REVIEW OF AI PLANNING SYSTEMS

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GRAPHPLAN:

Graphplan is a general-purpose planning system based on graph algorithms, designed by Avrim Blum and Merrick Furst in 1997 [1]. It takes STRIPS-based planning problems in a deterministic completely-specified world. The main concept of this system is that it uses a planning graph, instead of a state space graph.

It works in two alternating steps; graph expansion, and solution extraction. The graph expansion phase extends the planning graph by adding the possible next states until a necessary (but not sufficient) condition for plan existence has been reached; the solution extraction phase performs a backward-chaining search for an actual solution.

SSG (SENSORY GRAPHPLAN):

Sensory Graphplan was created as an extension of the Graphplan algorithm by Daniel Weld, Corin Anderson, and David Smith in 1998 [2]. It handles planning problems with uncertainty in the initial conditions, and with actions that include sensory effects.

The main additions are:

- An extension to the forward-chaining graph-expansion phase that derives knowledge propositions from a sensor model and the previous planning graph layer.
- The incorporation of a conditioning threat-resolution method into the backward-chaining solution-extraction phase.

STAN (STATE ANALYSIS PLANNER):

STAN is a Graphplan-based planner that uses a variety of State analysis techniques on the domain to enhance its performance. It was created in 1999 by Derek Long, and Maria Fox [3].

It has two main concepts:

- The representation of the graph as a single pair of layers built around bit vectors and logical operations.
- The use of a wave front which avoids the explicit construction of the graph beyond the fixed point.

IMPACT ON THE AI FIELD:

As we can see, Graphplan has had a big influence on planning; when introduced, it was orders of magnitude faster than the partial-order planners of the day. It spawned multiple other planners (two of which are discussed above), and is also heavily used in many heuristic search techniques.

REFERENCES:

1. A. Blum and M. Furst, "Fast Planning Through Planning Graph Analysis", Artificial Intelligence, 90:281--300 (1997)
2. Daniel S. Weld, Corin R. Anderson, David E. Smith. Extending Graphplan to Handle Uncertainty & Sensing Actions. In Proceedings of AAAI '98. 1998
3. M. Fox, D. Long, Efficient Implementation of the Plan Graph in STAN, Journal Of Artificial Intelligence Research, Volume 10, pages 87-115, 1999