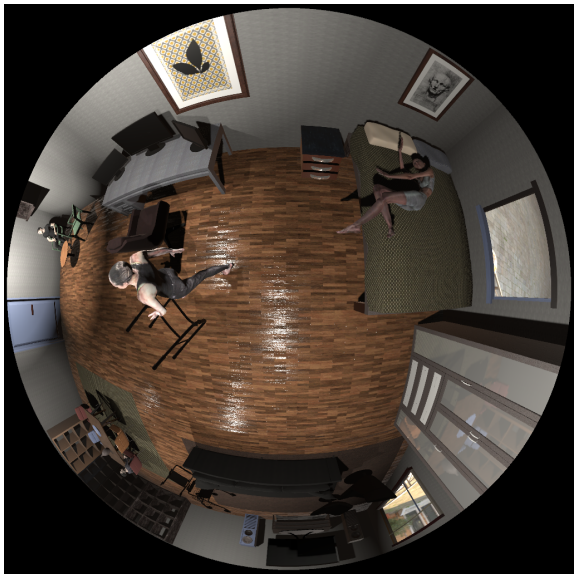
Research Project or Master Thesis

Unsupervised Domain Adaptation for Synthetic Images

Description

The Chair of Digital Signal Processing and Circuit Technology focuses on the development of AAL (Active Assisted Living) systems. In this context, the use of omnidirectional images is quite popular. As part of our research, we are also working on object detection techniques in omnidirectional images. The use of convolution neural networks (CNN's) for these techniques are common and can achieve state-of-the-art-results. CNN's require a lot of data for their training, but the existence of datasets with omnidirectional content is very sparsely. One approach to solving these problems is to acquire and use computer-generated or synthetic data [1], [2]. One of the biggest challenges using synthetic images to train CNNs, is that the acquired knowledge must be apply later to real images. As in Figure 1 depicted, the gap between real images compared to synthetic images is still recognizable. Properties like this, can be the reason why a model performs poor on real images if only synthetic images for a training are used.

(a) camera captured image



(b) computer generated synthethic image

Figure 1: Overview of an real image compared to a computer generated synthetic image

The goal of this work is in a first step a literature research for existing state-of-the-art methods using unsupervised domain adaptation techniques for synthetic images [3], [4]. Later, you will be responsible for implementing one or two of these methods (depending on the complexity of the work as a research or master thesis) into an existing CenterNet [5] implementation using PyTorch. As a final step of your work the whole approach will be evaluated on real fisheye images [6].

Recommended experience

- Understanding in Computer Vision
- Advanced knowledge in deep learning
- Very good knowledge in Python and PyTorch

References

[1] S. I. Nikolenko, "Synthetic data for deep learning," *arXiv preprint arXiv:1909.11512*, 2019.

[2] T. Scheck, R. Seidel, and G. Hirtz, "Learning from THEODORE: A synthetic omnidirectional top-view indoor dataset for deep transfer learning," in *The IEEE Winter Conference on Applications of Computer Vision*, 2020, pp. 943–952.

[3] T.-H. Vu, H. Jain, M. Bucher, M. Cord, and P. Pérez, "Advent: Adversarial entropy minimization for domain adaptation in semantic segmentation," in *Proceedings of the IEEE conference on computer vision and pattern recognition*, 2019, pp. 2517–2526.

[4] K. Saito, K. Watanabe, Y. Ushiku, and T. Harada, "Maximum classifier discrepancy for unsupervised domain adaptation," in *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, 2018, pp. 3723–3732.

[5] X. Zhou, D. Wang, and P. Krähenbühl, "Objects as points," *arXiv preprint arXiv:1904.07850*, 2019.

[6] F. Klöpfel. (2020). FES | research | digital signal processing and circuit technology | faculty of electrical engineering and information… | TU chemnitz, [Online]. Available: `https://www.tu-chemnitz.de/etit/dst/forschung/comp_vision/fes/index.php.en` (visited on 07/14/2020).

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