Extended Abstract: My research relevant to the Argument Knowledge Graph workshop

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Abstract

Some of my past and current research has addressed the generation and mining of scientific argumentation in monological text. Rather than representing argumentation in a knowledge graph (KG), arguments represented in propositional logic were generated from knowledge bases (KBs) using argumentation schemes [Green]. Argumentation schemes are abstract patterns describing types of arguments that are acceptable to a community.

In the GenIE project [Green, 2017], arguments were generated as part of a genetics counseling system. The KB represented accepted knowledge about genetic conditions and specific information about a patient's case. Arcs in the KB represented various qualitative causal relations between nodes. The argument schemes needed for this application represented simple paths through a KB: Effect to Cause, Cause to Effect, Joint Cause to Effect (e.g. the genetic contribution of each parent to a child), etc. Generating arguments on the fly for this type of application affords greater flexibility than storing and adapting previously written arguments addressed to genetic counseling clients.

More recently, we have attempted to model scientific argumentation in genetics research articles [Green, 2018]. Whereas the genetic counseling domain involves a simplified, accepted model of genetics to warrant the claims about a patient's case, the goal of scientific research is to discover new knowledge by rejecting or refining current models or proposing a new model. Thus, the argument schemes and type of KB used in GenIE were not sufficient to model scientific research. We proposed a method in which certain relational propositions (has_genotype, has_phenotype, cause, etc.) would be extracted from an article to create a (temporary) KB. Then, argument schemes implemented as logic programming rules would be applied to the KB to generate arguments, representing the arguments conveyed in the text. The argumentation schemes were formulated in terms of the extracted semantic predicates. The argument patterns implemented as schemes were specializations of Mills' Method of Agreement, Mills' Method of Difference, Analogy, etc. We demonstrated this approach by manually annotating a set of relational propositions and arguments in a single research article.

In a recent experiment, we attempted to acquire such argumentation schemes by inductive logic programming [Green and Crotts, 2021]. Using the previously annotated research article, the annotated arguments were given as positive examples for ILP. The relational propositions were used as background knowledge as well as certain domain knowledge that was not explicitly stated in the article (e.g., that a certain genotype is a specialization of another genotype). Then applying the argument schemes acquired by ILP, we performed an incremental interpretation of the arguments in the text. Incremental interpretation is necessary since an argument may have had an implicit conclusion (i.e., that was not stated in the text) which was later used as a premise of a subsequent argument. In addition to deriving the arguments that had been annotated, this method discovered arguments that had not been annotated, such as arguments with the same conclusion using different data or a different argument scheme. We showed that at the end of this process, the sequence

of conclusions mined from the article could be represented in a graph. This graph could be used in the future for summarization. If one wished to permanently store the results of argument mining, the graph along with the premises and argument scheme used to derive each conclusion could be stored in some formalism such as the Argument Interchange Format (AIF) [Chesnevar et al., 2006].

References

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