

EE 367 Project Proposal

Names:

Trisha Lian
Kyle Chiang

Goal:

For our final project, we would like to explore better algorithms for demosaicing data captured with a light field camera.

Light Field Simulation:

We plan to use a full light field camera pipeline simulator to collect light field data and to evaluate our demosaicing method. This simulator has been in development in Brian Wandell's lab. First a virtual scene with lighting and texture is created in a 3D modeling program, such as Blender. Next, a ray-tracer is used to trace rays (for each wavelength) from the scene, through the optics of a light field camera, to a sensor. Finally, ISET (Image Systems Engineering Toolbox) is used to simulate the sensor response and sensor noise, and we end up with simulated, raw light field camera data.

The advantage of using the simulator is two fold. First, we are able to access simulate raw (pre-demosaiced) data extracted from a light field camera. This is not possible with a real Lytro camera. Secondly, by using simulation we have ground truth color data from the scene that we can evaluate our algorithms against.

What others have done:

Not much work has been done in demosaicing images from light field cameras. Existing cameras simply demosaic the sensor data as if it were a standard camera. In other words, each microlens is demosaiced individually. This technique does not take into consideration, or take advantage, of the fact that we have captured a light field.

The method above both removes high frequency information and introduces color artifacts. Some researchers [1] have proposed projecting samples of the microlens to the refocus plane before demosaicing. To avoid the random RGB sampling that results from this, the authors resample the radiance according to the parameters of the focal plane in order to achieve even samples for demosaicing. With this method, the authors claim to achieve, visually, reduced demosaicing artifacts and more detail. Other demosaicing methods use disparity [2] or machine learning [3] to improve color quality.

What we want to do:

We would like to use ADMM and a TV prior to improve demosaicing. We would model demosaicing as a matrix multiply in order to implement ADMM. This would be implemented similar to [4] and to our homework problems. We would also use a priors that utilise our light field data (i.e 4D-TV color prior). Once we implement this method, we can use our ground truth to quantify our image quality.

Citations:

[1] Yu, Zhan, et al. "An analysis of color demosaicing in plenoptic cameras." *Computer Vision and Pattern Recognition (CVPR), 2012 IEEE Conference on*. IEEE, 2012.

[2] Seifi, Mozhdeh, et al. "Disparity-guided demosaicking of light field images." *Image Processing (ICIP), 2014 IEEE International Conference on*. IEEE, 2014.

[3] Huang, Xiang, and Oliver Cossairt. "Dictionary learning based color demosaicing for plenoptic cameras." *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops*. 2014.

[4] Heide, Felix, et al. "FlexISP: a flexible camera image processing framework." *ACM Transactions on Graphics (TOG)* 33.6 (2014): 231.