Research Review

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Richard Likes and Nils Nilsson developed a new approach to the application of theorem proving to problem solving[1] called **STRIPS** (**ST**anford **R**esearch **I**nstitute **P**roblem **S**olver) in 1971. The model attempts to find a sequence of operators in a space of world models to transform the initial world model into a model in which a given goal state exists. It attempts to model the world as a set of first-order predicate formulas and is designed to work with models consisting of a large number of formulas.

Avrium Blum and Merrick Furst at Carnegie Mellon University, developed a new approach to planning in STRIPS-like domains based on constructing and analyzing a compact structure[2] in 1997. The algorithm begins by explicitly constructing a compact structure referred to as a **Planning Graph**, rather than immediately embarking upon a search as obtainable in standard planning methods. It encodes the planning problem in such a way that many useful constraints inherent in the problem become explicitly available to reduce the amount of search needed. Planning Graphs offer a means of organizing and maintaining search information that is reminiscent of the efficient solutions to Dynamic Programming problems.

Heuristic Search Planner (HSP) is based on the idea of heuristic search, which performs forward search from an initial state to a goal state using an heuristic function that provides an estimate of the distance to the goal. HSP is useful because it allows the generalization of a heuristic computation to any general STRIPS problem formulation[3].

The developments discussed in this review constitutes three major developments in the field of AI Planning research. The STRIPS formulation gave researchers a general framework from which more advanced languages could be built. The Planning Graph construct was a revolutionary data structure that gave a new perspective on optimal planning techniques. In conclusion, HSP gave an automated approach for determining heuristics to general planning problems.

References

[1] STRIPS: A New Approach to the Application of Theorem Proving to Problem Solving, by Richard E. Fikes and Nils J. Nilsson at http://ai.stanford.edu/~nilsson/OnlinePubs-Nils/PublishedPapers/strips.pdf.

[2] Fast Planning Through Planning Graph Analysis, by Avrim L. Blum (CMU) and Merrick L. Furst (CMU) at https://www.cs.cmu.edu/~avrim/Papers/graphplan.pdf

[3] HSP: Heuristic Search Planner at https://bonetblai.github.io/reports/aips98-competition.pdf