Taxonomising Argument Types

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Abstract argumentation frameworks were introduced by Dung [2] to explore the interactions between arguments viewed at the most abstract level. He identified a single relation between arguments, "attack", the idea being that an argument would be defeated by its attacker, unless that attacker was itself defeated. Subsequently preference and value based frameworks distinguished between *attack* and *defeat*, so that it was possible to resist an attack if the attacked argument was preferred [4]. Other researchers have been interested in support as well as attack. For some, support for an argument is a second relation between abstract arguments, but others define it in terms of arguments which defeat its attackers. Others have explored structured arguments, in which an argument has several components, including (at least) a conclusion and premises [5], and support is expressed in terms of these components.

What is relatively unexplored is a degree of abstraction between fully structured and fully abstract argumentation. At this level several types of arguments and attacks can be identified. While types of argument and restrictions on the ways in which they can be attacked have been mentioned, there has been little systematic exploration of the roles, relations and effects of such types. We distinguish between practical arguments, where the conclusion suggests an action to be performed, and theoretical arguments, which suggest that a certain statement is true. Key here is the "direction of fit" [7]: in theoretical reasoning beliefs are made to fit the world, but in practical reasoning the world is changed so as to fit what is desired. Both kinds of arguments may be strict, valid without exceptions, or defeasible, normally (or typically, or presumptively) valid. The strict/defeasible distinction has rarely been made explicitly for practical arguments. In some planning systems they appear to be assumed to be strict when forming the plan and then performance is monitored to see whether replanning is needed, although others treat them as defeasible [1] during plan formation.

For attacks we start from the well-known distinction between *rebuttals*, arguments for a contrary of the conclusion; *underminers*, arguments that a premise does not hold; and *undercutters*, which challenge the applicability of the inference rule used [5]. For practical arguments we further distinguish between standard rebuttals, which argue that an action should not be performed, and *alternatives*, which argue that a different, incompatible, action should be performed. We also add a *counter example* attack, which is used to show that an argument is not strict.

To facilitate integration of practical and theoretical reasoning we give a common semantics in terms of Action Based Alternating Transition Systems (AATS) [8]. AATS are a variety of state transition diagram in which each transition corresponds to a 'joint' action which is formed by every agent performing some (independently chosen) action. AATS have been used to supply a semantical structure for practical argumentation [1], which additionally requires each transition to be labelled with the social values promoted

and demoted by the transition. For theoretical reasoning, the states of the AATS can be regarded as possible worlds, with the initial state as the actual world. We can then provide the conditions to instantiate all arguments available in a given world (or set of worlds) and the attacks on them in terms of an AATS. While seventeen ways of attacking practical arguments were defined in AATS terms in [1], these were not been characterised as rebuttals, undercutters and underminers.

We now examine which types of argument are subject to which kinds of attacks. While it has been noted that strict theoretical arguments can neither be rebutted nor undercut, there is no explicit discussion of other arguments types: for example, the attacks that can be used against strict practical arguments. We also consider properties of the different kinds of attack: for example rebuttals always give rise to a mutual attack between the arguments concerned, whereas undercutters are always uni-directional.

It is also important to analyse how attacks are resolved: often there is an appeal to preferences. But whereas resolution of practical rebuttals is in terms of subjective choice, often expressed in terms of the social values promoted by the arguments [1], the choice for theoretical arguments is more constrained (cf. [6]). For theoretical arguments it will be necessary to consider non-monotonic logics, such as circumscription [3], and probabilities. Choice can arise if the degree of risk an agent is willing to accept needs to be considered. These considerations may give rise to additional kinds of arguments, such as preference arguments, and possible extensions to the set of propositions constituting a state (e.g. to represent *ab* predicates for circumscription), or even the AATS (e.g. to explicitly represent audiences).

A key contribution of this work is to propose a means of integrating strict and practical reasoning in a principled fashion by basing both on the AATS structure. There may well be computational implications of this analysis, but here our focus is on strategies for attacking an argument: given that attack options are limited, a particular kind of argument can only be attacked in particular ways, and often some kinds of attack will be preferred over others. Also some attacks need to be used in combination. Thus to attack a strict theoretical argument in the absence of underminers, one will first find a counter example, and then need an undercutter or rebuttal to attack the resulting defeasible argument. In the case of a rebuttal, an argument to prefer the attacker will also be needed. Understanding of these strategies will improve the naturalness of computational dialogues.

References

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