TECHNISCHE UNIVERSITÄT CHEMNITZ

Chemnitz University of Technology
Chair of Digital Signal Processing
and Circuit Technology

Master Thesis

Motion and edge fusion via dense extreme inception network

Description

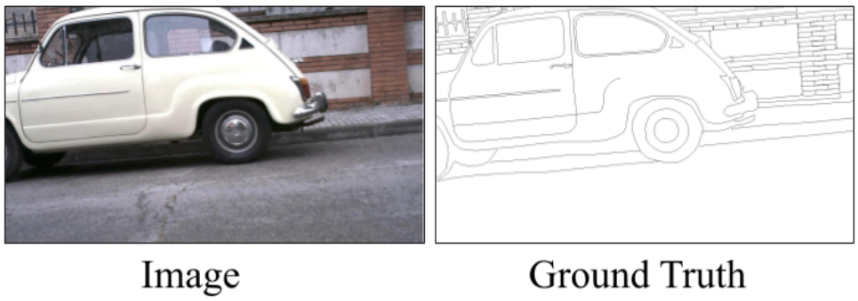

Figure 1: Input image and ground truth of edges from DexiNed. Image from Fig. 5 of [1]

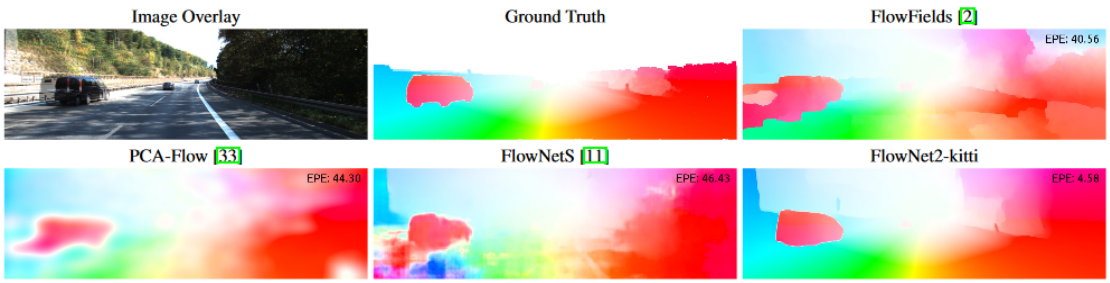

Figure 2: Comparison of CNN-based optical flow approaches from Fig. 7 of [2]

The professorship of Digital- and Circuit design (DST) is working in the field of Convolutional Neural Networks (CNNs) for various computer vision tasks.

In this work the aim is to improve the accuracy of current U-Net architectures (e.g. FlowNet [2]) for optical flow estimation in perspective and omnidirectional images. Recent challenges in optical flow, such as small fast motions can be overcome with the help of information from segmentation networks or motion boundary estimation networks. For reducing the A dense optical flow field for each pixel thereby can be combined with motion boundaries.

The state of the art detection of edges can be found in the work from [1]. This edge-detector is inspired by HED (Holistically-Nested Edge Detection) and Xception networks. The proposed approach generates thin edge-maps that are plausible for human eyes

The students work isn't limited to this work but should at least contain the following steps:

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- Setting up Implementation of FlowNet2[1] and DexiNed[2]
- Investigate of different methods of Network fusion (in which stage of the network, based on loss function)
- Evaluation of on ground truth optical flow datasets which contains boundaries
- The evaluation should be contains at least the following: i) EPE and AAE errors on state-of-the-art optical flow datasets ([3], [4]) with and without motion boundaries
- (optional) Evaluation on above mentioned datasets with Canny Edge detector [5].

Recommended experience

- basic understanding in computer vision
- at least a 'good' result in Computer Vision I
- knowledge in Python

Literature

[1] X. S. Poma, E. Riba, and A. Sappa, "Dense extreme inception network: Towards a robust cnn model for edge detection," in *Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision*, 2020, pp. 1923–1932.

[2] E. Ilg, N. Mayer, T. Saikia, M. Keuper, A. Dosovitskiy, and T. Brox, "Flownet 2.0: Evolution of optical flow estimation with deep networks," in *Proceedings of the IEEE conference on computer vision and pattern recognition*, 2017, pp. 2462–2470.

[3] D. J. Butler, J. Wulff, G. B. Stanley, and M. J. Black, "A naturalistic open source movie for optical flow evaluation," in *European conference on computer vision*, 2012, pp. 611–625.

[4] A. Geiger, P. Lenz, and R. Urtasun, "Are we ready for autonomous driving? the kitti vision benchmark suite," in *2012 IEEE conference on computer vision and pattern recognition*, 2012, pp. 3354–3361.

[5] J. Canny, "A computational approach to edge detection," *IEEE Transactions on pattern analysis and machine intelligence*, no. 6, pp. 679–698, 1986.

[1] https://github.com/NVIDIA/flownet2-pytorch
[2] https://github.com/xavysp/DexiNed

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