

Automatic Detection of Argumentation in Legal Cases

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Outline

- Introduction
 - Motivation
 - Argumentation
- Automatic Argumentation Detection
 - Argumentation annotation
 - Argumentation Detection
- Conclusions

Introduction

- Motivation
- Argumentation

Motivation

1. Number of legal documents rapidly growing. Case Law based on prior legal cases.

2. Legal documents are long and complex to read. High use of rhetoric.

3. Time consuming and high costs.



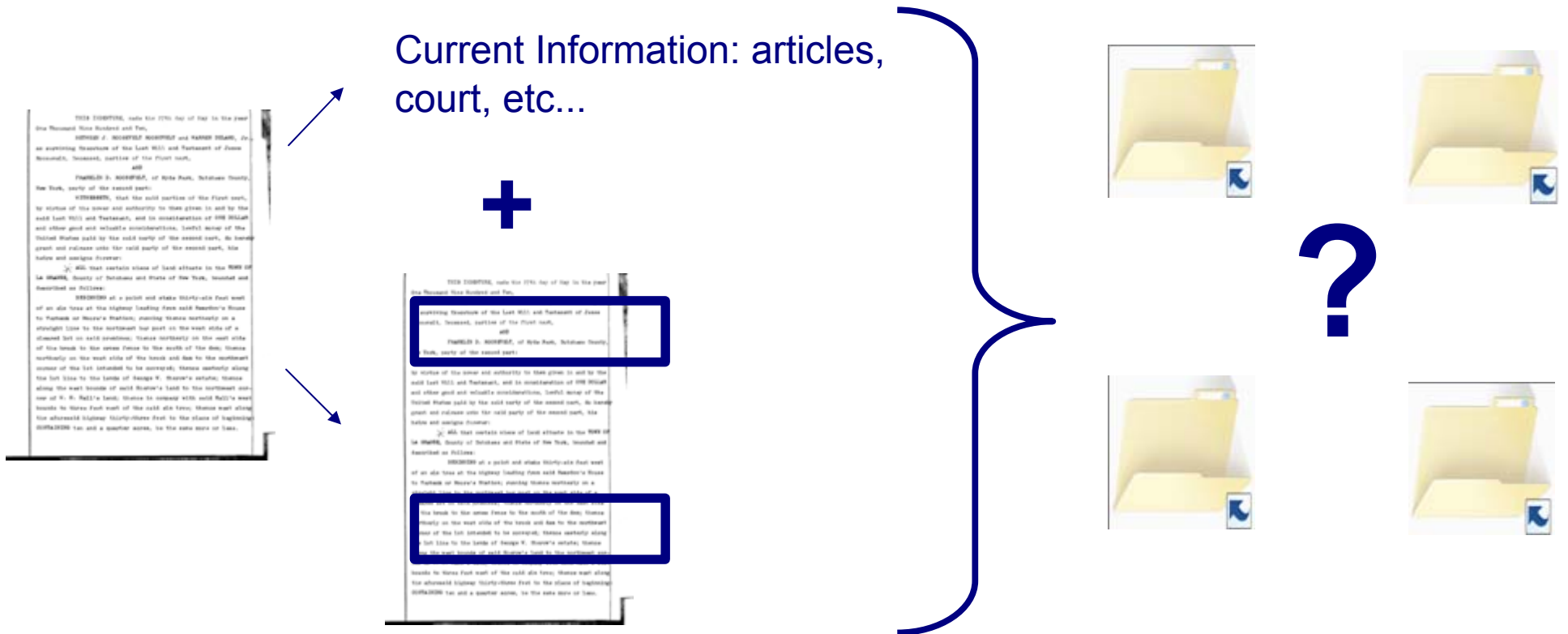
4. Need better ways to access, summarize and visualize the information.

5. Current search technologies based on keywords (FindLaw, Justis, JustCite, LexisNexis, WestLaw, etc...)

6. Legal documents contain high range of argumentation.

Motivation

- Argumentation detection
 - ease the understanding of the text
 - better **identification** of important information
 - new possibilities to **index/search** documents

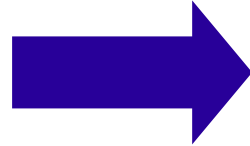


Motivation

- Argumentation classification & visualization
 - produce/show clear, strong, **well-organised** arguments
 - ease the **evaluation** of reasoning
 - ease the **understanding** of someone's reasoning
 - help on teaching general reasoning
 - help on teaching critical thinking skills



Motivation

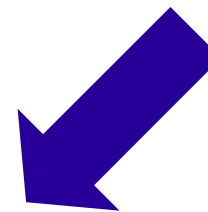


Argumentative sentences detected

With the right to build a dam across the brook at or near the old dam just above the cross fence aforesaid thirteen feet high, not to interfere with any other person's rights, but it is intended by this conveyance to include all the persons described in deed from John R. Keech of Poughkeepsie, N.Y., as Referee, to James Roosevelt by deed dated the 10th day of April, 1897, and recorded in the Dutchess County Clerk's Office in Liber 293 of Deeds at page 190 on the 9th day of October, 1897. SUBJECT, however, to

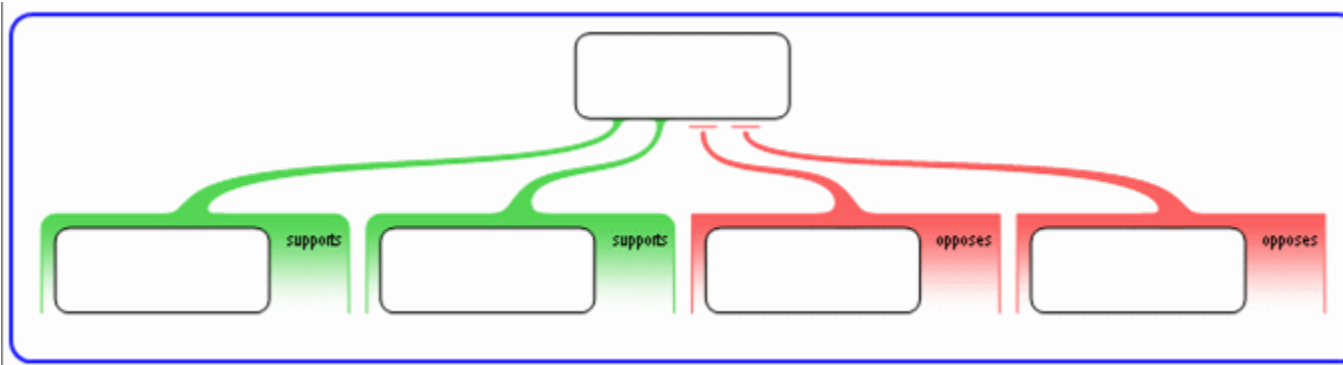
TOGETHER WITH the appurtenances and also all the estate which the said Testator had at the time of his decease in said premises. AND ALSO the estate therein which the said parties of the first part had or have power to convey or dispose of, whether individually or by virtue of said Will or otherwise.

IN WITNESS WHEREOF, the said parties of the first part have hereunto set their hands and seals the day and year first above written.



Argumentative sentences classified

Argumentative structure visualized



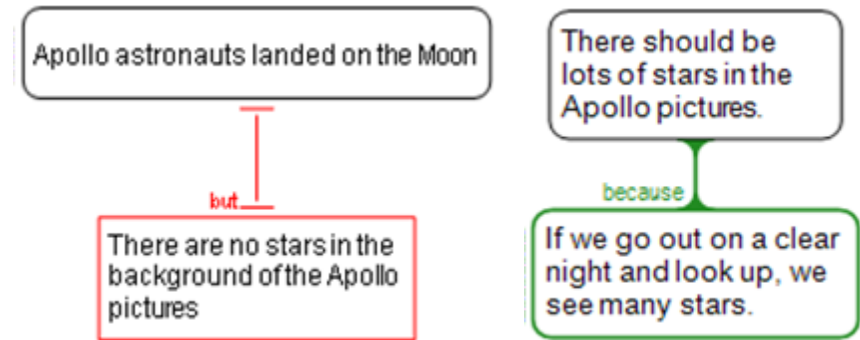
Introduction

- Motivation
- Argumentation
 - Overview
 - Problems

Argumentation

- Argumentation

- => to defend a standpoint (or conclusion)
- => set of premises to support or attack
- => inference rule to move from A to B



- Legal Cases

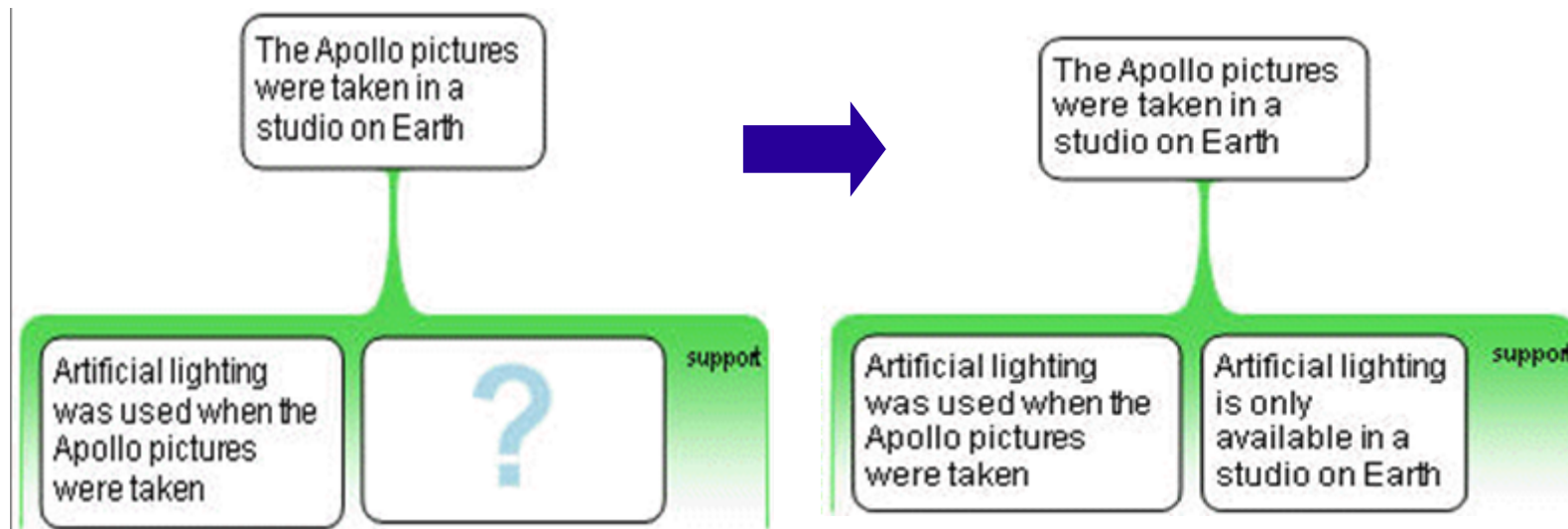
- => plaintiff files a claim : alleges certain facts + states a conclusion of law
- => defendant files an answer:
 - (a) deny the allegations of fact in the plaintiff's complaint
 - (b) assert additional facts + necessary conclusions of law
- => factfinder determines what actually happened in the case

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Argumentation: problems (I)

- Ambiguity language & implicit information



- How related is “artificial lighting” to “studio on Earth”?
 - World knowledge
 - Domain dependency
- Usually when people provide reasons or objections they don't explicitly state all the premises. People typically "hide" one or more premises.
- Logicians use the term **enthymeme** for an argument with a hidden premise. Most arguments encountered in everyday contexts are **enthymematic**.

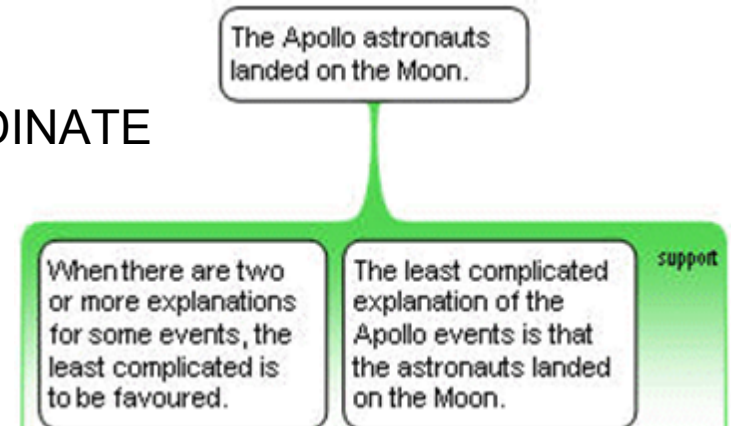
Argumentation: problems (II)

- Different structures

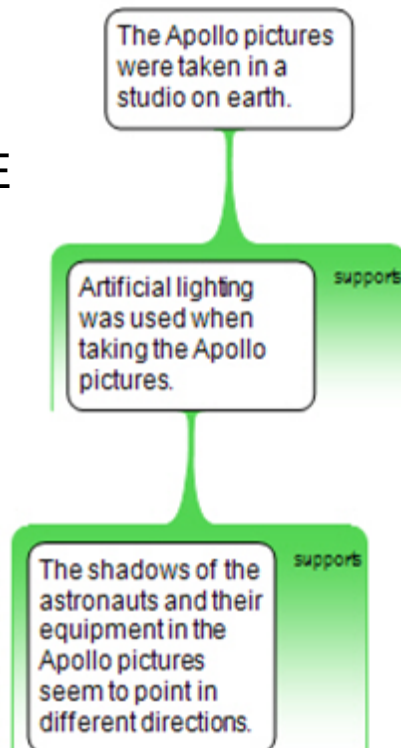
BASIC



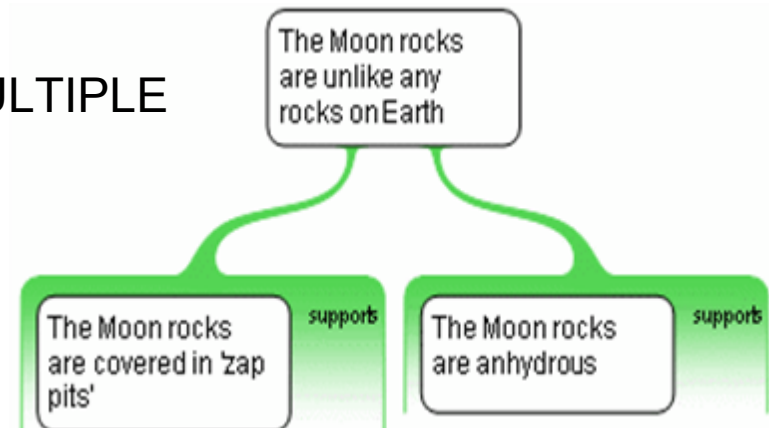
COORDINATE



SUBORDINATE

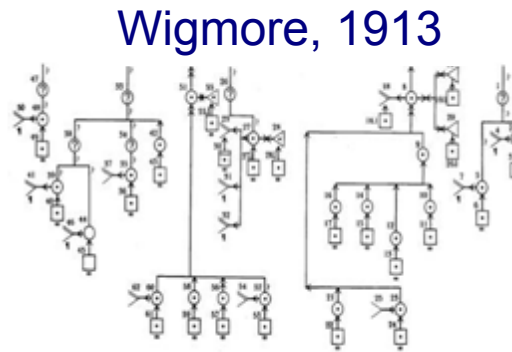
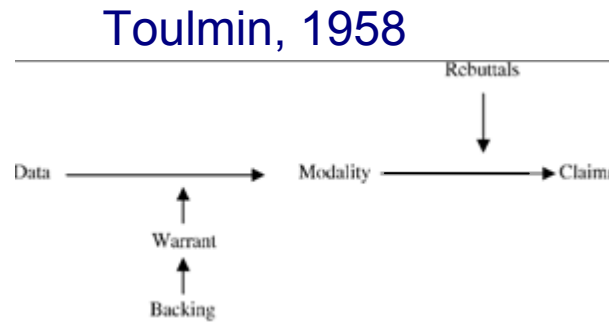


MULTIPLE

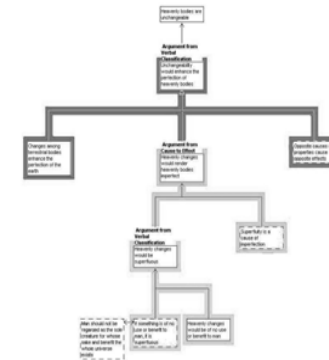


Argumentation: problems (III)

- Argumentation ambiguity



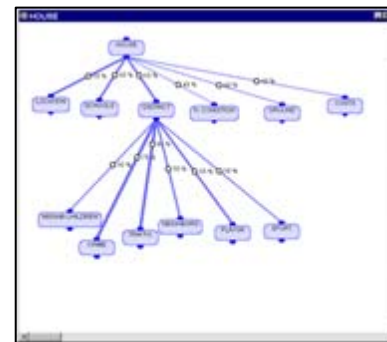
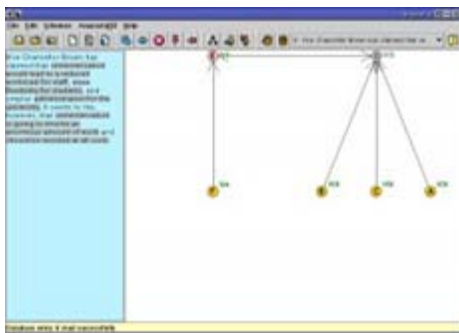
Walton, 1995



+ ...

- Several visualizations:

Argunet, Araucaria, Reason!Able, Athena, Carneades, ...



Automatic Argumentation Detection

- Argumentation annotation
- Argumentation Detection

Argumentation annotation

- Problems
 - Manual process
 - Time consuming
 - High costs
 - Human errors

- Lack of resources

	ECHR
Source	Case Law of the European Court Human Rights (judgements & decisions)
Language	English
Annotators	2 annotators + judge
Restrictions	set of guidelines
Documents	full documents
Agreement	High (80%)
Remarks	Homogeneous

Automatic Argumentation Detection

- Argumentation annotation
- **Argumentation Detection**

Argumentation Detection

- Argumentative parsing by manually derived rules [Mochales & Moens, 2008]
 - Study of case law argumentation (syntactic, semantic, structural)
 - Development context-free argumentation grammar
 - Implementation of a LR parser

Argumentation Detection

- Context-Free Grammar

G is a 4-tuple: $G = (V, \Sigma, R, S)$ where

1. V , is a finite set of **non-terminal characters** or variables.
2. Σ , is a **finite set of terminals**, disjoint with V .
3. R , is a relation from V , to $(V \cup \Sigma)^*$ such that $\exists w \in (V \cup \Sigma)^* : (S, w) \in R$. R is a finite set, called the rules of the grammar.
4. S , is the **start variable**, used to represent the whole sentence (or program). It must be an element of V .

- LR parser

Bottom-up parsing because it attempts to deduce the top level grammar productions by **building up from the leaves**.

Grammar for:

“astronomers saw stars”

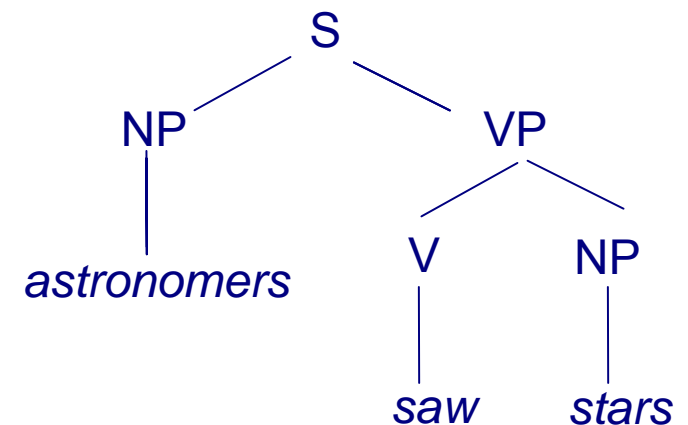
$S \rightarrow NP VP$

$VP \rightarrow V NP$

$NP \rightarrow \textit{astronomers}$

$NP \rightarrow \textit{stars}$

$V \rightarrow \textit{saw}$



Argumentation Detection

$$T \Rightarrow A^+D$$

$$A \Rightarrow \{A^+C|A^*CnP^+|Cns|A^*sr_cC|P^+\}$$

$$D \Rightarrow r_cf\{v_c s|\}^+$$

$$P \Rightarrow \{P_{verb}P|P_{art}|PP_{sup}|PP_{ag}|sP_{sup}|sP_{ag}\}$$

$$P_{verb}P = sv_p s$$

$$P_{art} = sr_{art} s$$

$$P_{sup} = \{r_s\}\{s|P_{verb}P|P_{art}|P_{sup}|P_{ag}\}$$

$$P_{ag} = \{r_a\}\{s|P_{verb}P|P_{art}|P_{sup}|P_{ag}\}$$

$$C = \{r_c|r_s\}\{s|C|P_{verb}P\}$$

$$C = s^*v_c s$$

<i>T</i>	General argumentative structure of legal case
<i>A</i>	Argumentative structure that leads to a final decision of the factfinder $A = \{a_i, \dots, a_j\}$, each a_i is an argument from the argumentative structure
<i>D</i>	The final decision of the factfinder $D = \{d_i, \dots, d_j\}$, each d_i is a sentence of the final decision
<i>P</i>	One or more premises $P = \{p_i, \dots, p_j\}$, each p_i is a sentence classified as premise
<i>C</i>	Sentence with a conclusive meaning
<i>n</i>	Sentence, clause or word that indicates one or more premises will follow
<i>r_c</i>	Conclusive rhetorical marker (e.g. therefore, thus, ...)
<i>r_s</i>	Support rhetorical marker (e.g. moreover, furthermore, also, ...)
<i>r_a</i>	Contrast rhetorical marker (e.g. however, although, ...)
<i>r_{art}</i>	Article reference (e.g. terms of article, art. x para. x, ...)
<i>v_p</i>	Verb related to a premise (e.g. note, recall, state, ...)
<i>v_c</i>	Verb related to a conclusion (e.g. reject, dismiss, declare, ...)
<i>f</i>	The entity providing the argumentation (e.g. court, jury, commission, ...)
<i>s</i>	Sentence, clause or word different from the above symbols

Argumentation Detection

- Results
 - over 20 ECHR documents

Type	# Sentences	Precision	Recall	F-measure
Premise	430	59%	70%	64.03%
Conclusion	156	61%	75%	67.27%
Non-Argumentative	1087	89%	80%	84.26%
Final Decision	63	100%	100%	100.00%

- 60% accuracy on the correct recognition of tree-structures
- 65% average compression ratio
- Problems:
 - Ambiguity between structures (40% errors)
 - High human cost, time consuming and dataset dependent
 - Terminal symbols detection -> low precision

Argumentation Detection

```
T
|--D
| |--x: for these reasons, the Commission by a majority declares the
|       application admissible, without prejudging the merits.
|--A
| |--c: it follows that the application cannot be dismissed as
|       manifestly ill-founded.
| |--A
|     |--P
|           |--p: it considers that the applicant's complaints raise serious
|           |       issues of fact and law under the convention, the
|           |       determination of which should depend on an examination
|           |       of the merits.
|           |--p: the Commission has taken cognizance of the submissions
|           |       of the parties.
|--A
| |--c: in these circumstances, the Commission finds that the application
|       cannot be declared inadmissible for non-exhaustion of domestic
|       remedies.
|--A
|     |--P
|           |--p: the Commission recalls that article art. of the convention
|           |       only requires the exhaustion of such remedies which
|           |       relate to the breaches of the convention alleged and at
|           |       the same time can provide effective and sufficient redress.
|           |--P
|                 |--p: the Commission notes that in the context of the section
|                 |       powers the secretary of state has a very wide discretion.
|                 |--P
|                       |--p: the Commission recalls that in the case of temple
|                       |       v. the united kingdom no. x dec. x d.r. p. the Commission
|                       |       held that recourse to a purely discretionary power
|                       |       on the part of the secretary of state did not
|                       |       constitute an effective domestic remedy .
|                       |--p: the Commission finds that the suggested application
|                       |       for discretionary relief in the instant case cannot
|                       |       do so either.
```

Argumentation Detection

```
|---A
|---c: the agent_arg accordingly finds that mrs isik ahmet and her two children , mr levent ahmet
|      and miss funda ahmet , have standing to continue the present proceedings in the applicant 's stead .
|---A
|---P
|---p: the agent_arg notes , firstly , that the applicant was convicted by the greek courts of
|      disturbing , through his writings , the public peace and the peace of the citizens of western
|      thrace .
|---P
|      |---p: like the delegate of the commission , the agent_arg considers that the applicant 's heirs
|      |      also have a definite pecuniary interest under article of the convention art. .
|      |---P
|      |---p: furthermore , it notes that the applicant was sentenced to fifteen months ' imprisonment
|      |      , commutable to a fine of grd per day of detention , which sum he paid .
|---P
|      |---p: without prejudice to its decision on the objection relating to non-exhaustion of domestic
|      |      remedies , the agent_arg considers that mr ahmet sadik 's widow and children have a
|      |      legitimate moral interest in obtaining a ruling that his conviction infringed the right to
|      |      freedom of expression which he relied on before the convention institutions .

|---A
|---c: accordingly , domestic remedies were not exhausted in the instant case .
|---A
|---P
|---p: even if the greek courts were able , or even obliged , to examine the case of their own motion
|      under the convention , this cannot have dispensed the applicant from relying on the convention
|      in those courts or from advancing arguments to the same or like effect before them , thus drawing
|      their attention to the problem he intended to submit subsequently , if need be , to the
|      institutions responsible for european supervision see the van oosterwijck v. belgium judgment of
|      november 1980 , series a no. p. para. .
```

Conclusions

- Contributions
 - Dataset for argumentation detection
 - Automatic tool:
 - detects
 - classifies
 - visualizes
- Open Questions
 - Is the detection enough accurate?
 - Can it help on real legal searches?

Thank you for listening!

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