Validating FF-Replan vs. a state-of-the-art propabilistic planner in a real world domain

I.C.T.M Speek, A.C. Stolwijk

Seminar Algorithms, Embedded Software, Msc Embedded Systems,
Delft University of Technology
{i.c.t.m.speek,a.c.stolwijk}@student.tudelft.nl

Abstract. This paper argues that for many real life domains dead-ends are the end of the world, and by for example human interaction the goal can still be reached. By relaxing the definition of a dead-end, we argue that for many real life domains a simpler planning algorithm, like FF-Replan, can be sufficient, and that it's not needed to have newer and sophisticated probabilistic planners.

1 Introduction

- Describe probabilistic planning problem
- Introduce planning for uncertainty
- Describe how deterministic classical planners can be used in probabilistic domains and motivate why this is interesting
- Introduce the qualities of replanning and the second planning algorithm
- Describe the need for a new domain for real world applications
- Describe the goal and tools used to reach this goal

2 Problem formulation

- Summarize shortcomings of the previous solutions
- Describe the planning problem
- Argument the choice for 2 current papers to analyze
- Define how we would like to test the planning algorithms in a domain by our choice

3 Domain description

- Describe domains from IPPC
- Explain shortcomings
- Evaluate a valuable real-world domain in which we can test 2 papers
- Show PPDDL or RDDL of domain (probabilistic extension of PDDL)

4 Theoretical approach

- Describe how we are using the created domain
- show pseudo code for the 2 papers
- Introduce the improvements (or combination) of the approaches of the papers fitted for the domain

5 Empirical evaluation

- Describe the experiment setup
- Show results for the experiment
- Critically analyze the results
- Compare with results from the original papers

6 Related Work

- Discuss the related work and how their approaches are different
- Discuss the other domains and why our domain adds anything to the community
- Introduce the current state of the art papers that use deterministic approaches for probablistic domains deadling with uncertainty

Probabilistic Planning via Determinization in Hindsight (2008) [15] Hindsight optimization is an online technique that evaluates one-step-reachable states by sampling future outcomes to generate multiple non-stationary planning problems which are deterministic and can be used using search. It reinterprets FF-Replan's [9] strategy randomly generating a set of non-stationary determinized problems and combining their solutions.

Improving Determinization in Hindsight for Online Probabilistic Planning (2010) [16] Hindsight optimization has enjoyed some success for online probabilistic planning. Although it has proven to be effective for many domains, it is computationally expensive. This paper presents significant improvements. 1) a method for detecting potential useful actions, 2) exploit determinism in the domain by reusing relevant plans, 2) improves action evaluation by increasing the chance that at least one deterministic plan reaches a goal.

Probabilistic Planning in the Graphplan Framework (1999) [2] Graphplan is a successful planning algorithm for classical STRIPS domains. This paper explores the extend it can be used in *probabilistic* domains. The paper discusses two variations of Graphplan: PGraphplan and TGraphplan. PGraphplan produces an optimal plan, while TGraphplan produces a sub-optimal plan but it has increased speed. By comparing the speed and quality of the two planners the authors are able to estimate how far they are from the ideal.

Compiling Conformant Probabilistic Planning Problems into Classical Planning (2013) [10]

How Much Does a Household Robot Need To Know In Order To Tidy Up? (2013) [7] For household robot planning, it appears easy, but actually involves uncertainty. For tidying things up objects might not be there, or sensing operations might tell things wrong. This paper looks into conditions for classical planning in a replanning loop in order to solve nondeterministic partially observable open domains This paper looks into conditions for classical planning in a replanning loop in order to solve nondeterministic partially observable open domains.

Progressive heuristic search for probabilistic planning based on interaction estimates (2013) [14] In this paper a probabilistic plan graph heuristic is described which computes information about the interaction between actions and between propositions. This information is used to find better relaxed plans to compute the probability of success. This information guides a forward state space search for high probability, non-branching seed plans. These plans are then used in a planning and scheduling system that handles unexpected outcomes by runtime replanning.

Translation based approaches to probabilistic planning (2013) [11]

Reverse Iterative Deepening for Finite-Horizon MDPs with Large Branching Factors (2012) [1] The IPPC-2011 introduces more realistic MDPs to accomodate real-world systems with large branching factors cause by *natural dynamics* and a limited time for the planner to come up with a policy. For this reason planners needed to be scalable and sensitive to the expected reward maximization. Glutton introduces an offline algorithm based on LR^{2}TDP and relies on the fact that a succesfull policy can be produced by solving an MDP M(H) for a smaller horizon h. Incrementally solving the sequence M(1), M(2) forms the basis of LR^{2}TDP. By iterating on the distance from the horizon, data can be reused (and is stored in the cache untill the hash-table is full). The max-reward heuristic finds the largest horizon value h' for which already a heuristic value V is estimated. The cmputation time remains much lower because it runs quickly into states that converged while solving M(h-1). The max-reward computation relies on knowing the maximum reward any action can yield in any state or an upper bound on it.

7 Conclusion

- Conclude on the success of the 2 approaches
- Conclude the work done in the paper
- Hint to some future work developments

8 Some papers

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