Query Answering and Conformant Planning

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Papers

One paper on this work, entitled *"Conformant Planning for Domains with Constraints - A New Approach"* **by Tran Cao Son, Phan Huy Tu, Michael Gelfond and A. Ricardo Morales will appear in AAAI'05.**

A second paper entitled *"An Approximation of Action Theories of $\mathcal{AL}$ and its Application to Conformant Planning"* **by the same authors is submitted to LPNMR'05.**

The Problem

We are investigating how to reason about the following query:

Can an actor achieve some goal? e.g.

- **Can John fly from Boston to Baghdad?**
- **Can John meet Bill tomorrow in New York?**

If all the relevant facts about the story are known, answering these queries is reduced to finding a plan to achieve the corresponding goal. Methods for dealing with this have been available for some time already.

Incomplete Information

However, in the presence of incomplete information, such queries can be interpreted in two different ways:

a) Is there a plan that possibly achieves the goal?

b) Is there a plan that surely achieves the goal?

Example:

John is in Lubbock and wishes to fly to Orlando. There is a flight to Orlando via Dallas. However, there is a storm approaching Dallas and it is not known if flights will be canceled

- **Can John possibly reach Orlando?**

Yes

- **Can John surely reach Orlando?**

No: His flight could get canceled in Dallas

Finding the Answers

- **Answering the first query is reduced to finding a possible plan to achieve the goal.**
- **Answering the second query can be reduced to finding a** *conformant plan*, **a sequence of actions that achieves the goal from any physical state of the system compatible with the agent's knowledge.**

What is done

- We developed AnsProlog based methods for efficient conformant planning.

- These methods are sound and, under certain circumstances, complete.

- Our planners are as good or better than most advanced conformant planners available in the literature. (Efficiency is important since the problem is very hard).

- Unlike most other planners, ours can use a large amount of knowledge about both the domain and the agent's ability which is crucial for query-answering.

Uses of our Method

Our Method can be used to answer other types of queries.

- **It can be used to check if a plan is conformant or not.**

- **It can also be used to check if the effect of a sequence of actions is independent of the actual state of the world.**

Example

Fortunately the storm missed Dallas and John took the flight to Orlando. John carried a piece of carry-on baggage, and a piece of check-in baggage. The airline John used sometimes misplaces the check-in baggage.

Example

Which of John's belongings possibly reached Orlando?

His carry-on and his check-in baggage

Which of John belongings surely reached Orlando?

Only his carry-on baggage, his check-in baggage could have been misplaced

Any Questions?