Robot Motion Planning by Integrating Multiple Rules

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The programming of robot motions is an arduous task. Typically, specialists design and implement a robot motion for each particular task with a cut-and-try approach. In addition, reprogramming is indispensable to deal with even a slight change in tasks and work environments since robots cannot adapt their motions to the changes. The difficulty in motion planning is a major hurdle to automating various complex tasks with robots.

In this study, we propose a method for planning appropriate robot motions by integrating various task-relevant rules: programs for similar tasks; human demonstration data; expertise for the task and the robot. Determining the conditions for effectively applying the rules to a target task is difficult, and some parts of the applied rules would conflict with others. In addition, the rules exist in different forms. In our method, we represent a control policy for robots with a state-action map in order to exploit various rules; this map denotes a lookup table that connects a state of a robot to its action. First, all rules are included in the map. Then, robot motions feasible for the whole task are efficiently developed by modifying the policy for the states where no rule is written or when the rules result in failure. We applied the proposed method to rearrangement tasks of multiple objects and developed the feasible control policies by integrating programs for similar tasks and a simple rule for the task process. In addition, we address appropriate task segmentation in order to express human demonstration data as a rule.

Keywords: Multiple Rule Integration, Policy Modification, State-Action Map

References

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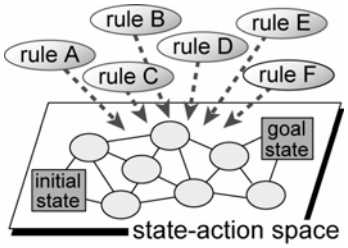

Fig. 1 State-action map developed by integration of multiple rules

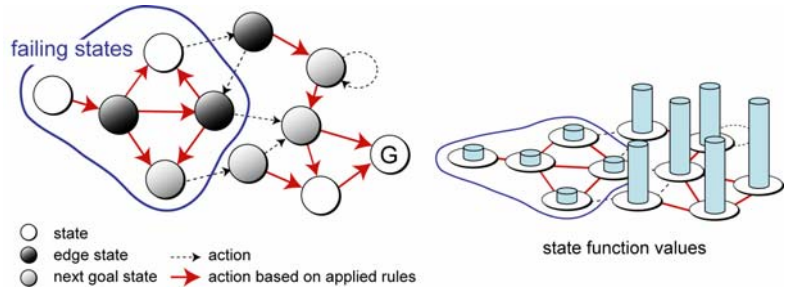

Fig. 2 Failing states detection

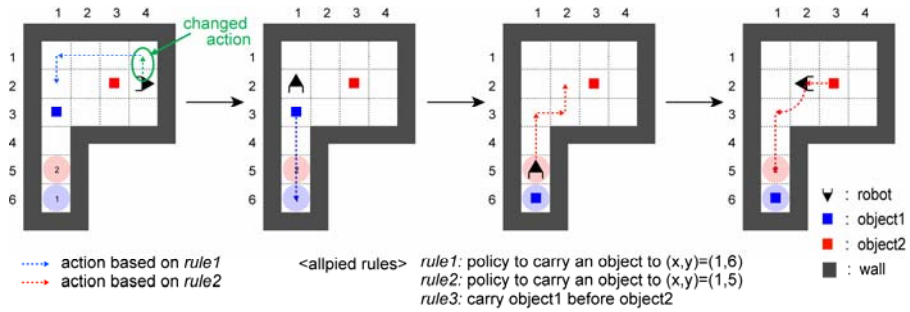

Fig. 3 Result of rearrangement task using developed state-action map