AIND Planning - Research Review

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In this research review, I will talk about three important developments in the history of AI Planning.

STRIPS:

STRIPS stands for Stanford Research Institute Problem Solver and is an approach to automated planning and a formal language developed by Richard Fikes and NIls Nillsson in 1971. An instance of STRIPS is composed of an initial state, a goal state, and a set of actions (including the preconditions and post conditions of the action). A valid plan for an instance of STRIPS would therefore be a series of actions which can lead from the initial state to the goal state. Various search algorithms can be used to achieve this, such as BFS and A* Search.

Planning Graphs and Graph Plan:

Graphplan is an algorithm developed for automated planning by Avrim Blum and Merrick Furst in 1995. Graphplan takes as input a planning problem expressed in STRIPS and generates a sequence of operations for a reaching a goal state (if possible). There are some key differences between a graph plan and a traditional state space graph. In a state space graph, nodes are possible states and the edges indicates their relationships via possible actions. In a Graphplan planning graph, the nodes are actions and atomic facts, arranged into alternating levels. The edges can either be an atomic fact which leads to an action, or an action which leads to an atomic fact. There are two key phases of the graphplan algorithm: graph expansion and solution extraction. In graph expansion, the graph plan is constructed iteratively by growing the planning graph and inferring mutex relationships between states or actions. In solution extraction, the graph is searched backwards by solving a Boolean CSP whose variables are the actions at each level.

Hierarchical Task Networks (HTN) based planners:

HTN's are based on hierarchies of tasks that can be broken down recursively. HTN's require a rich domain knowledge to characterize the world by grouping related tasks into compound actions Hierarchical Task Planning can be considered an extension of STRIPS. Planning problems are specified in the hierarchical task network approach by providing a set of tasks, which can be, primitive tasks, which roughly correspond to the actions of STRIPS; compound tasks, which can be seen as composed of a set of simpler tasks; and goal tasks, which roughly corresponds to the goals of STRIPS, but are more general. Some implementations of HTN's include SHOP2, Nonlin, and O-Plan.

Sources:

https://en.wikipedia.org/wiki/STRIPS
https://en.wikipedia.org/wiki/Graphplan
https://en.wikipedia.org/wiki/Hierarchical_task_network