ARTIFICIAL INTELLIGENCE NANODEGREE

PROJECT-3

PLANNING

Research_review

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Some historical developments in planning and search space:

1. KINODYNAMIC PLANNING:-

In robotics and motion planning, kinodynamic planning is a class of problems for which velocity, acceleration, and force/torque bounds must be satisfied, together with kinematic constraints such as avoiding obstacles. The term was coined by Bruce Donald, Pat Xavier, John Canny, and John Reif.[1] Donald et al. developed the first polynomial-time approximation schemes (PTAS) for the problem. By providing a provably polynomial-time ε-approximation algorithm, they resolved a long-standing open problem in optimal control. Their first paper considered time-optimal control ("fastest path") of a point mass under Newtonian dynamics, amidst polygonal (2D) or polyhedral (3D) obstacles, subject to state bounds on position, velocity, and acceleration. Later they extended the technique to many other cases, for example, to 3D open-chain kinematic robots under full Lagrangian dynamics. More recently, many practical heuristic algorithms based on stochastic optimization and iterative sampling were developed, by a wide range of authors, to address the kinodynamic planning problem. These techniques for kinodynamic planning have been shown to work well in practice. However, none of these heuristic techniques can guarantee the optimality of the computed solution (i.e., they have no performance guarantees), and none can be mathematically proven to be faster than the original PTAS algorithms (i.e., none have a provably lower computational complexity).

2.MULTI-AGENT PLANNING:-

In computer science multi-agent planning involves coordinating the resources and activities of multiple "agents". NASA says, "multiagent planning is concerned with planning by (and for) multiple agents. It can involve agents planning for a common goal, an agent coordinating the plans (plan merging) or planning of others, or agents refining their own plans while negotiating over tasks or resources. The topic also involves how agents can do this in real time while executing plans (distributed continual planning). Multiagent scheduling differs from multiagent planning the same way planning and scheduling differ: in scheduling often the tasks that need to be performed are already decided, and in practice, scheduling tends to focus on algorithms for specific problem domains".

2. GRAPHPLAN:

Graph Graphplan is a general-purpose planner for STRIPS-style domains, based on ideas used in graph algorithms. Graph plan is popular from 1996. Given a problem statement, Graphplan explicitly constructs and annotates a compact structure called a Planning Graph, in which a plan is a kind of "flow" of truth-values through the graph. This graph has the property that useful information for constraining search can quickly be propagated through the graph as it is being built. Graphplan then exploits this information in the search for a plan. Graphplan always returns a shortest- possible partial-order plan, or states that no valid plan exists. Graphplan was created by Avrim Blum and Merrick Furst, with subsequent extensions and improvements made by many researchers at many different institutions around the world.

3. SATPLAN:

Satplan (better known as Planning as Satisfiability) is a method for automated planning . Satplan is popular from 1995. It converts the planning problem instance into an instance of the Boolean satisfiability problem , which is then solved using a method for establishing satisfiability such as the DPLL algorithm or WalkSAT . WalkSat is a local search algorithms , work on formulae in Boolean logic that are in, or have been converted into, conjunctive normal form . They start by assigning a random value to each variable in the formula. If the assignment satisfies all clauses , the algorithm terminates, returning the assignment. Otherwise, a variable is flipped and the above is then repeated until all the clauses are satisfied. The Davis–Putnam–Logemann–Loveland (DPLL) algorithm is a complete, backtracking -based search algorithm for deciding the satisfiability of propositional logic formulae in conjunctive normal form .

References:

-A. Blum and M. Furst, "Fast Planning Through Planning Graph Analysis" [pdf], Artificial Intelligence

-http://www.cs.mtu.edu/~nilufer/classes/cs5811/2012-fall/lecture-slides/cs5811-ch10c-satplan

-https://en.wikipedia.org/wiki/WalkSAT