Search and Planning

Search and planning have been one to the main focus areas in Artificial Intelligence research for long time since they are crucial to problem solving agents. Many groups of researchers had made search and planning more and more efficient with many different approaches. In this essay, I will discuss series of problem approaches which are fundamental to search and planning.

When problems are given to an agent to solve, it perceives a state it is currently in and figures how to archive goal by search through possible states. To do so, comprehensive and effectives representation of any given state is necessary. Hence, *STRIPS* was introduced. *STRIPS* does the task mentioned earlier by creates models of states, actions, and goals in *First Order Logic* sentences and searches through each branch of initial state search tree until it finds state that match with goal conditions. In other words, *STRIPS* uses depth-first search to search the state tree until it find the goal. However, *STRIPS* struggles with the size of its search tree for complex problem and its performance when dealing with complex problems. Therefore *UCPOP* was introduced.

UCPOP is *partial order planer* built upon *Action Description Language* (*ADL*), the more relax state model representation than *STRIPS. UCPOP* needs only initial state and goal state. It checks whether the goal state is possible to match from current state and unless addition actions, for example reordering steps, or adding new states or constrains, are need it will add those actions to checks the goal state is satisfied. It also introduces *causal link* to ensure that all necessary steps are included to satisfy goal states. This gives *UCPOP* ability to create the fewest states representation needed to solve problems given to it.

The another approach to enhance *STRIPS* is *Graphplan*. The approach uses *planning graph analysis* on top of *STRIPS* to reduce the amount of search needed. It also creates partial planning ordered plans as *UCPOP* does. *Graphplan* guarantee that there will be a valid plan in its search result or the search is halt. This is the one of keys distinction between *partial order planner* like *UCPOP* to *Graphplan*. The other characteristic that *Graphplan* sets the *mutual exclusive constrains* between nodes in planning graph and recursively search over to find set of actions until it can conclude that the problem is solvable or not.

With features above, *Graphplan* usually outperform others planner in term of search time and number of goals found. Nevertheless, Limitations of *Graphplan* are problems must be deterministic, *mutual exclusive constraints* in the problem must be the majority of problem constrains, and performance trade off when expecting the shortest plan.

In summary, planner are crucial to problem solving agents that researchers have been trying to develop more and more efficient approaches. The researcher use previous works of others to introduce the approach that better than the previous but there are always space to improve and introduce the new novel search and planner.

References

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