

Performing a Cleaning Task in a Simulated Human-Robot Interaction Environment

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Abstract. In this work we introduce a human-robot interaction task where a robot performs a domestic activity which consists of cleaning a table in a simulated environment. Our scenario has two objects (sponge, cup) and the robot is allowed to perform four actions: *get* $\langle object \rangle$, *drop* $\langle object \rangle$, *go* $\langle location \rangle$, and *clean*.

For this purpose, we develop an interactive reinforcement learning approach integrated with the DOCKS¹ speech recognition system to provide human interactive feedback via speech guidance [1]. Our approach is written in Python and connected to the V-REP² simulator using the remote API. The external trainer is able to advise the robot on what action to perform next using live or previously recorded instructions. Once having received the external advice, a Baxter³ robot performs the next suggested action if possible. To be able to move to a location or clean the table, direct planning is employed; for getting or dropping an object, the robot uses inverse kinematics which are integrated in the simulator.

The V-REP simulator currently lacks simulated sound sources which could be an interesting extension for further experiments. Nevertheless, by using our human speech guidance architecture we are able to finish the task faster than using autonomous learning.

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References

1. F. Cruz, J. Twiefel, S. Magg, C. Weber, and S. Wermter, *Interactive reinforcement learning through speech guidance in a domestic scenario*, in The International Joint Conference on Neural Networks (IJCNN), pp. 1341–1348, 2015.

¹ Find it at <https://www2.informatik.uni-hamburg.de/wtm/software/>

² <http://www.coppeliarobotics.com/>

³ <http://www.rethinkrobotics.com/baxter-research-robot/>