Artificial Intelligent Nanodegree Program
Research Analysis | Project 3: Implement a Planning Search
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How AI Began

Artificial Intelligence (AI) started by John McCarthy in 1956 at the Dartmouth Summer Research Project on AI. AI has gradually developed from winning game checkers, solving word problems in algebra and proving logical theorems, ... to process big data using deep learning. There are many algorithms developed to solve various problems such as planning, natural language processing, learning and knowledge representation. This research paper aims to summarise the three key developments in the field of planning and search.

Domain Independent Planning

Domain Independent planners solve planning problems of all types of domains. A domain model and a specific problem are typically input and to be specified by the initial state and goal. Robot task planning, workflow management and logistics are examples of domains.

Planning Domain Modelling Languages

STRIPS and PDDL for classical planning are the most commonly used languages.

- STRIPS - Stanford Research Institute Problem Solver
  An automated planner.
- PDDL - Planning Domain Definition Language
  Attempts to standardize AI planning languages and was inspired by STRIPS.

These languages are based on state variables and each state of the world is an assignment of values to the state variables while the actions determine the changes in values of the state variables. Given that the set of state variables induce a state space is exponential in size, implications, such as the curse of dimensionality and the combinatorial explosion, in planning will occur.

Hierarchical task networks is the alternative language for describing planning problems where set of tasks is given with each task being either primitive action or decomposed to another set of tasks. State variables may not be involved although they simplify the description of task networks.

Algorithms for Planning

1. Classical planning

Forward chaining that can be enhanced with heuristics; backward chaining that can be enhanced with the use of state constraints.

2. Reduction to other problems

Reduction to propositional satisfiability problem and to model checking.

3. Temporal planning

Closely related to scheduling. Difference from classical planning being there can be temporal overlapping of actions with the duration of execution.

4. Probabilistic planning

Can be solved using iterative methods then the state space is small. Examples of probabilistic planning includes markov decision process and partially observable markov decision process.

5. Preference-based planning

To satisfy user-specified preferences than to solely product the plan. This planning algorithm relates more towards reward-based planning and preferences do not need to have precise numerical value.

Source:

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