Research review on Planning and Search in AI

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[1] STAN – Is a planner based on Graphplan originaly created in 1999, by Long and Fox. They introduced a new technique in graph planner called Symmetry. The symmetry is making search to the goal faster. The definition of symmetry in their paper: The actions are symmetrical if they are indistinguishable. In the classical graphplan algorithm they added 2 (two) new data structures which are used to follow which actions are symmetrical. If an action has been chosen by the plan, it is not symmetrical to its peers anymore. For example, if we performed an action in a layer n-1, we won't consider actions that are symmetrical to the action from n-1 in the layer n, and we just move to the next action. One more detail: No-ops are not in the symmetry with any action but itself. Long and Fox gave excellent examples in their white paper, for better understanding I instruct you to read it.

[2] [3] BLACKBOX – This is a system used for solving SATPLANS (For those readers who are not familiar with SATPLANS - https://en.wikipedia.org/wiki/Boolean_satisfiability_problem or more abstract - https://en.wikipedia.org/wiki/Satplan). This system is working in 3 stages. First, it uses STRIPS notation as an input. We get a plan graph from that and then it is converted to CNF wff (CNF is output for SATPLAN, for example we have worked with Graphplan and output of it is a plan graph). After converting to CNF format, it uses some of the fast algorithms for solving. This approach allowed them to solve more complex problems, even with 10^{16} states, which is not possible to do with normal Graphplan. Another interesting thing that they have added to Blackbox is it has its own internal schedule for executing. The example that they have mentioned in the white paper was: "it can run Graphplan for 30 seconds, then Walksat for 2 minutes, and if still no solution is found, satz for 5 minutes."

[4] PDDL – "Planning Domain Definition Language" - this language is created as an attempt to standardize planning domain and problem description language. The main reason why they created it was for International Planning Competitions. PDDL contains many techniques such as STRIPS, ADL and many more, however in most planners PDDLs is not supported as a full. A PDDL definition consists of two parts: the domain and the problem definition. In this language domain predicates and operators are called *actions.* In the AirCargo problem we used standard PDDL representation of problem itself and actions performed inside of it.

Bibliography:

[1] The Detection and Exploitation of Symmetry in Planning Problems - Wrote by: **Maria Fox and Derek Long** - https://pdfs.semanticscholar.org/397b/983870e744a5ed739a069a4ac8715122a0b3.pdf

[2] BLACKBOX: A New Approach to the Application of Theorem Proving to Problem Solving - Wrote by: **Henry Kautz and Bart Selman** - http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=97C552C8A47DCBE6805729094203ADCA?doi=10.1.1.21.1189&rep=rep1&type=pdf

[3] *BLACKBOX homepage* - https://www.cs.rochester.edu/u/kautz/satplan/blackbox/

[4] *Writing Planning Domains and Problems in PDDL* - http://www.ida.liu.se/~TDDC17/info/labs/planning/2004/writing.html