ELECTRONIC NEWSLETTER ON
REASONING ABOUT ACTIONS AND CHANGE

Issue 98056 Editor: Erik Sandewall 14.7.1998

Today

Today's newsletter contains the answer by Jixin Ma to Erik Sandewall's question yesterday in the discussion about the ontology of time, plus a question from Michael Thielscher to Marc Denecker, Daniele Theseider Dupré, and Kristof Van Belleghem, making it the third question for their ETAI submitted article.

ETAI Publications

Discussion about received articles

An Inductive Definition Approach to Ramifications

by Marc Denecker, Daniele Theseider Dupré, and Kristof Van Belleghem

Comment from: **Michael Thielscher**

Dear Marc, Daniele and Kristof,

I have a question concerning the notion of negative cycles. If I understand correctly, they arise whenever the absence of some causation is the cause of some effect. Now, on page 23 you consider a construction like

$$caus(p) \leftarrow \neg caus(q)$$
$$caus(q) \leftarrow \neg caus(p)$$

ambiguous or nonsensical. But what if you specified, say, the effect of tossing a coin by "if heads isn't caused, then tail is" and "if tail isn't caused, then heads is." The expected model would be that either of heads or tail is caused, which is what the stable models semantics proposes. Of course it is questionable whether the above is a good specification of tossing a coin, but I would argue that this is due to the notion of "absence of causation as cause" being rather odd from an intuitive point of view in general. I therefore wonder if this notion is really needed? The suitcase scenario, for example, can be handled with Lin's approach (and others) without this notion.

Also I would like to make a remark on your discussion on zero vs. nonzero delays (Section 6). This is a very interesting question, and I have recently discovered a related problem in connection with my method of using causal relationships: If effects with zero delay are not distinguished from effects with real delay, then some desirable conclusions may not follow. Since your approach has much in common with mine, I wonder if the distinction between so-called steady and stabilizing state constraints, which solves the problem in my approach, is needed here as well? (C.f. my paper entitled "Steady vs. Stabilizing State Constraints" at this year's CommonSense workshop; see

`http://www.ida.liu.se/ext/etai/nj/fcs-98/listing.html`

Michael

Debates

Ontologies for time

From: Jixin Ma

In ENRAC 11.7 (98054), Erik wrote:

> *I had actually asked for something more concrete: a scenario that can't be expressed, or a scenario query that requires inordinately long completion time, for example. Is it possible to be more specific about in what sense it "will be more difficult" to represent time points that stand between intervals?*

As I put in my former arguments, for many practical cases (e.g., in cognitive robotics perspectives), the Dividing Instant Problem may be just simply dealt with by means of taking point-based intervals as semi-open. However, from the perspectives of philosophy, or commonsense reasoning, this approach seems arbitrary in deciding which end the intervals should include/exclude. The choice has to be artificial and hence unjustified. For example, there is nothing to justify the reason why the light MUST BE off (or on) at the switching point, although, practically, one may just artificially take a choice which will make the robot work well in most cases (But who can prove, even practically, there is no problem for ALL cases?).

As for the sense of "it will be difficult to represent time points in an appropriate structure so that they can stand between intervals conveniently", what I mean here is, if all time intervals are taken as semi-open and therefore they can sit next to one another, it would br difficult to allow time point to stand between intervals, since it is not appropriate to represent time points with the semi-open structure.

> However, it seems that by some careful and proper treatments, we may also reach the same results by defining the concepts of intervals based on points. The key point here is, in addition to the concept of lower and upper bounds for point-based intervals, the concept of left type and right type for intervals needs to be addressed as well. What follows is the skeleton of the structure:
>
> 1. P is a partially-ordered set of points;
> 2. $Type$ is a two-member set $\{open, closed\}$;
> 3. An interval i is defined as a quaternion $seq(p1, p2, l, r)$ such that:

- $p1 \leq p2$
- l and r belong to *Type*
- if $p1 = p2$ then $l = r = closed$

Yes, but how does this differ from the standard notions of open and closed intervals? It would appear that

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(a,b,open,open) = (a,b)
(a,b,open,close) = (a,b]
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and so on. Are there some models where your fourtuple intervals can not be reduced to standard definitions, such as

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(a,b) = {x | a < x < b}
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and so on? Do those "nonstandard" models have some interesting properties?

First of all, in the quaternion form (p1, p2, l, r), the left-type, l, and right-type, r, are allowed to be unspecified. Therefore, without knowing what is the exactly value of r' and l", we can still have Meets((p1',p2',l',r'), (p1",p2",l",r")) if we just have $r' \neq l''$. This allows one to express the case that the light changes from state "Off" to state "On" (but without modelling the state of the light at the switching point), that is the case 3 in the classfication given in my former contributions to the ETAI. However, if we insist on that the light is "On" at the switching point p2, then we have $r' = open$ and $l'' = closed$. This is the case 1. Similarly, we can express case 2, that is the light is "Off" at the switching point.

Secondly, for general treatments, intervals don't necessarily have to be sets of points, though they can be specified as such a model, e.g., as Erik suggested, $seq(a, b) = \{xmidaltxltb\}$. In fact, we can have various other models. For instance, we may specify that all the bounding points of time intervals are integers, while the internal points are all the reals bounded by the bounding points. In fact, we can have models which can be discrete, dense, or neither discrete nor dense. Also, we may have models which can be linear (one or both directions), parallel, circular, bounded (one or both sides). And so on.

In addition, both the point-based time theory using the quaternion structure, and the time theory that takes both intervals and points as primitive allow the expression of the case (case 4?) where a left-open interval Meets a point which, in turn, Meets a right-open interval (This open/closed nature would be expressed by the Meets relation when both intervals and points are taken as primitive).

What follows is an example of using the time model in modelling some critical problems:

Gelfond et al noted some of the limitations of the Situation calculus, and specially proposed an approach to represent actions with delayed effects. They use an action called *Wait* to deal with the delay between action A and its effect. That is: $Result(S0, A + Wait)$, where the duration of *Wait* equals the time delay. However, if we consider some critical cases, such as that one that throwing a ball into the air: While the ball is going up (say for just 8 seconds), the velocity is not zero (and again, not zero when the ball is going down). Only at the apex (the stationary point) where the ball is neither going up nor going down, the velocity becomes zero. Now, how to express the (delayed) effects of the action of throwing the ball? Specially, using the approach of Gelfond et al, one may use $Result(S0, Throw + Wait)$ to represent the situation 8 seconds after throwing the ball (here, we assume the duration of Wait is 8 seconds). However, in this result situation, is the velocity zero or not? The answer is not unique.

In fact, there are two situations, one is the situation where the ball is at the stationary point, another is the situation immediately after the stationary point. Both of them satisfy that the *Wait* action lasts for 8 seconds. Gelfond's approach seems unable to distinquish these two delayed effects. I have put this question to Pat in my former discussions with him, and he suspected (and I have the same feeling) that the real problem with the idea of Gelfond et al, like many applications of sitcalc, is that it doesn't give one a good way to distinguish 'instantaneous' situations from 'stable' ones (where eg the block is on the table).

However, if we associate actions with "typelised" point-based intervals, we may sucessfully express them. For the former, the associated interval's right type is "open", i.e., excluding the stationary point; while for the latter, the associated interval's right type has to be "closed", i.e., including the stationary point. For both cases, the left type may be unknown.

Jixin
