Research Review by Ng Fang Kiang

Udacity – Artificial Intelligence Nanodegree (Class of 2017)

Key Developments in the field of AI planning and search

STRIPS

In 1971, the Richard Fikes and Nils Nilsson has developed a Stanford Research Institute Problem Solver (STRIPS), which is an automated planner that written by first order logic language. There is a lot different problems can be solve by using STRIPS. For example, Rubik's cube, stacking blocks, navigating a robot in Shakey's World, Starcraft build orders, and a lot more. The robot in Shakey's World is one of the first robots built with AI technology. It's controlling by STRIPS with capable of moving his camera eye, moving objects and traveling from place to place while dealing with unexpected obstacles. For future development, they use the Action Description Language (ADL) and the Planning Domain Definition Language (PPDL) which has more expressive subsets of the First-Order Predicate Logic (FOPL).

GraphPlan

In 1995, the Avrim Blum and Merrick Furst has developed an algorithm for automated planning. Graphplan used graph algorithms for general-purpose planning for STRIPS-style domains. Graphplan is used to a novel planning graph, it used to estimate the numbers of steps to takes to achieve the goal and helps to minimize the numbers of search needed to explore the state space graph solution. The planning graph is an estimate of a total tree of every single conceivable activity and their outcomes.

Kinodynamic Planning

The Kinodynamic Planning is introduced by Canny, Donald, Reif and Xavier for solving problems for robotics and motion planning. Kinodynamic planning is a path planning solver and also extends kinematic planning which helps robotics system to velocity, acceleration, and force/torque bounds must be satisfied, together with kinematic constraints such as avoiding obstacles.

Reference

- Richard E. Fikes, Nils J. Nilsson (Winter 1971). "STRIPS: A New Approach to the Application of Theorem Proving to Problem Solving" (PDF). *Artificial Intelligence*. 2 (3–4): 189–208

- A. Blum and M. Furst (1997). Fast planning through planning graph analysis. Artificial intelligence. 90:281-300.

- Donald, B.; Xavier, P.; Canny, J.; Reif, J. (1993), "Kinodynamic motion planning" (PDF), *Journal of the ACM (JACM)*, 40 (5): 1048–1066

- https://asl.stanford.edu/projects/real-time-kinodynamic-planning/

- http://www.cs.ucc.ie/~dgb/courses/ai1/19-notes.pdf