Research Review

Intro:

This review is a companion to the "Implement a Planning Search" Project as part of Udacity's Artificial Intelligence NanoDegree. The goal of this review is to briefly highlight relationships between three historical developments in the field of AI planning and search and their impact on the field of AI.

Planning and Scheduling are technologies with wide impact in real-world applications such as Autonomous Vehicles, Manufacturing, Space Systems, Software Engineering, Robotics, Education and Entertainment. The International Conference on Automated Planning and Scheduling (ICAPS), is a premier source of information on these technologies, and has been holding competitions since 1998 that showcase cutting-edge developments in this field.

Some of the more recent competitions have revolved around Robotics Logic, planners that distinguish unsolvable problem sets from solvable ones, and Multi-Agent, cooperative Planners. Deterministic, Learning and Probabilistic Tracks are common. In this review, I will focus on Planning Languages that are being used in these competitions to date.

STRIPS (Stanford research Institute Problem Solver) is an automated planner developed in 1971, and the name also refers to the Language of the inputs to this planner. STRIPS continues to be the base for most of the languages in use today that express automated planning problems. STRIPS consists of a Problem Space (world), initial state, actions (with preconditions and postconditions), and a goal state as a collection of first-order predicate calculus formulas.

PDDL (Problem Domain Definition Language) was developed in 1998 as a standardized syntax for representing STRIPS, ADL (Action Description Language) and other languages, specifically for the 1998 AIPS Competition. PDDL is intended to express the "physics" of a domain: what predicates there are, what actions are possible, what the structure of compound actions is, and what the effects of the actions are.

Domains can be described in PDDL, PPDDL (Probabilistic PDDL) or RDDL (Relational Dynamic Influence Diagram Language). RDDL is intended to be used to model classes of problems that are difficult to model with PDDL or PPDDL. An example of these classes include jointly reconciled stochastic effects and concurrency. RDDL uses a Dynamic Bayes Net (DBN) with potentially many intermediate layers, extended with a influence Diagram (ID) utility node representing immediate reward. An objective function specifies how these immediate rewards should be optimized over time.

For more information on the history of AI Planning and Search, see the Bibliographical and Historical Notes section in Chapter 11 of the book Artificial Intelligence: A Modern Approach by Norvig and Russell.

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