Web-based Mass Argumentation in Natural Language

Adam Wyner
Department of Computer Science
University of Liverpool
adam@wyner.info

Tom van Engers
Leibniz Center for Law
University of Amsterdam
vanengers@uva.nl

ABSTRACT

We provide a novel framework and implementation which integrates tools to support the acquisition of mass, distributive, incremental, dynamic, argumentative knowledge in natural language. With the Attempto Controlled English (ACE) system, natural language statements are automatically translated to a machine processable form. A discussion forum allows the specification of argumentation theoretic relationships among statements. Statements and their relationships are input to a formal, implemented argumentation system, which calculates inferences from asserted premises.

Keywords

Natural Language Processing, Argumentation, Knowledge Engineering

1. INTRODUCTION

There exist robust systems for building ontologies and instantiated knowledge bases using natural language input, which in part help to overcome the knowledge bottleneck of translating human knowledge, expressed in natural language, into machine processable information. However, ontologies and knowledge bases may be debatable and inconsistent. Formal argumentation systems have been developed to reason with inconsistent, defeasible knowledge bases [1] and [2]. Yet, such systems are abstract; translating arguments which are expressed in natural language into formal argumentation frameworks is labour and knowledge intensive. A tool which supports users to build and argue about ontologies and knowledge bases in natural language could find widespread application in important domains. Among many possible application areas, we consider public policy-making, wherein members of the public contribute statements on policy [3]. While current tools, e.g. argument visualisation *DebateGraph*[1] or forums *Have Your Say*[2], allow web-based contributions by the public, they do not fully analyse the linguistic content of the contributions nor structure the argumentative relationships among the statements, losing information and hindering automated reasoning. In this paper, we outline a natural language interface tool to formal argumentation systems using the Attempto Controlled English system (ACE)[3], integrated with a discussion forum to specify statement relationships, which then outputs an argument graph on which reasoning can be executed; the theoretical framework is detailed in [4, 5]. In the following, we briefly discuss an example and the implemented components.

[1]http://debategraph.org
[2]http://www.bbc.co.uk/news/have_your_say/

International Conference on Knowledge Engineering and Knowledge Management 2010 Lisbon, Portugal

2. EXAMPLE

[5] provide a normalised example that has been adapted from the BBC's *Have Your Say* online discussion of the question *Should people be paid to recycle?* In normalising the sentences, we have followed the lexical and syntactic conventions of ACE. The have a sample from the 19 statements:

> p5: If a household pays a tax for the household's garbage then the tax is unfair to the household. p6: Every household should pay an equal portion of the sum of the tax for the household's garbage. p7: No household which receives a benefit which is paid by a council recycles the household's garbage. p8: Every household which does not receive a benefit which is paid by a council supports a household which receives a benefit which is paid by a council.

The statements p6, p7, and p8 are should be taken as supports for the claim in p5.

3. SYSTEM OUTLINE

We outline an implemented system which is theoretically described in [4, 5]; the components and flow through are represented in Figure 1. We give illustrative fragments of the components of the system.

A Discussion Forum.

We have a *user* and a web-based *threaded discussion forum* (which uses PhP, MySQL, and XML). As with standard threaded forums, the user can read statements, select a statement to respond to, and enter a new statement. In addition to entering the statement itself, the user selects the argumentation theoretic relationship between the input statement and previous statements on the forum, where

[3]http://attempto.ifi.uzh.ch

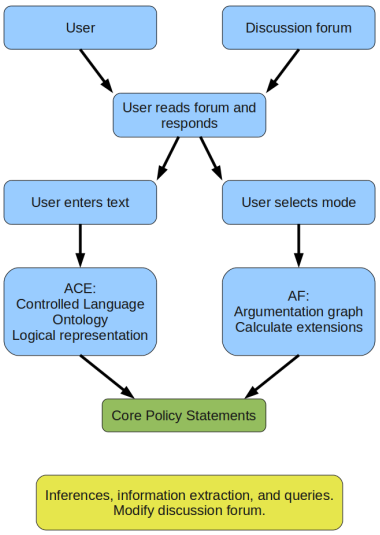

Figure 1: Flow of Input

the choices are among *contradiction*, *premise*, or *conclusion*. These relationships are also stored in the MySQL database. Figure 2 shows the statements (5)-(8) in the forum.

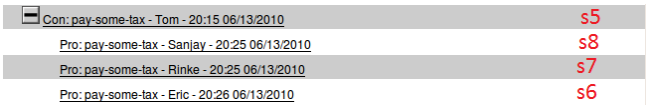

Figure 2: Discussion List

ACE.

In entering a new statement, an ACE editing window opens which provides a *predictive editor* that guides the user to input well-formed statements using the ACE grammar and lexicon. A controlled natural language is a formal yet expressive subset of a natural language with a restricted lexicon, restricted range of syntactic forms, and correlated semantic interpretations. After entering the statement, it is parsed and semantically interpreted as a statement of First-order Logic; the parse and semantic interpretation is stored in an XML representation in the MySQL database for further processing. For instance, inputting "Every household creates some garbage." automatically generates a First-order Logic representation:
$\forall$ x [[household'(x)] $\rightarrow \exists$ y [garbage'(y) $\wedge$ create'(x,y)]]
As reported in [4], the sentences in the example are all parsed and given accurate semantic interpretations in ACE.

A Formal Argumentation System.

The statements in their relationships are then used to *generate* an argumentation graph such that, given asserted premises, one can infer conclusions, which are also stored in the MySQL database. In Figure 3, from the premises p6, p7, and p8, we infer with a good likelihood (indicated by +.53), that p5 follows. The assertions and premises can, in a policy discussion, be taken as the *core policy statements*. While here we have used [2], other argumentation formalisms are possible [5].

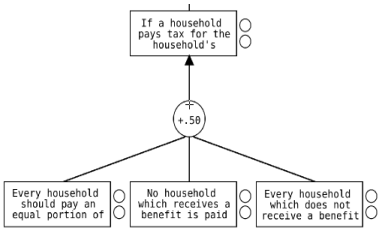

Figure 3: Graphic Fragment of Recycling Debate

4. DISCUSSION

With respect to the database of statements, relationships, assertions, and inferences, one can apply further processes such as information extraction and querying. In future work, we intend to extend the expressivity of ACE to cover deontic notions (e.g. obligation), to support interactive feedback for questions on implicit information, to give greater interactive guidance on well-formedness of expressions, to leverage ontological information, and to enrich argumentative information. Finally, we will examine the applicability of the system to a range of other domains in the social and empirical sciences.

Acknowledgements

We thank the European Commission for supporting this research in the IMPACT Project (Integrated Method for Policy making using Argument modeling and Computer assisted Text analysis) FP7 Grant Agreement No. 247228. We thank Kiavash Bahreini for system development and graphics.

5. REFERENCES

[1] P. M. Dung. On the acceptability of arguments and its fundamental role in nonmonotonic reasoning, logic programming and n-person games. *Artificial Intelligence*, 77(2):321–358, 1995.

[2] T. Gordon, H. Prakken, and D. Walton. The carneades model of argument and burden of proof. *Artificial Intelligence*, 171:875–896, 2007.

[3] A. Macintosh. Moving toward "intelligent" policy development. *IEEE Intelligent Systems*, 24(5):79–82, 2009.

[4] A. Wyner, T. van Engers, and K. Bahreini. From policy-making statements to first-order logic. In *Proceedings of International Conference on Electronic Government and the Information Systems Perspective (EGOVIS 2010)*, Lecture Notes in Computer Science. Springer Verlag, 2010. To appear.

[5] A. Wyner, T. van Engers, and A. Hunter. Working on the argument pipeline: Through flow issues between natural language argument, instantiated arguments, and argumentation frameworks. In *Proceedings of the Workshop on Computational Models of Natural Argument*, 2010. To appear.