Research Review
Historical Developments in the Field of AI Planning and Search

Rafael Correia Nascimento

According to Russell and Norvig Artificial Intelligence a modern approach book, “AI planning arose from investigations into state-space search, theorem proving, and control theory and from the practical needs of robotics, scheduling, and other domains”. STRIPS (Fikes and Nilsson, 1971), was the first major planning system and it illustrates the interaction of these influences.

STRIPS – STanford Research Institute Problem Solver is a member of the class of problem solvers that search a space of world models. The goal of STRIPS is to find the sequence of operators that transforms a given initial world model into one that satisfies the goal condition. Operators are actions, for a robot, an operator can be go through a doorway, for example. To verify whether an operation can be applied and if a goal state is satisfied theorem-proving methods are used. To search through the space search a GPS-like strategy are used. It is also important to note that the representation language used by STRIPS were more influential than its algorithmic approach. STRIPS influenced the Action Description Language – ADL (Pednault, 1986) and the Problem Domain Description Language – PDDL (Ghallab *et al*., 1998).

NOAH planner (Sacerdoti, 1975, 1977) and Tate’s (1975b, 1977) NONLIN system introduced partial-order planning, a technique that dominated the planning research for 20 years. The ideas underlying partial-order planning included the detection of conflicts and the protection of achieved conditions from interference. Resolving conflicts involves ordering unordered operations to avoid precondition violations. Partial-order planning fell out of favor in the late 1990s giving space back to state-space planning.

In 1996, UNPOP was introduced by Drew McDermott the first to suggest the *ignore-delete-list* heuristic. The heuristic function is derived by considering a relaxation of the planning task at hand, where the relaxation is to assume that all delete lists (i.e. the negative effects of the available planning operators) are empty. During search, may it be forward or backward, state space or plan space, the heuristic value of a search state in this framework is (an estimate of) the difficulty of extending the state to a solution using the relaxed operators, where “difficulty” is defined as the number of (relaxed) actions needed (Hoffmann, 2005).