LEARNING ROBOT SKILL SEQUENCES WITH REINFORCEMENT LEARNING FOR OFF-PLANET ASSEMBLY

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ABSTRACT

To enable production outside Earth, there is a great need for robots and machines that can perform agile tasks and learn how to complete tasks where there is an element of uncertainty, as manual corrections and reprogramming may not be possible due to e.g. vast distances.

This paper explores the possibilities for utilizing reinforcement learning to automate the reprogramming of demonstrated robot skills for batch-oriented assembly productions. Reinforcement learning is a machine learning paradigm where a system, or agent, learns through trial and error. Interactions with an environment yield various rewards, which are used to incentivize specific, and optimal, behaviours. This process can be formulated as a Markov Decision Process (MDP), defined by states, actions, and rewards.

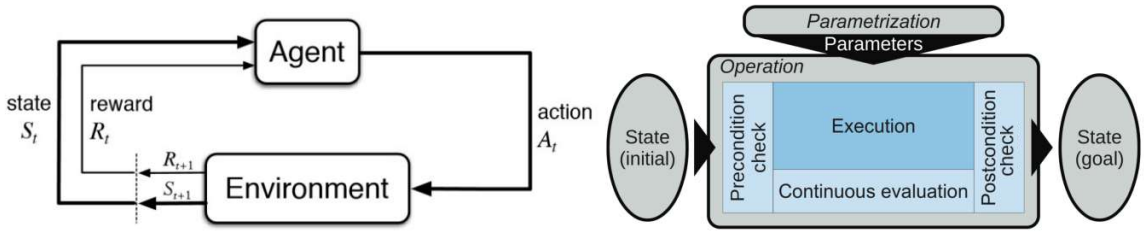

Fig. 1: (a) Reinforcement Learning interface, (b) robot skill model. The central part of the skill is the execution block which performs the desired manipulation of the world. The light blue blocks ensure that the skill can only be executed in a safe and predictable manner [2,3].

The environment is created by a simulation set up with the Nvidia Isaac SDK. When a stable model has been developed in the simulated gym environment, the robot skills are tested at the AAU Smart Lab by using a physical 7 DoF Panda robot manipulator developed by Franka Emika.

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