HISTORICAL DEVELOPMENTS IN THE FIELD OF PLANNING AND AI RESEARCH

The study of AI planning emerged from the practical needs of robotics, control theory, state-space, and other domains, STRIPS (Fikes and Nilsson, 1971) was the first major planning system, designed as the planning component of the software for the Shakey robot project at SRI, its global control structure was modeled on GPS, the General Problem Solver (Newell and Simon, 1961). The representation language used by STRIPS has been very influential in any AI field, Action Description Language (ADL) (Pednault, 1986), has made it possible to solve more complex problems by relaxing some of the STRIPS language constraints and A Problem Domain Description Language PDDL (Ghallab et al., 1998) was introduced as a standardized and computer-translatable syntax to represent planning problems and has been used as the standard language of international planning competition since 1998.

The UNPOP program of Drew McDermott (1996), responsible for the resurgence of interest in planning in state spaces, was the first to suggest a heuristic of ignoring exclusion lists. The Heuristic Search Planner (HSP) of Bonet and Geffner and their subsequent derivatives (Bonet and Geffner, 1999; Haslum et al., 2005; Haslum, 2006) were the first to make practice the search in spaces of states for great planning problems . HSP searches in the forward direction, while HSPR searches backward (Bonet and Geffner, 1999). The most successful state-space searcher to date is the FF (Hoffmann, 2001; Hoffmann and Nebel, 2001; Hoffmann, 2005), winner of the AIPS 2000 planning competition. FASTDOWNWARD (Helmert and Richter 2004, Helmert, 2006) won the 2004 planning competition, and LAMA (Richter and Westphal, 2008), a planner based on FASTDOWNWARD with improved heuristics, won the 2008 competition.

Another important development in the field of AI was the GRAPHPLAN system, developed by Avrim Blum and Merrick Furst (1995, 1997) that revitalized the area of planning orders of magnitude faster than the partial order planners of the time. Other planning graph systems, such as the IPP (Koehler et al., 1997), STAN (Fox and Long, 1998), and SGP (Weld et al., 1998) were developed. Shortly before, a data structure resembling the planning graph was developed by Ghallab and Laruelle (1994), used by the IXTET partial order planner to derive precise heuristics to guide the search.

More recently, interest has arisen in the representation of plans as a binary decision diagram, compact data structures of Boolean expressions. There are techniques for demonstrating properties of binary decision diagrams, including the property of being a solution to a planning problem. Cimatti et al. (1998) present a planner based on this approach.

Other representations were also used; for example, Vossen et al. (2001) investigate the use of whole programming for planning, the research has not yet been completed, but there are already some interesting comparisons between the various approaches to planning. Helmert (2001) analyzes several classes of planning problems and shows that constraint-based approaches such as GRAPHPLAN and SATPLAN are best for problems in the NP-difficult domain, whereas search-based approaches work best in domains where solutions can be found possible without backward movement. One of the biggest obstacles faced by GRAPHPLAN and SATPLAN is the difficulty in domains with many instances of objects, since they have to create many actions. In some cases, the problem can be minimized or avoided by dynamically generating propositional actions, that is, actions are instantiated only when necessary, instead of instantiating all of them before the search begins.