<u>Project Proposal</u>: Depth Estimation and disruption Simulation

Hilel Polak
Dated: February 12, 2020

1. MOTIVATION

One of the most important aspects of computer vision is depth estimation.
It gains more and more importance since more and more applications need this ability:

Autonomous cars
Driver assistance system
Robot vision
VR applications
AI usages

As all the disciplines above become more popular, it becomes crucial to get an accurate computer vision.

2. OVERVIEW

I plan to explore and implement an image processing algorithm that will estimate depth from two images that were taken by dual camera.
The 1st step will be to generate a depth map from these images.
Based on the depth map I want to try and simulate disruptions on the original image:
Twilight
Fog
smoke

I want to generate a realistic disruption of the original image. As we all know from real life, more distant objects will be more obscured by the disruption.
Furthermore, I can simulate a concentrated source of smoke, such as a chimney. It can be applied to video games, autonomous driving training and pilot training.

3. MILESTONES

1. Image correction:

I will process the raw images by implementing image processing pipeline. By 2/20

2. Object recognition and depth estimation:

I will identify the objects in the images from dual camera. By calibrating the displacement of objects, I will be able to get the depth information. By 2/27

3. Background effects:

I can implement background rendering or refocusing based on depth map, for example fog simulation. I will design our mask for local source of fog and apply it on images. By 3/5

4. RELATED WORK

There are some works on depth estimation by a variety of methods:
Quiyan, et al., use a short video clip with minor camera movement to estimate depth and implement refocusing. The parallax of different frames of the video clip are used to determine the depth of each object. It uses the same principle of a dual camera system but instead using one camera over a period. [2]
Martinello, et al., use a dual camera to accomplish depth estimation. Their work is notable that they use a mobile camera. They also implement some denoising techniques in combining two images. [3]
Fan, et al., compare a few methods for fog simulation and apply it to images for different amounts and types of fog. [4]

The general idea is once I have a few photos from different perspective,I will be able to estimate the depth of the objects in the photo. There are a lot of publications based on this idea for other applications, which may be helpful even for fog simulation.

---

[1] S. Lee, N. Kim, K. Jung, M. H. Hayes, and J. Paik, in *Acoustics, Speech and Signal Processing (ICASSP), 2013 IEEE International Conference on* (IEEE, 2013) pp. 2247-2251.
[2] Q. Tao, J. Li, L. Wang, and M. Zhang, in *Wireless Communications & Signal Processing (WCSP), 2015 International Conference on* (IEEE, 2015) pp. 1-5.
[3] M. Martinello, A. Wajs, S. Quan, H. Lee, C. Lim, T. Woo, W. Lee, S.-S. Kim, and D. Lee, in *Computational Photography (ICCP), 2015 IEEE International Conference on* (IEEE, 2015) pp. 1-10.
[4] F. Guo, J. Tang, and X. Xiao, International Journal of Computer Games Technology **2014**, 10 (2014).
[5] *Fan Xiaoting, Li Yi, Luo Xiaowei, Zhang Ning, Han Mengxin, Lei Jianjun. Depth estimation based on light field structure characteristic and multi view matching[J]. Infrared and Laser Engineering, 2019, 48(5)*