TECHNISCHE UNIVERSITÄT MÜNCHEN
Human-centered Assistive Robotics
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February 22, 2019

M A S T E R ' S T H E S I S
for
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Hand pose estimation for hand-object interaction cases using augmented autoencoder

Problem description:

Hand pose estimation plays an important role in many human-robot interaction tasks, such as gesture recognition and learning grasping capability by human demonstration. State-of-the-art learning based hand pose estimation methods require a large dataset for training to obtain good performance. Existing large datasets only contain clean hand samples, where the hand is not in contact with other objects [4], which constrains the trained models to be applied on hand-object interaction scenarios. In this thesis, the student will explore the augmentded autoencoder [3] to handle hand-object interaction cases. The influence of the object will be removed by reconstructing a clean hand sample from hand-object case. Then the hand pose will be estimated using other state-of-the-art method [2] for clean hand sample.

Tasks:

- Literature review on hand pose estimation and autoencoder for point cloud [1].
- Implementation of denoising autoencoder for point cloud.
- Implementation of hand pose estimation pipeline.
- Evaluation on datasets and on real captured data.

Bibliography:

[1] H. Fan, H. Su, and L. J. Guibas. A point set generation network for 3d object reconstruction from a single image. In *Proceedings of the IEEE conference on computer vision and pattern recognition*, pages 605–613, 2017.

[2] S. Li and D. Lee. Point-to-pose voting based hand pose estimation using residual permutation equivariant layer. *arXiv preprint arXiv:1812.02050*, 2018.

[3] M. Sundermeyer, Z.-C. Marton, M. Durner, M. Brucker, and R. Triebel. Implicit 3d orientation learning for 6d object detection from rgb images. In *Proceedings of the European Conference on Computer Vision (ECCV)*, pages 699–715, 2018.

[4] S. Yuan, Q. Ye, B. Stenger, S. Jain, and T.-K. Kim. Bighand2. 2m benchmark: Hand pose dataset and state of the art analysis. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, pages 4866–4874, 2017.

Supervisor:	Shile Li, Prof. Dongheui Lee
Start:	01.03.2019
Intermediate Report:	XX.XX.2019
Delivery:	XX.XX.2019

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