Research Review
Conformant Planning

by Alexey Denisov 01/14/2018

The paper describes three research papers in the area of conformant planning.

Planning is a key area in Artificial Intelligence. In its general form, planning is concerned with the automatic synthesis of action strategies (plans) from a description of actions, sensors, and goals. Different assumptions about the nature of actions, sensors, and costs lead to various forms of planning.

Conformant planning is the problem of computing a sequence of actions that achieves a goal in presence of incomplete information about the initial state. By definition, conformant planning searches for a plan in the belief state space which has a very large size due to the incomplete information.
There are two approaches how to deal with this: 1/ to employ different compact representations of the belief state, 2/ to translate conformant planning problem to a classical planning problem.

The following research papers illustrate some relatively recent developments in the conformant planning.

[1] Conformant Planning via Symbolic Model Checking by Alessandro Cimatti et all, University of Milano, 2000
The paper describes a usage of Symbolic Model Checking techniques, in particular Binary Decision Diagrams, to compactly represent and efficiently search the planning domain as a finite state automation.
Authors present also CMBP (Conformant Model Based Planner), an implementation of data structures and algorithm described in the paper.
The analysis shows that CMBP outperforms other state-of-the-art planners (CGP, QBFPLAN and GPT).

[2] A New Approach to Conformant Planning using CNF by Son Than To et all, NMSU, 2010
The paper describes a heuristic, progression based conformant planner, called CNF, which represents belief states by a special type of CNF formulae, called CNF-state.
The overall performance of CNF on several benchmark problems shows that it is competitive with other state-of-the-art planners in many domains. In addition, it provides a better scalability than all other planners; it can solve larger instances of many problems that were challenging to previous conformant planners.

[3] Conformant Planning via Classical Planners by Khoi Nguyen, NMSU, 2011
The paper describes a new approach, called CpCl, which solves a conformant planning problem by solving several classical problems.
Author shows that a problem P can be solved by generating a solution α for one of its sub-problems and trying to create a solution of P, using α as a seed, by inserting actions to α to maintain the executability of actions in α or to achieve a goal.
The results of testing the proposed CpCl planner against state-of-the-art planners, when the appropriate strategy is used, were better than benchmarks. But using inappropriate strategy makes the results much worse.