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State space planning

In artificial intelligence and computer programming, **state space planning** is a process used in designing programs to search for data or solutions to problems. In a computer algorithm that searches a data structure for a piece of data, for example a program that looks up a word in a computer dictionary, the *state space* is a collective term for all the data to be searched. Similarly, artificial intelligence programs often employ a process of searching through a finite universe of possible procedures for reaching a goal, to find a procedure or the best procedure to achieve the goal. The universe of possible solutions to be searched is called the state space. *State space planning* is the process of deciding which parts of the state space the program will search, and in what order.

Definition

The simplest classical planning (see Automated Planning) algorithms are state space search algorithms. These are search algorithms in which the search space is a subset of the state space: Each node corresponds to a state of the world, each arc corresponds to a state transition, and the current plan corresponds to the current path in the search space. Forward Search and Backward Search are two of main samples of **state space planning**.

Forward search

Forward search is an algorithm that searches forward from the initial state of the world to try to find a state that satisfies the goal formula.

Forward-search(O, s_O, g)

```
s = $s_0$
P = the empty plan
loop
    if s satisfies g then return P
    applicable = {a | a is a ground instance of an operator in O,and precond(a) is true in s}
    if applicable = ∅ then return failure
    nondeterministically choose an action a from applicable
    s = γ(s, a)
    P = P.a
```

Backward search

Backward-search is an algorithm that begins with goal state and back track to its initial state. This method is sometimes called "back propagation."

Backward-search(O, s_O, g)

```
s = $s_0$
P = the empty plan
loop
    if s satisfies g then return P
    relevant = {a | a is a ground instance of an operator in O that is relevant for g}
    if relevant = ∅ then return failure
    nondeterministically choose an action a from relevant
    P = a.P
    s = $\gamma^{-1}(s, a)$
```

See also

- State space
- State space search

References

- Ghallab, Malik; Nau, Dana S.; Traverso, Paolo (2004), *Automated Planning: Theory and Practice* (https://books.google.com/books?id=eCj3cKC_3ikC&q=%22state+space%22), Morgan Kaufmann, ISBN 1-55860-856-7

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