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Foundations of AI

Project 3 Implement a Planning Search

Research Review of AI Planning and Search

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Search Spaces and Planning Databases

I was intrigued by the idea of a planning database as I have spent a large part of my career and study to this point on databases. More specifically I now have been working in the medical field and am pondering ideas for how to better evaluate medical solutions. A pattern database stores a collection of solutions of solutions to sub-problems that must be achieved in order to solve the given problem.

As it was discussed in the Biographical and Historical Notes section in Chapter 10 of Artificial Intelligence A Modern Approach Third Edition planning databases show encouraging results for solving sliding puzzles, but have limitations for classical planning problems.

From the paper Searching with Pattern Databases, Joseph Culbertson and Jonathan Schaeffer experimented to apply symmetry to search. Their findings were that because of the complexity of some problems it may be thought too expensive to find optimal solutions. However they felt that with planning databases, "the database information can be used to increase the accuracy of any heuristic estimate." There for the cost of finding optimal solutions will decrease.

In researching this paper I found where Ariel Felner, Ricard Korf, Ram Meshulam and Robert Holt in 2007 wrote a paper on Compressed Pattern Databases. They were experimenting with using compressed databases to solve more difficult problems. They experimented with the classic Tower of Hanoi and Top Spin Puzzle. They were able to show that using Compressed Pattern Databases was able to significantly speed up and enhance the existing heuristics in order to tackle these problems effectively. "In the Towers of Hanoi they achieved dramatic improvements of several orders of magnitude in running time." For the Top Spin puzzle they found improvements using a very naïve compression.

In conclusion, it appears that planning databases could in some cases be used to enhance heuristic search strategies. As with anything limitations were found originally on what could be achieved with planning databases. I suspect as with most things in computer science, though, if dedicated individuals continue to try new strategies to improve performance, planning databases may continue to develop and be beneficial in future AI endeavors.

References

1. Artificial Intelligence A Modern Approach, Third Edition by Stuart J. Russell and Peter Norvig
2. Searching with Pattern Databases (1996) by Joseph Culbertson and Jonathan Schaeffer
3. Compressed Pattern Databases, Journal of Artificial Intelligence Research 30 (2007) by Ariel Felner, Richard E. Korf, Ram Meshulam, Robert Holte