ELECTRONIC NEWSLETTER ON REASONING ABOUT ACTIONS AND CHANGE

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Today

August is pretty slow in this medium. Some of the readers have come back from the AAAI, others are preparing to go to the ECAI next week, and many are on vacation. Today we have a set of questions by Chitta Baral to Murray Shanahan's ETAI submitted article. (See also the questions by Paulo Santos to Murray on August 1). Furthermore, the third anonymous referee for Erik Sandewall's article has a follow-up question. The present Newsletter contains the question and the answer.

ETAI Publications

Discussion about received articles

A Logical Account of the Common Sense Informatic Situation for a Mobile Robot

by **Murray Shanahan**

Comment from: **Chitta Baral**

Dear Murray:

It was nice (but a little exhaustive :-)) reading your paper. I hope the following feedback will be useful.

In this paper you have initially (Section 2-5) expressed using logic: actions and their effects, occurrences of robots actions, initial value of fluents, event calculus axioms, domain constraints, formulation of continuous change using the release predicate, representation of space and shape, and axioms about triggered events.

Given information on occupies (at the initial situation) the formulation can predict occurrence of triggered events. You rightly argue that an abductive method can make conclusions about occupies when told about (or when it senses) triggered events. This is the basic essence of the first part of the paper I like the detailed logical formulation.

Some of the questions and suggestions that I have about this part are as follows:

(i) I think that in general a robot does not really sense events, rather it notices changes in certain fluent values (in say resistors linked to the sensors) from which it abduces the occurrences of triggered events. Nevertheless, it is ok with me to skip this part and directly talk about robots observing triggered events. But a clarification would help.

(ii) Since you mention several times (abstract, Section 2, etc.) that you use a novel solution to the frame problem using 'Releases' it will be nice if you say about it a little more than what is said in Section 2 (just after EC 5). (You do use it in axioms in later sections, but you don't discuss them.)

Although from the illustrations I can appreciate the use of 'Releases' in formulating continuous change, its utility in formulating constraints is not clear to me. For example, why not eliminate B4 and instead of 'Releases' have 'Terminates' in the head of rule E2.

To me the advantage of having constraints such as B4 is that by having it we avoid explicit compilation of it to effect axioms. I.e. we can use constraints for automatically deducing effects indirectly. But if we have both B4 and E2 then we are not really avoiding the compilation, as E2 is like an effect axiom.

(iii) I am not sure if 'Bearing' is a standard geometrical notion. Perhaps an intuitive meaning of it will help. Or may you can use the more familiar notion of 'slope'.

(iv) You say (just after Sp3): "the term $Line(p1, p2)$ denotes the straight line whose ...". Perhaps it is more appropriate to say "straight line segment" instead of "straight line".

(v) I think in axiom (B3) you are assuming velocity to be one. If you do please mention it.

(vi) The sentence after (B6). In it you explain $Blocked(w1, w2, r)$ by 'if object $w1$ cannot move any distance at all in direction r without overlapping with another object'. Perhaps you should say: "if object $w1$ cannot move any distance at all because of $w2$ in direction r without overlapping with another object'.

(vii) When defining $HoldsAt(Touching(w1, w2, p), t)$ are you making some assumptions about the shape of $w1$ and $w2$. Imagine two triangles which touch at a point, you can align them such that they touch but yet do not satisfy the conditions you have in B6.

(viii) I am not clear about the intuition behind the notion of partial completion in Section 5; especially in the text after (5.7).

For example in proposition 5.8, I would encode the intuition "bump switches are not tripped at any other time" by

$$Happens(Switch1, t) \rightarrow t = T_{\{bump\}}$$

and

$$Happens(Switch2, t) \rightarrow t = T_{\{bump\}}$$

I am not clear about the intuition behind your formulation.

Also, why not use the standard Clark's completion and explain the Clark's completion of Ψ, where Ψ is as mentioned in Definition 5.9 and the paragraph before. I.e, have the Clark's completion of Ψ in the right hand side of the turnstyle in Proposition 5.8

(ix) In section 6 you logically express a region as a list of straight lines. (You say it just before Bo3.) Is there any particular reason you use lists instead of sets. If not, since you already use set notation in the rest of your formulation, by using sets here also, you might avoid additional axioms such as Bo3 and Bo4

(x) Also (Bo3) is a fixpoint expression and you probably need (as needed when defining transitive closure) to minimize 'Members' to get the right models.

(Recall that the logic program

$$anc(X,Y) \leftarrow par(X,Y)$$
$$anc(X,Y) \leftarrow par(X,Z), anc(Z,Y)$$

is not equivalent to the formula

$$anc(X,Y) \leftrightarrow par(X,Y) \vee (par(X,Z) \wedge anc(Z,Y))$$

You are not minimizing 'Members' in Proposition 6.2. Or perhaps I am missing something.

(xi) In Section 7 you first take into account noise and formulate it and later define preferred explanations.

From Section 2-7 your formulation is in logic. It seems to me in Section 8 you give an independent formulation and relate it to the logical formulation with necessary and partially sufficient conditions. Your algorithms in section 9 are justified based on the formulation and results in Section 8.

(xi) Although I can appreciate the usefulness of the logical formulation in Section 2-7, some may pose the following question: Why not just formulate as in Section 8 (with some extensions perhaps) and then have the correctness of the algorithm in Section 9 proven with respect to the formulation in Section 8. Why go through the formulation in Section 2-7? I think it will be a good idea to address this or say a few lines about this to preempt such questions/attacks on logical formulation.

These are some of the questions and/or suggestions I have so far. I am reading the proofs now. If I have additional questions I will take the opportunity provided by this wonderful forum.

Best regards Chitta

Logic-Based Modelling of Goal-Directed Behavior

by **Erik Sandewall**

Comment from: **Anonymous referee 3**

Thank you for your reply to my comments. One point is still not clear to me. You claim that, in Theorem 1, there is no need to assume that the set of intervals is finite. The following seems to be a counterexample:

$$s_i = 1/(2*i+1), t_i = 1/(2*i)$$

where i=1,2,... Please explain.

Comment from: **Erik Sandewall**

Theorem 1 states that under the axioms and for *some ordering* of the intervals, $s_i < s_{i+1}$ and $t_i \leq s_{i+1}$ for all i. In your example, there is an infinite sequence of intervals that has a Zeno property and proceeds to the limit from above. This infinite sequence of intervals therefore has to be renumbered so that

$$s_{-i} = 1/(2*i+1), t_{-i} = 1/(2*i)$$

In other words, the numbering is reversed and you have to consider $i = -1, -2, \ldots$ With this ordering the consequent of the theorem holds.

Your example also shows that if there is an infinite sequence of intervals, the theorem does not hold in the limit as i tends to infinity. However, this is also not claimed.

Your example does however remind me that if one is going to be very technical, it might be better to phrase the theorem so that it states that if interval i precedes interval j under the ordering, then $s_i < s_j$ and $t_i \leq s_j$. In this way one does not give the impression that a numbering of the intervals always exists using natural numbers. Such a numbering does exist in your example, but if one combines several Zeno sequences then it doesn't. Of course all of this is very remote from the situations that arise in the context we're addressing.

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