On Recognizing Argumentation Schemes in Formal Text Genres

By: Nancy L. Green

Green, N. L. On Recognizing Argumentation Schemes in Formal Text Genres. Abstract in E. Cabrio, G. Hirst, S. Villata and A. Wyner (Eds.), Natural Language Argumentation: Mining, Processing, and Reasoning over Textual Arguments (Dagstuhl Seminar 16161), April 17-22, 2016. (Note: Due to a publishing error, only the abstract of the paper appeared in the published Seminar Report at http://dx.doi.org/10.4230/DagRep.6.4.80)

Abstract:

Argumentation mining research should address the challenge of recognition of argumentation schemes in formal text genres such as scientific articles. This paper argues that identification of argumentation schemes differs from identification of other aspects of discourse such as argumentative zones and coherence relations. Argumentation schemes can be defined at a level of abstraction applicable across the natural sciences. There are useful applications of automatic argumentation scheme recognition. However, it is likely that inference-based techniques will be required.

Keyword: argumentation schemes

Article:

*****Note: Full text of article below**

On Recognizing Argumentation Schemes in Formal Text Genres

Nancy L. Green
Dept. of Computer Science
U. of N. Carolina Greensboro
Greensboro, NC 27402, USA
nlgreen@uncg.edu

Abstract

Argumentation mining research should address the challenge of recognition of argumentation schemes in formal text genres such as scientific articles. This paper argues that identification of argumentation schemes differs from identification of other aspects of discourse such as argumentative zones and coherence relations. Argumentation schemes can be defined at a level of abstraction applicable across the natural sciences. There are useful applications of automatic argumentation scheme recognition. However, it is likely that inference-based techniques will be required.

1 Models of Argumentation vs. Other Models of Discourse

Argumentation schemes are abstract descriptions of acceptable arguments used in everyday conversation and in formal genres such as legal and scientific text (Walton et al., 2008). Their conclusions may be defeasible. The critical questions of an argumentation scheme may be posed as challenges to arguments instantiating the argumentation scheme. An enthymeme is an argument with implicit premises or conclusion. Recognition of argumentation schemes can assist in interpretation of enthymemes. Note that the schemes listed by Walton et al. are not claimed to be exhaustive, and we have found variants of them in biomedical text (Green, 2015a; 2015b). The schemes we have identified are described at a level of abstraction that should be applicable to other qualitative causal domains.

We have argued previously that analysis of argumentation differs from analysis of discourse in models such as argumentative zoning (AZ) (Teufel, 2002) and CoreSC (Liakata et al., 2012). For example, consider the following excerpt from a biomedical research article (Schrauwen et al., 2012):

(1) Next, we checked the inheritance of the *CABP2* variant in the entire Sh10 family (Figure 1) and screened an additional 100 random Iranian controls to ensure that the variant is not a frequent polymorphism.

(2) The mutation was not detected in any of the controls, and inheritance was consistent with hearing loss in the family.

In models such as AZ, the first sentence might be described as MTH (Method) and the second as RSL (Result). However, it is beyond the scope of that type of model to represent the two arguments conveyed in (1)-(2). The first argument is an instance of a causal argumentation scheme related to Mill's Method of Agreement (Jenicek and Hitchcock, 2004):

- Premise: All the affected members of Sh10 had the *CABP2* variant.
- Conclusion (implicit): The *CABP2* variant may be the cause of the condition in Sh10.

The underlying argumentation scheme can be described as follows:

- Premise: A group of individuals I present with an atypical property P, and all have in common an atypical feature F.
- Conclusion: F may be the cause of P in I.
- Critical question 1: Do the members of I have some other feature in common that could be the cause of P?
- Critical question 2: Is there a plausible causal mechanism linking F to P?

The second argument is an instance of a causal argumentation scheme related to Mill's Method of Difference (Jenicek and Hitchcock, 2004):

- Premise: The affected members of Sh10 had the *CABP2* variant.
- Premise: No one in a control group nor any unaffected members of Sh10 had the *CABP2* variant.
- Conclusion (implicit): The *CABP2* variant may be the cause of the condition in Sh10.

The underlying argumentation scheme can be described as follows:

- Premise: A group of individuals I present with an atypical property P, and all have in common an atypical feature F.
- Premise: A group of individuals C do not present with P and none have F.
- Conclusion: F may be the cause of P in I.
- Critical question 1: Is there some other difference between the members of I and C which could account for P?
- Critical question 2: Is there a plausible causal mechanism linking F to P?

Note that in each of the arguments, the premises were expressed in both (1) and (2), and the conclusions were implicit.

In models of discourse coherence such as Rhetorical Structure Theory (RST) (Mann and Thompson, 1988) or related models employed in annotation of corpora such as the Biomedical Discourse Relation Bank (Prasad et al., 2011), the two parts of (1) separated by 'to ensure that' might be labeled with the Purpose relation, and the relation of (1) to (2) with Result. Thus, using the Result label here would conflate premises of two different arguments. In RST the Evidence relation could be used to capture the relationship of premise to conclusion. However, since some approaches to annotation of discourse relations only permit annotation of explicitly conveyed propositions, it would not be possible to relate (2) by the Evidence relation to the conclusion in each argument.

Another challenge in using discourse coherence relations to characterize argumentation is that most coherence models require textual contiguity. Green (Green 2010) proposed ArgRST, an extension to RST for argumentation analysis permitting non-contiguity and representing implicit components identified by the analyst; identification is enabled by use of the preceding discourse context, the presumed common ground of the reader and writer, the writer's domain knowledge, and constraints of the argumentation scheme. In ArgRST, the relations of Background, Evidence, Concession and Antithesis were used to describe arguments and counterarguments; Summary and Restatement were used to describe multiple (possibly summarized) occurrences of the same argument in a text; and RST analyses were annotated with names of argumentation schemes.

However, RST's constraints on Evidence and other relations are more general than constraints of argumentation schemes. For example, they do not express the differences between the Method of Agreement and Method of Difference argument schemes described above. Note that distinguishing the two argumentation schemes also is important since different critical questions are associated with them. A critical question that could be posed in response to the above Method of Agreement argument is whether the affected members of the family have some other mutation in common which could explain hearing loss. A different critical question that could be posed in response to the above Method of Difference argument is whether there is some other difference between the unaffected individuals (in the control group as well as unaffected family members) and the affected family members that could explain hearing loss. It is not clear how to associate critical questions of argumentation schemes with coherence relations. Although one can superimpose an argumentation scheme-based analysis onto an RST analysis, as was attempted in ArgRST, it makes more sense to represent coherence and argumentation in separate models. Analysis of argumentative zones (e.g. MTH and RSL) and discourse coherence relations (e.g. Result and Evidence) still could be useful in recognition of argumentation schemes. Also, mapping an argumentation structure to an RST structure could be useful in natural language generation, as was done in (Green et al. 2011)

2 Applications

Analysis of the argumentation scheme underlying an argument can help determine implicit premises and/or an implicit conclusion. Ideally, then, an automatically generated summary of an argument should include its implicit components. In applications designed to support critical thinking, the argument summary also could include instantiations of the critical questions of the argumentation scheme. Furthermore, critical questions play a key role in automatic summarization of a group of interrelated arguments. In argumentation theory, posing/responding to critical question is one way of opposing/supporting a posi-

tion. In (Green, 2012), we provided an analysis of the complex argumentation, including enthymemes and responses to critical questions, involved in marketing genetic testing to the healthcare consumer. Future applications may provide such an analysis automatically.

The long-term goal of our recent research has been argumentation mining of scientific research articles, using biomedical articles on genetic mutation as a challenging test bed (Green 2014a, 2014b, 2015a, 2015b). As a step towards that goal, we have analyzed and defined some argumentation schemes used in that literature. An interesting question is to what extent those argumentation schemes are applicable in other scientific domains. As an informal experiment, we analyzed part of the debate on global climate change presented on a government web site and found use of causal argumentation schemes similar to those we have found in our test bed.

3 Concluding Thoughts

Feng and Hirst (2011) attempted automatic classification of argumentation schemes using surface features of a text. However, their approach presupposed that the premises and conclusions given explicitly in a text would be classified as such before argumentation scheme recognition would be performed. Also, their approach did not infer implicit components of arguments. It is not clear how well that type of approach will overcome the challenges outlined in section 1 and support the types of applications described in section 2. In contrast, our strategy will be to use semantic definitions of argumentation schemes and inference-based techniques.

References

Feng, V. and Hirst, G. 2011. Classifying Arguments by Scheme. In *Proceedings of the 49th Annual Meeting of the Association for Computational Linguistics*, Portland, OR, 987-996.

Green, N. 2010. Representation of Argumentation in Text with Rhetorical Structure Theory. *Argumentation* 24(2): 181-196.

Green, N.L., Dwight, R., Navoraphan, K., and Stadler, B. (2011). Natural Language Generation of Biomedical Argumentation for Lay Audiences. *Argument and Computation* 2(1), 23-50.

Green, N. 2012. Argumentation and risk communication about genetic testing. *Journal of Argumentation in Context*. Volume 1, Issue 1 (2012), 113-129. Reprinted in Rubinelli, S. and Snoeck Henkemans, A.F. (Eds.) Argumentation and Health. Vol. 14 Benjamin Current Topics 2014. Amsterdam: John Benjamins, 113-128.

Green, N. 2014a. Towards Creation of a Corpus for Argumentation Mining the Biomedical Genetics Research Literature. In *Proc. First Workshop on Argumentation Mining*, Association for Computational Linguistics, Baltimore, Maryland, USA.

Green, N. 2014b. Argumentation for Scientific Claims in a Biomedical Research Article. In Cabrio, E., Villata S., and Wyner, A. (Eds.) *ArgNLP 2014: Frontiers and Connections between Argumentation Theory and Natural Language Processing*, Forli-Cesena, Italy, July 21-25, 2014, CEUR Workshop Proceedings, Vol-1341.

Green, N. 2015a. Identifying Argumentation Schemes in Genetics Research Articles. In *Proc. Second Workshop on Argumentation Mining*. Conference of the North American Chapter of the Association for Computational Linguistics – Human Language Technologies (NAACL HLT 2015), May 31-June 5, 2015, Denver, Colorado, USA.

Green, N. 2015b. Annotating Evidence-Based Argumentation in Biomedical Text. In *Proc. 2015 Int. Workshop on Biomedical and Health Informatics, IEEE Int. Conf. on Bioinformatics and Biomedicine (BIBM 2015), Washington, D.C, Nov. 9-12, 2015*, IEEE Computer Society Press.

Jenicek, M. and D. Hitchcock, *Logic and Critical Thinking in Medicine*, American Medical Association Press, 2005.

Liakata, M, et al. 2012a. Automatic recognition of conceptualization zones in scientific articles and two life science applications. *Bioinformatics* 28(7).

Mann, W. and Thompson, S. 1988. Rhetorical Structure Theory: Towards a Functional Theory of Text Organization. *Text* 1988, 8(3), pp. 243-281.

Schrauwen et al. 2012. A Mutation in CABP2, Expressed in Cochlear Hair Cells, Causes Autosomal-Recessive Hearing Impairment. *The American Journal of Human Genetics* 91, 636-645, October 5, 2012.

Prasad, R., McRoy, S., Frid, N., Joshi, A., and H. Yu. 2011. The Biomedical Discourse Relation Bank. *BMC Bioinformatics* 2011, 12:188.

Teufel, S. 2010. *The Structure of Scientific Articles: Applications to Citation Indexing and Summarization*. Stanford, CA, CSLI Publications.

Walton, D., Reed, C., and Macagno, F. 2008. *Argumentation Schemes.* Cambridge University Press.