Synthesis Depth-of-Field from Depth Estimation using Mobile Devices

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1 Summary

In the scope of this project, we would like to investigate some recent advances in depth estimating algorithms using mobile devices for producing realistic shallow depth-of-field as captured with DSLR-style cameras. We would like to 1. Review different approaches used in this area and 2. Re-implement and improve algorithms proposed by the most interesting and best qualified approach.

2 Background

Depth-of-Field is an important component for creating engaging photographs, it refers to letting object in focus be sharply presented in the field and elsewhere blurred. Shallow (small) DOF benefits from large aperture setting and vice sersa. However, for mobile devices, the size of the apertures are limited by the space allowed for camera module, making the RAW images taken having wide (large) depth-of-field, which means we cannot achieve the same level of DOF as using professional DSLR cameras optically.

Computationally synthesizing depth-of-field is a common approach used by mobile phone manufacturers to overcome this problem. Depth estimation is tightly coupled with DOF synthesis, and sometimes used as a prior in DOF synthesis pipeline (Wadhwa et al., 2018). It can be computed with depth from defocus (Subbarao and Surya, 1994), (Tang et al., 2017), confocal stereo (Hasinoff and Kutulakos, 2006), depth-from-focus (Suwajanakorn et al., 2015). some manufacturer used dual-pixels as well (Garg et al., 2019), or even time-of-light (ToF) sensors for depth inference.

3 Resources

The images used in this project are taken with mobile phones which are easily accessible. Inspired by (Wadhwa et al., 2018), we will also use Flickr (www.flickr.com) as a resource to collect data.

Some image processing pipelines contain deep learning based methods, e.g., person segmentation, the computational resources are also accessible.

4 Goals and deliverables

Since some algorithms are not open-sourced, we will choose the most interesting one for re-implementation and try to optimize some steps during which.

5 Schedule(tentative)

Date	Work
Oct.31 - Nov.4	Read papers
Nov.7 - Nov.11	Select the most interested algorithm for re-implementation
Nov.14 - Nov.18	Re-implementing paper results
Nov.21 - Nov.25 (Thanks-giving)	Slack days for adjustment and pivot
Nov.28 - Dec.2	Get some preliminary results
Dec.5 - Dec.9	Fine tuning or figure out some better ideas
Dec.9 - Dec.12	Compose project report and presentation
Dec.13	Project presentation

References

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