TECHNISCHE UNIVERSITÄT MÜNCHEN
Human-centered Assistive Robotics
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May 11, 2021

M A S T E R ' S T H E S I S
for
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Visually Perceiving Symbolic Representation for Manipulation Task in Robotics

Problem description:

To perform a task planning of manipulation, a robot needs to perceive the environment of its workspace first. It needs to perceive the object types as well as relationships between objects, such that symbolic representations of the observed environment (i.e., book-under-cup) can be generated. Based on this, robot would be able to perform its manipulation task, which changes the relationship between objects as it desires (i.e., book-under-cup $\rightarrow$ book-in-shelf). In this work, the goal is to employ a deep learning based model for visually perceiving symbolic representations for manipulation robots. Regarding this, a straight-forward approach would be using existing approaches related to object relationship detection [1, 2]. However, it is hard to employ the previous works, since they only deals with the environment that humans can face in everyday life, rather than the environment that manipulation robots will face. Therefore, the goal of this work will encompass suggesting a model as well as a dataset, which would be suitable for the perception module of manipulation robots. The final model trained with the dataset should be able to generate symbolic representations from the given images of robot's workspace.

Tasks:

- Literature review on object relationship detection and symbolic representation for robotics.
- Synthetic dataset collection regarding symbolic representations for manipulation robots.
- Apply a neural network based model for visually perceiving symbolic representations.
- Evaluation and ablation study based on the collected dataset.

Bibliography:

[1] Cewu Lu, Ranjay Krishna, Michael Bernstein, and Li Fei-Fei. Visual relationship detection with language priors. In *European Conference on Computer Vision*, 2016.

[2] Ruichi Yu, Ang Li, Vlad I Morariu, and Larry S Davis. Visual relationship detection with internal and external linguistic knowledge distillation. In *Proceedings of the IEEE international conference on computer vision*, pages 1974–1982, 2017.

Supervisor:	Dr. Hyemin Ahn
Start:	07.05.2021
Intermediate Report:	xx.07.2021
Delivery:	xx.09.2021

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