Arguing to Support Human-like Computing

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Abstract. Inter-human communication rests on the exchange of opinions, built up of claims and justifications for these claims, as well as rebuts and undercuts to the claims. It has been argued that such argument based dialogues underpin human reasoning, and in fact, some have argued that human intelligence has evolved in order to improve the ability to argue [4].

The study of argument, and its relation to reasoning, has been studied for millennia. More recently, computational models of argument have emerged, with Dung's abstract model [3] describing a *semantics* for argumentation — given a set of atomic arguments which interact with each other through the notion of attack or defeat, this model describes which subset arguments can be considered as justified. It has been shown by several researchers that human intuitions broadly agree with Dung's model [2].

Researchers have also proposed instantiated models of arguments [5]. Here, a logical language captures facts and describes defeasible rules from which new conclusions can be drawn. Sequences of facts and conclusions, linked by rules, then form arguments which, in the presence of inconsistency, attack each other, and which are evaluated according to Dung's semantics.

Abstract and instantiated argumentation systems provide a means to encode knowledge in a way reminiscent of human argument. However, for humans, such arguments are often presented in some order, and this ordering is critical to the reasoning process, as the conclusions of one argument may cause specific other arguments to be introduced, while others are ignored. The combination of argumentation and *dialogue* or monologue therefore facilitates not only reasoning, but also a search mechanism through the space of possible arguments. It has been shown that argumentation can aid in the understanding of complex concepts [1] in areas such as legal reasoning and decision support.

Argumentation forms a human-understandable form of reasoning, which also appears to capture — and underpin — important aspects of the human thought process. However, many open research questions still remain. For example, there are open questions about which dialogues are most appropriate to facilitate human understanding of computational argument; how quantitative properties should be integrated into argumentation; and how argumentation can integrate with the belief revision process. We believe that any human-like computational system will utilise argumentative processes, and aim to describe some solutions to these open challenges.

References

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