

Research Review

The task of **finding sequences of actions** in a state space where the states have logical representations is called planning. To reach this goal, planning systems (PS) need input data containing descriptions of **initial states** of the world, desired **goals** and **actions**.

The domain of PS there contains different dimensions of problems: deterministic or nondeterministic actions, fully or partially observable state of world, actions concurrency, their durations and time limits and many more.

To represent planning problems we use **Artificial Intelligence planning languages** that describe environment's conditions which then lead to desired goals by generating chain of actions based on these conditions.

STRIPS

The STRIPS was a part of the first major planning system with the same name. It was first used in a planning system developed in the late 1960s/early 1970s called STRIPS (Stanford Research Institute Problem Solver). Although the STRIPS language is quite a restricted language, it seems to be just about expressive enough to represent many typical planning problems.

STRIPS is a classical planning language composed by:

- An **initial state**: a conjunction of positive literals which cannot contain variables and invoke functions.
- The specification of the **goal states**: similarly to the state, is a conjunction of positive and ground (no variables and no functions) literals.
- A set of **Actions** which includes:
 - **preconditions**: what must be established before the action is performed;
 - **postconditions**: what is established after the action is performed.

Both represented as a conjunction of function-free literals.

In the STRIPS language, we make the closed-world assumption. This means that any statement that is not mentioned in a state representation is assumed false

ADL and PDDL

STRIPS language represent a starting point for planning problems but after its development many improvements were realised. **ADL** (Action Description Language) is an extension of STRIPS which relaxed some of its constraints in order to handle more complex problems. For instance, ADL doesn't assume that unmentioned literals are false, but rather unknown.

PDDL (Planning Domain Definition Language) represent an attempt to standardise planning languages. it contains STRIPS, ADL and other representational languages. The PDDL was the first modeling language to be used widely for solving planning problems and it has remained the standard for the International Planning Competition since 1998. Thanks to PDDL it is possible to compare the performances of different planning systems using a set of benchmark problems allowing to speed up the progress in the field.

REFERENCES

Richard E. Fikes, Nils J. Nilsson (Winter 1971). "STRIPS: A New Approach to the Application of Theorem Proving to Problem Solving".

Stuart J. Russell, Peter Norvig (2010), Artificial Intelligence: A Modern Approach

M.; Long, D. (2002). "PDDL+: Modeling continuous time dependent effects". Proceedings of the 3rd International NASA Workshop on Planning and Scheduling for Space.