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Today

As often as possible, we invite one or two question/comment/review statements for each submitted research article. Today we transmit such an invited review by Fangzhen Lin to Camilla Schwind's recently submitted article on Causality in Action Theories.

Murray Shanahan has withdrawn his recently contributed reference article on the event calculus, but with an intention to resubmit a similar article later.

ETAI Publications

Discussion about received articles

Causality in Action Theories

by **Camilla Schwind**

Comment from: **Fangzhen Lin**

Given that an online open review is written not just for the author and editors, but also for other readers, some of whom may not even have a chance to read the paper yet, it seems to me a good idea to summarize the paper first.

This paper considers statements of the form "A causes B", and proposes the following nine criteria to characterize them (in the following, I shall use $\Rightarrow$ to stand for "causes"):

1. Monotonicity: this concerns the question of whether from $A \Rightarrow B$, one can conclude that $A \wedge C \Rightarrow B$ for any C. This property should not hold, according to the author. In the following, all answers are those according to the author.

2. Transitivity: from $A \Rightarrow B$ and $B \Rightarrow C$, should one always conclude $A \Rightarrow C$? No.

3. Contraposition: from $A \Rightarrow B$, should one conclude $\neg B \Rightarrow \neg A$? No.

4. Reflexivity: Should $A \Rightarrow A$ always be true for any A? No.

5. Conjunction of preconditions: from $A \wedge B \Rightarrow C$, should one conclude that either $A \Rightarrow C$ or $B \Rightarrow C$ must be true? No.

6. Conjunction: from $A \Rightarrow B$ and $A \Rightarrow C$, should one conclude $A \Rightarrow B \wedge C$? Yes.

7. Reasoning by cases: from $A \Rightarrow C$ and $B \Rightarrow C$, should one conclude $A \vee B \Rightarrow C$? Yes.

8. Right weakening: from $A \Rightarrow B$ and that C logically follows from B (in classical logic), should one conclude that $A \Rightarrow C$? Yes.

9. Left logical equivalence: from $A \Rightarrow B$ and that A and C are logically equivalent, should one conclude $C \Rightarrow B$? Yes.

It then proceeds to consider five theories of causation found in the area of reasoning about actions and classify them using these nine criteria.

It seems to me that this is a reasonable approach to take for comparing various theories of causation, and the only paper that I know of that attempts to connect commonsense notion of causation with recent formal theories of causation proposed in the area of reasoning about actions.

I have no idea how fruitful it would be to connect causal theories of actions to commonsense notion of causation. My following comments and questions are only about issues that in my opinion are relevant to reasoning about actions.

1. First of all, why these nine conditions? In the paper, these conditions are often compared to the corresponding ones for material implication in classical logic. But there are many other properties of implication. For instance, if p implies q, then p implies $q \vee r$ for any r. What is the corresponding property about causation? Is it a property worth investigating?

2. A related but more important question is how revealing these conditions are. For instance, the paper shows that some particular interpretations of McCain and Turner's causal logic (McCain & Turner AAAI'97) and Lin's causal action theory (Lin IJCAI'95) are monotonic and transitive, contrary to the proposed criteria 1 and 2 above. Now how bad this is for the two logics in question? Does it tell us anything about the range of applications of these two logics?

3. These nine conditions are about statements of the form "A causes B". But it seems to me that many theories of causation in the area of reasoning about actions are not directly about this kind of statements. For instance, Geffner (AAAI'91), Giordano et al (ECAI'98) and Turner (AIJ 1999) all use a modal operator, and Lin (IJCAI'95) uses a predicate that has only one argument for fluents. It makes a lot of difference whether to represent 'A causes B' as, for example, $\Box A \rightarrow \Box B$, $A \rightarrow \Box B$ (the one used in the paper), or $\Box(A \rightarrow B)$. It seems to me that there are good reasons for not going into a logic about the binary causal connective $\Rightarrow$. On the one hand, the logic would be a lot more involved. One the other hand, it is not necessary for the purpose of reasoning about the effects of actions.

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