

# Multi-Focal Plane portrait mode with light fields

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EE 367 Project Proposal

## Objective

Generate a portrait mode image where multiple people at different depths are in focus and the background has a depth dependent blur.

## Motivation

One of the many interesting features introduced in mobile phones is the Portrait Mode. Portrait mode helps emulate the shallow depth of field effect that DSLRs deliver. It works brilliantly for subjects that are in the focal plane but tends to be very “aggressive” in blurring out objects that are even slightly off of the focal plane. An example is shown in figure 1. These examples suggest that there is scope to improve the portrait mode of mobile cameras.

## Related Work

Google’s camera team describes the process of simulating the shallow depth of field effect in [1]. The authors use a neural network to generate a segmentation mask and then blur the rest of the image. This paper was the inspiration for this idea and there doesn’t seem to be a lot of literature in this topic. The approach of the course project is to utilize light fields for the depth estimation.



(a) Example 1



(b) Example 2

Figure 1: Cases where one subject is blurred out. [Google Search]

[2] elucidates the use of light fields in estimating the depth map. They boast of high single thread CPU performance of the algorithm . Another algorithm to estimate depth map using light fields is proposed in [3]. While [2] & [3] don't tie in directly, their methods can be adopted.

## Project Overview

The Lytro Illum will be used to capture a light field image of a scene with multiple subjects at different depths; with the aim of creating a ‘unified’ portrait mode and to eliminate the issue pointed out in figure 1. The goal would be to identify various segmentation masks of all the subjects, unify the masks and apply a depth-dependent blur to simulate an effect similar to a DSLR.

## Milestones & Timeline

1. Literature survey & existing implementation: 18<sup>th</sup> Feb 2019
2. Familiarize with camera & basic operations: 23<sup>rd</sup> Feb 2019
3. Segment people out: 28<sup>th</sup> Feb 2019
4. Create portrait mode for a single face: 4<sup>th</sup> Mar 2019
5. Repeat for multiple faces & apply depth dependent blur: 11<sup>th</sup> Mar 2019

## Novelty

The novelty here lies in the fact that we can have multiple objects at various depths in focus and apply a depth dependent blur. The Google Pixel does this but uses a conventional camera with dual pixel sensors and this project aims to do the same with lightfields.

## Risks and Payoffs

Like the entire tech industry, the risk here lies in the fact that there might be a (purely) Deep Learning based method that outperforms this system and that some firm might already be well on their way to implementing something similar. The payoff here is creating such an image with relatively fewer computation- machine learning is good but there may be simple methods to get comparable results. This can then be incorporated as an additional feature in portrait mode.

## References

- [1] Neal Wadhwa, Rahul Garg, David E. Jacobs, Bryan E. Feldman, Nori Kanazawa, Robert Carroll, Yair Movshovitz-Attias, Jonathan T. Barron, Yael Pritch, Marc Levoy, "*Synthetic Depth-of-Field with a Single-Camera Mobile Phone*", ACM Transactions on Graphics, 2018.
- [2] Yuriy Anisimov and Didier Stricker, "*Fast and Efficient Depth Map Estimation from Light Fields*", International Conference on 3D Vision, Qingdao, China, October 2017.
- [3] Chen Yang, Alain Martin and Smolic Aljosa, "*Fast and Accurate Optical Flow based Depth Map Estimation from Light Fields*", Irish Machine Vision and Image Processing Conference, 2017.