

Argument Mining for Scholarly Document Processing: Taking Stock and Looking Ahead

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Objectives

We present a survey of existing works in **argument mining** in **scholarly discourse**, and provide an overview of current models, data, tasks, and applications

- We identify the major datasets, annotation schemes, argmining models, and applications
- We summarize the major challenges for the problem on scholarly discourse
- We present future directions on argmining for full paper discourse.

Introduction

- Scholarly documents are argumentative
 - Present verifiable evidence for a series of stated claims
 - Establish the relevance, validity, and novelty of the main claims
- Computational Argumentation is emerging
 - Computational analysis and generation of argumentative discourses
 - Argument mining, argument quality assessment, and argument generation
- Argument mining for scholarly documents
 - Understudied domain

Taking Stock: ArgMin on SciDoc

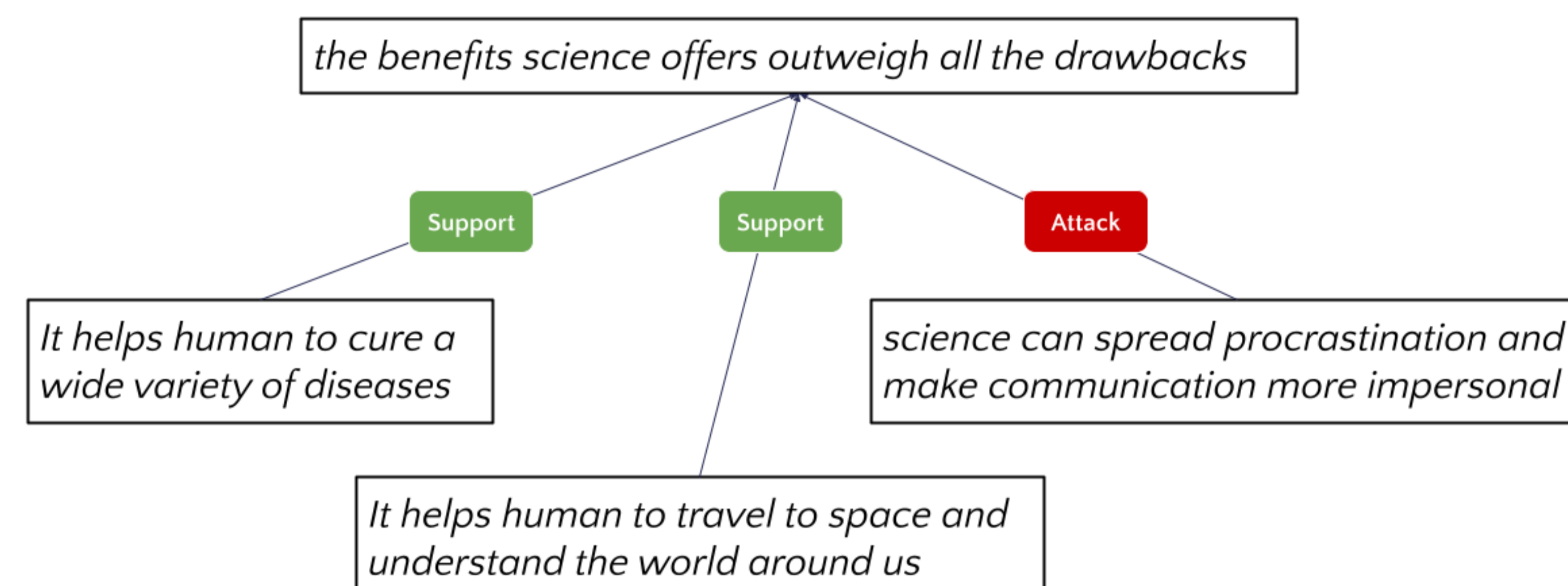
- Survey of existing work in the literature (2000 - 2021)
 - **33** papers, mostly from the NLP community
 - Found via Google Scholar and references of some pivotal papers
- Work was grouped into four dimensions:
 - Corpus Creation and New Annotation Schemes
 - Automatic Argument Unit Identification
 - Automatic Argument Structure Identification
 - Applications
- Identified for each paper:
 - Domain, Objectives, Methods, Additional Contributions

Survey

<https://tirthankar-ghosal.github.io/ArgMin/argmin-scholarly-survey.html>

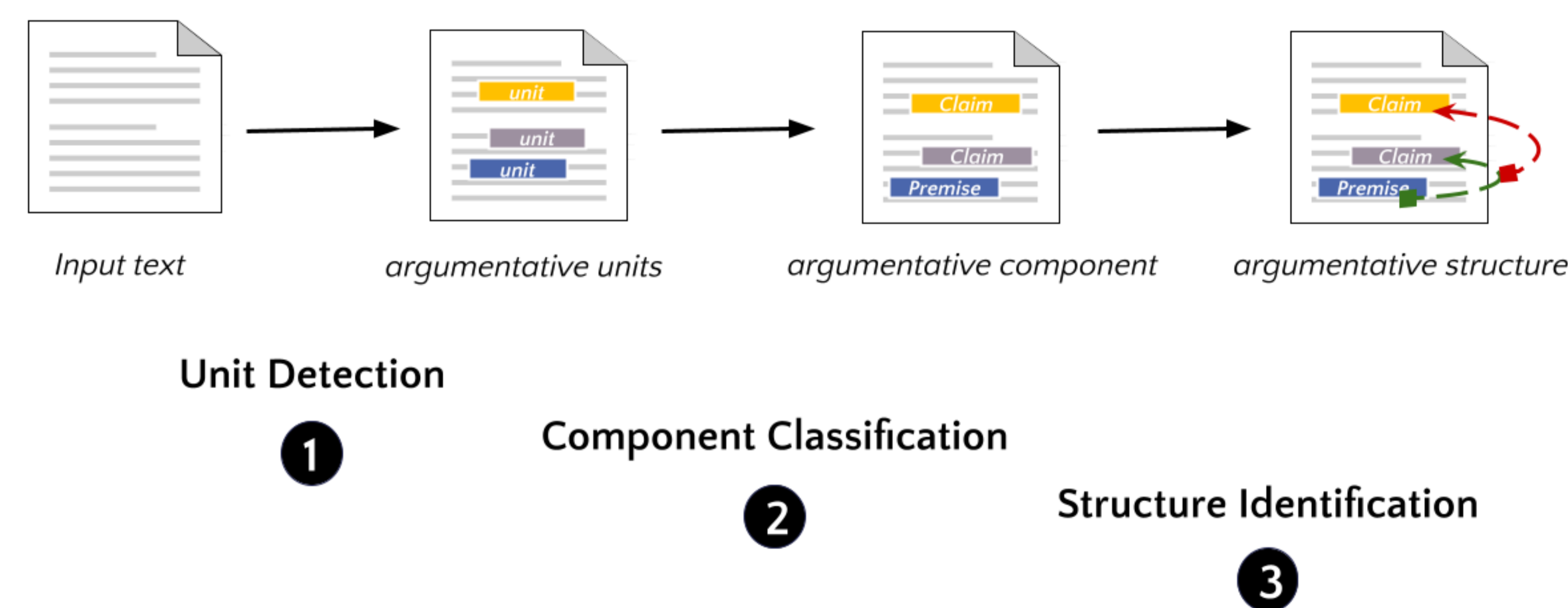
Scientific Argument

Argument



Argument Mining Pipeline

Argument Mining



Looking Ahead

- Greater collaboration between Scholarly Document Processing and ArgMining communities
- Shared models, corpora, and other resources

Challenges

- **Domain Knowledge**
 - Science communication is different, using different methodologies and argumentation strategies for different research communities.
 - Should argument mining techniques be tailored to individual scientific communities or can a unified model be adapted to address domain-specific features of scientific argumentation?
- **Scientific Document Type**
 - Do different document types require different models, or can they be accommodated by a single representation?
 - Similar to domain-specific conversation
- **Enthymemes**
 - **Enthymeme** is the implicit (unstated) premise or conclusion in an argument.
 - However, to the extent that shared knowledge is required, which is not found in the document, Enthymemes offer a challenge for argument mining techniques.
- **Subjective Interpretation**
 - An argumentative text may have multiple valid interpretations of its structure.
 - In particular, experimental papers of biology can follow a line of reasoning that is unclear for a nonbiologist. The reason for the order is results often not explicitly stated in the text.
- **Context-Dependence**
 - Context plays a crucial role in text mining in general and argument mining in particular.
 - Selecting the optimal boundaries of argumentative units in scientific documents can be challenging and inter-annotator agreement is hard to find.

Conclusion

- We argue for more extensive research on **argument mining in scientific documents**.
- Main question: if we view scholarly discourse as a pragmatic discourse, can we model a richer representations of the knowledge structures underlying scientific progress?
- Phenomena targeted by argument mining are mostly orthogonal to the factual content of scientific arguments
- We see an opportunity for many innovative applications in this area including machine reading comprehension of scholarly literature, scientific fact verification, etc.

Challenges

- **Argumentation Modeling**
 - Most previous studies utilize either Toulmin's model or specific argumentation schemes.
 - However, Toulmin's models with its warrants and rebuttals:
 - Is not common in scholarly argumentation.
 - Does not take the specific nature of scholarly argumentation which e.g. includes experimental components.