



Annotation of Scientific Arguments in Terms of Semantic Relations and Argument Schemes

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Our Goal: Argument Mining Full-Text Bio/Biomed Research Articles

- **Argument** = Presentation of author's reasoning for validation by other scientists
- **Mining** = Inferring type of argument (*argument scheme*) and its (implicit or explicit) premises/conclusion in propositional form (not text segments)

Example Argument Scheme

Scheme name: Agreement

Premise: A group of individuals I have atypical **phenotype** P (e.g. , *a disease*)

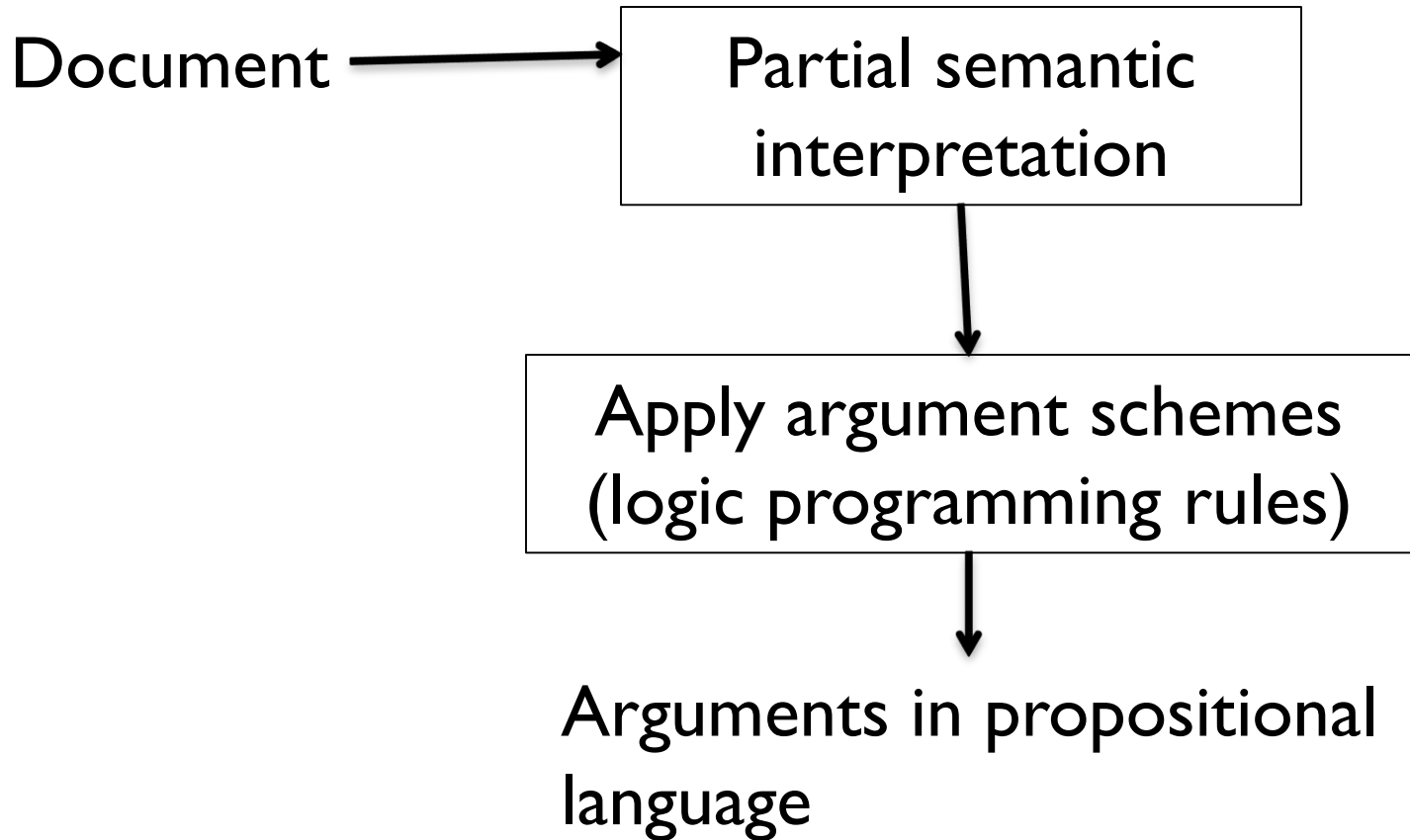
Premise: All of the individuals in I have atypical **genotype** M (e.g. , *variant gene*)

Conclusion: M may be the **cause of P**
(in group I)

Challenges to Surface Mining Arguments in Science Research Pubs

- Premises or conclusion occurring in noncontiguous text segments
- Different arguments occurring in overlapping or embedded text segments
- **Implicit** premises or conclusion
- Recognizing argument scheme

Proposed Alternative to Surface Mining



Propositional Argument Mining Pipeline – Step I: Partial Semantic Interpretation

- use current and future BioNLP tools (named entity extraction, relation extraction, coreference resolution, ...)
- output propositions, e.g.

have_genotype(group I, 'ITPR1 opt/opt')

have_phenotype(group I, ataxia)

Propositional Argument Mining – Step 2: Apply argument schemes

Argument scheme implemented as Prolog rule:

```
arg(  
  scheme('Agreement'),  
  premise(have_phenotype(G, P)),  
  premise(have_genotype(G, M)),  
  conclusion(cause(M, P)))
```

```
:- group(G),  
   have_phenotype(G, P),  
   have_genotype(G, M).
```

Example Mined Argument

Scheme: Agreement

Premises:

have_phenotype(group I, ataxia)),

have_genotype(group I, 'Itpr I opt/opt'),

Conclusion:

cause('Itpr I opt/opt', ataxia)))

Plan of Research

- Identify relevant argument schemes
- Implement them as logic programming rules; prototyped in (Green, 2018)
- Annotate corpus of bio articles:
 - partial semantic interpretation
 - arguments
- Use corpus to evaluate argument mining systems

An Open-Access* Catalog of Argumentation Schemes in
In Biomedical Genetics Research Articles
(*<https://github.com/greennl/BIO-Arg>)

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Definitions of domain terminology

Ontology of argument schemes:

 Causation

 One-group

 Agreement arguments

 Method of Agreement

 Failed Method of Agreement (no Effect)

 Failed Method of Agreement (no Cause)

 Eliminate Candidates

 Explanation-based

 Effect to Cause

 No Effect to No Cause

 Consistent with Predicted Effect

Ontology continued on next slide

An Open-Access* Catalog of Argumentation Schemes in
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(*<https://github.com/greennl/BIO-Arg>)

Ontology of argument schemes (continued from previous slide)

Causation

One-group ...

Two-group

Difference arguments

Method of Difference

Eliminate Difference

Failed Method of Difference

Analogy (Causal)

Explanation-based

Consistent Explanation

Difference Consistent Explanation

Other

Classification

Confirmation

Acknowledgements

References

Proposed Method for Annotating Arguments

- Tag source text with `<content>` elements
- Separately annotate discourse entities and propositions outside of `<content>`
 - `<entity ID="geno1" paraphrase="..." />`
 - `<prop>have_geno(group1, geno1)</prop>`
- Separately annotate arguments in terms of semantic annotations

Example: annotating argument

```
<argument ID="1" scheme="Agreement">  
<premise-list>  
  <premise prop="have_pheno(group1, pheno1)" />  
  <premise prop="have_genotype(group1, geno1)" />  
</premise-list>  
<conclusion  
  inferred-prop= "cause(geno1, pheno1, group1)"  
  paraphrase="A homozygous mutation on  
  chromosome 6qE1 may be the cause of the  
  ataxia-like disorder in the affected mice" />  
</argument>
```

Annotation Experiment

Manually annotated semantics and arguments in Results/Discussion section of one bio/biomed journal article

(see <https://github.com/greennl/BIO-Arg>)

- 27 discourse entities
- 41 propositions
- 15 arguments, 7 schemes
 - 9 implicit conclusions
 - 7 implicit premises

For more information

Open-access catalog of argumentation schemes
and sample annotated article:

<https://github.com/greennl/BIO-Arg>

Green, NL. 2018. Towards mining scientific
discourse using argumentation schemes.

Argument and Computation, 9(2):121-135. DOI
10.3233/AAC-180038.