EE 367 Project Proposal:
Estimating Depth with the Light Field Camera

By: Marcus Pan (mpanj@stanford.edu)
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Images taken with a light field camera contain rich data that can be used to estimate depth from a single shot. Since the light field image encodes both views from multiple positions, and views with different focus, depth estimation typically involves either of the following approaches:

1. depth from correspondences
2. depth from defocus

In my project, I plan to combine depth estimates from both correspondences and defocus to estimate depth, improving on the algorithm proposed by Tao et. al. [1]. They first estimated depth from using correspondences found in the epipolar images of a light field camera [2]. Then they estimated depth from defocusing by finding the focus that maximizes the contrast for a given pixel. For each estimate, they assign a confidence value of their estimate. Finally they combine both estimates with a Markov Random Field algorithm.

I plan explore other depth estimates, and incorporate them into Tao's framework. For a start, I intend to implement Adelson's optical flow algorithm [3] and Bishop et. al's anti-aliasing estimation algorithm [4]. I also plan to explore the use of priors to regularize the depth estimation map.

Milestones:

1. Learn Tao's algorithm (code online)
2. Implement Adelson's algorithm and compare
3. Implement with Bishop's algorithm and compare

References

[1] Michael W. Tao, Sunil Hadap, Jitendra Malik, and Ravi Ramamoorthi. Depth from combining defocus and correspondence using light-field cameras. December 2013.

[2] Martin Matouek, Tom Werner, and Vclav Hlav. Accurate correspondences from epipolar plane images. 2001.

[3] Edward H. Adelson and John Y. A. Wang. Single lens stereo with a plenoptic camera. *IEEE Trans. Pattern Anal. Mach. Intell.*, 14(2):99–106, February 1992.

[4] Tom E. Bishop and Paolo Favaro. The light field camera: Extended depth of field, aliasing, and superresolution. *IEEE Trans. Pattern Anal. Mach. Intell.*, 34(5):972–986, May 2012.