

EE368 Project Proposal

Using Depth Mapping to realize Bokeh effect with a single camera Android device

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Overview

Artistic enhancement of photographs is a very popular field of research with several applications that are common place in the world of smart phone photography. Recently researchers have sought to produce an effect known as Bokeh in smart phone photos using digital image processing techniques. Bokeh is the shallow-depth of field effect which blurs the background of portrait photos (typically) to bring emphasis to the subject in the foreground. This effect is usually achieved in high end SLR cameras using portrait lenses that are relatively large in size and have a shallow depth of field. It is extremely difficult to achieve the same effect (physically) in smart phones which have miniaturized camera lenses and sensors. At the core of Bokeh effect production in smart phone photography is depth mapping. A depth map (an estimate of depth at each pixel in the photo) is used to identify portions of the image that are far away and belong to the background and therefore apply a digital blur to the background.

In this project we seek to produce a bokeh effect with photos taken using an Android device by post processing the photos within the Android device. The photos can also come from Photo Stream. In this paper, the depth at each pixel from a single image will be estimated based on the image gradient [1]. Different PSF models will be evaluated and selected [2]. We assume that the faster the image changes, the closer to the camera when it was taken. A gradient-based image blurring function will be applied on the images. Different levels of image blurring will be applied based on the estimated depth map. This method can be used to perform foreground and background segmentation as well as remove spatial varying blur. The new images can be saved into Photo Stream.

To evaluate the performance of the algorithm, reference images are needed. We could compare our results to the images in existing literatures. We also plan to use Photos from iPhone 7 Plus with Bokeh effect will be our comparison reference images. Because the iPhone 7 Plus has a dual-camera, resulting in a pretty accurate estimation of depth map. Mathematic metrics will be developed to measure the difference between images from our algorithm and from iPhone 7 Plus.

We are a team of three SCPD students from the same company. We all have a background in Mechanical Engineering with no experience in OpenCV or Android development. We anticipate that this will be a problem requiring us to learn and implement several advanced image processing techniques. In addition we hope to take on the challenge of learning how to develop image processing solutions for mobile devices (Android). A mentor with experience in OpenCV and Android development will be very helpful for us. In addition, only one of us has an Android device, and we would like to get another Android device from the class if possible. We are open to suggestions on the modifying the scope of our proposal.

References

- [1] X. Zhu, S Cohen, S Schiller, and P. Millanfar. Estimating Spatially Varying Defocus Blur. IEEE Transactions on, volume 22, pages 4879 – 4891, 2013.
- [2] A. Chakrabarti, T. Zickler, and W. T. Freeman, “Analyzing spatially varying blur,” in Proc. IEEE CVPR, Jun. 2010, pp. 2512–2519.