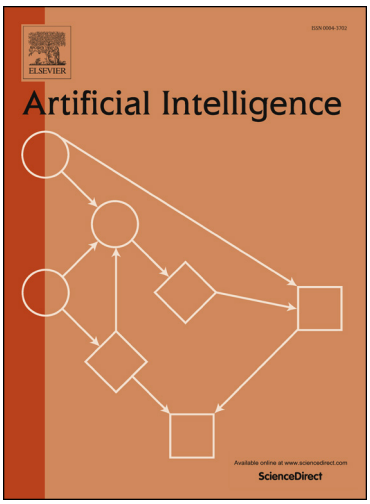
Accepted Manuscript



Rational Deployment of Multiple Heuristics in Optimal State-Space Search

Erez Karpas, Oded Betzalel, Solomon Eyal Shimony, David Tolpin, Ariel Felner

PII: S0004-3702(17)30126-1
DOI: https://doi.org/10.1016/j.artint.2017.11.001
Reference: ARTINT 3039

To appear in: *Artificial Intelligence*

Received date: 21 August 2016
Revised date: 9 October 2017
Accepted date: 3 November 2017

Please cite this article in press as: E. Karpas et al., Rational Deployment of Multiple Heuristics in Optimal State-Space Search, *Artif. Intell.* (2017), https://doi.org/10.1016/j.artint.2017.11.001

Rational Deployment of Multiple Heuristics in Optimal State-Space Search

Erez Karpas[a,*], Oded Betzalel[b], Solomon Eyal Shimony[b], David Tolpin[b], Ariel Felner[c]

[a] *Faculty of Industrial Engineering and Management, Technion, Haifa 32000, Israel*
[b] *CS Department, Ben-Gurion University of the Negev, Beer-Sheva, Israel*
[c] *ISE Department, Ben-Gurion University of the Negev, Beer-Sheva, Israel*

Abstract

The obvious way to use several admissible heuristics in searching for an optimal solution is to take their maximum. In this paper, we aim to reduce the time spent on computing heuristics within the context of A^* and IDA^*. We discuss *Lazy* A^* and *Lazy* IDA^*, variants of A^* and IDA^*, respectively, where heuristics are evaluated lazily: only when they are essential to a decision to be made in the search process. While these lazy algorithms outperform naive maximization, we can do even better by intelligently deciding when to compute the more expensive heuristic. We present a new rational metareasoning based scheme which decides whether to compute the more expensive heuristics at all, based on a myopic regret estimate. This scheme is used to create *rational lazy* A^* and *rational lazy* IDA^*. We also present different methods for estimating the parameters necessary for making such decisions. An empirical evaluation in several domains supports the theoretical results, and shows that the rational variants, rational lazy A^* and rational lazy IDA^*, are better than their non-rational counterparts.

Keywords: Heuristic search, A^*, Admissible Heuristics, Rational Metareasoning

*Corresponding author
Email addresses: karpase@technion.ac.il (Erez Karpas), odedbetz@cs.bgu.ac.il (Oded Betzalel), shimony@cs.bgu.ac.il (Solomon Eyal Shimony), tolpin@cs.bgu.ac.il (David Tolpin), felner@bgu.ac.il (Ariel Felner)