✓	✓
47 judgments	✓	✓	✓
731 comments			✓
5 topics (1,907 pairs)			✓
9,666 words	✓		
60 sessions	✓		
34 sent., 123 paragr.			✓

- Incredibly complex annotation
- Incomplete information
- Agreement may not be reached

Current state of the art

- Popular models: BERT, (Bi)LSTMs
    - **Segmentation** up to 80% accuracy, or as low as 55%
    - **Detection** using BERT (or variants), reaches around 0.7 F1 within constraints
    - **Relations** very difficult, only around F1 0.5
    - **Schemes** even more difficult, very limited experiments available
- Cross domain application difficult
    - Topic independent approaches work using discourse markers (*because..*)
    - Topic dependent information required, but hurts generalization

Resources

- Argument Mining survey – Lawrence and Reed [2020]
- Argument Mining for Social Good – Vecchi et al. [2021]
- Yearly workshop on Argument Mining (happening now!)

Argument Mining

Take-away message

Argument Mining

- Mining reasoning from text
- Complex but highly relevant
- Use state of the art in NLP . . .
- . . . but also take on novel challenges

Interested? Make this your final TM project!

Even more interested? Message me for open position(s) for a MSc thesis.

m.t.van.der.meer@liacs.leidenuniv.nl

John Lawrence and Chris Reed. Argument mining: A survey. *Computational Linguistics*, 45(4):765–818, 2020. doi: $10.1162/coli_a_00364$. URL :https\protect\protect\leavevmode@ ifvmode\kern+.2222em\relax//www.researchgate.net/ publication/336351909_Argument_Mining_A_Survey/link/ 5e21ca47299bf1e1fab9d627/download:URL.

Eva Maria Vecchi, Neele Falk, Iman Jundi, and Gabriella Lapesa. Towards argument mining for social good: A survey. In *Proceedings of the 59th Annual Meeting of the Association for Computational Linguistics and the 11th International Joint Conference on Natural Language Processing (Volume 1: Long Papers)*, pages 1338–1352, 2021. URL https://aclanthology.org/2021.acl-long.107.pdf.