Planning & Search in AI

Planning and search are basic building blocks of AI. They enable AI to be autonomous . Let's look into some of the historical development done in this field.

STRIPS

The STRIPS system made a very important contribution to Planning research by introducing the *Strips Assumption* as a way to avoid the complexity of the frame problem for the purposes of planning within the situation calculus. The assumption is that the only changes that arise on application of an action to a situation are those that are explicitly mentioned as positive effects of the action.

Planning problems are fundamentally dynamic in structure. It is therefore natural to interpret collections of action schemas as defining the transitions in a parameterised automaton and a plan as the transitions traversed by an accepting trace through the instantiated automaton. This view is in contrast with the static view imposed by the situation calculus.

Both the dynamic and static views have influenced the design of algorithms for planning, although the dynamic view has dominated approaches taken to representation of planning problems.

PDDL

The lack of reasoning and expressive power of STRIPS leads to new development of language like PDDL.

Planning Domain Description Language was proposed as standards for modelling planning problems based on the STRIPS assumption and support the modelling of a planning problem in terms of a compact representation of the finite state automaton that describes its behaviour. This style of modelling can be extended to support reasoning about continuous as well as logical change, and can provide sufficient expressive power for the modelling of very complex realistic planning problems.

LPG

In solving search problem, new development is evolved to treat it as a number of sub-problems that can be searched locally and potentially solve the entire problem as a whole. It also leads to the research of reusability of sub-problem search.

LPG involves identifying an initial candidate plan and refining it by generating alternative possible repairs or modifications to the candidate. Evaluation of alternative refinements is carried out by a heuristic evaluation function. LPG demonstrates that there is significant potential in this technique coupled with techniques capable of exploiting the reachability structure of planning problems.

Heuristic search planning

Another big exciting trend in development is Heuristic Search Planner. It is able to find a good enough acceptable plan quickly .

It works by directing search towards a solution with intelligent exploration of the problem state space. It's proven to be very effective in guiding search with some kind of control knowledge.

The novel contribution made by McDermott and by Geffner and Bonet demonstrated a method by which a surprisingly informative heuristic function could be constructed automatically simply by analysing the domain.

The underlying principle is: The heuristic value of a particular choice of action is based on an estimate of how much work remains to be accomplished following the addition of that action to the plan.To estimate the outstanding work is a very simple: **the number of actions required to achieve all the outstanding goals.**

Reference: [An overview of recent algorithms for AI planning](#)

[Progress in AI Planning Research and Applications](#)