Generating Anaglyphs from Light Field Images

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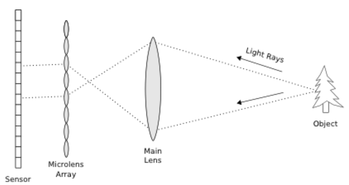
Motivation

Light-field imaging systems have received a lot of attention recently, especially with the release of Lytro cameras for consumer application. Extensive research has been conducted in optimizing and developing applications for light-field images. In order to investigate the potential use of light-field imaging systems as an experimental research analysis tool, an automated image processing algorithm was developed to generate anaglyphs images from light-field images acquired from a Lytro Illum camera.

Background

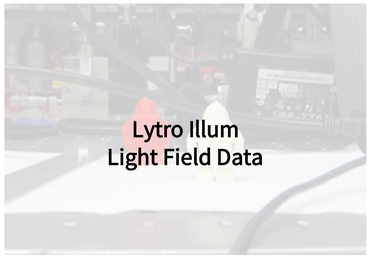
Conventional cameras capture 2D images, which are projections of a 3D scene. Light-field imaging systems capture not only the projection but also the directions of incoming lighting that project onto a sensor. Specifically, Lytro cameras consist of an array of microlenses placed in front of the photosensor used to separate the light rays striking each microlens, and to focus them on different sensors according to their directions. The acquired light-field allows for more flexible image manipulating. Enough information in captured that one can refocus images after acquisition, as well as shift one's viewpoint.



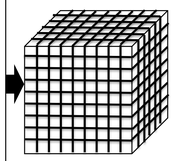
Anaglyphs requires a pair of images, which have been taken at slightly different perspective viewing angles to create the desired 3D effect. There are two possible methods for generating anaglyphs from light field images.

For the first method, two perspective views can be extracted directly from the light field image to generate an anaglyph. For the second method, the anaglyph image can be generated using depth-field information computed from the light-field image. Using the computed depth-field information, two different perspective views can be generated by segmenting the image into different regions corresponding to different depths and displacing the segmented regions accordingly.

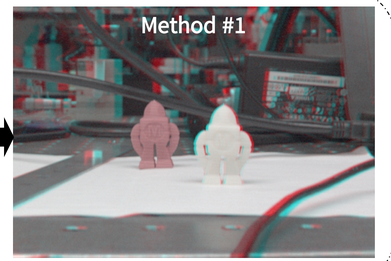
Method



Decode Raw 2D Light Field Image into Array of Images



Extract Left and Right Most Perspective Views and Generate Anaglyph



Compute Depth Map*

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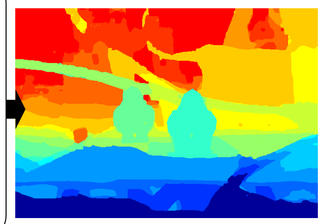
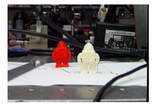
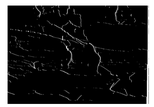
Segment Depth Map (Optimized Multilevel Otsu's Method)



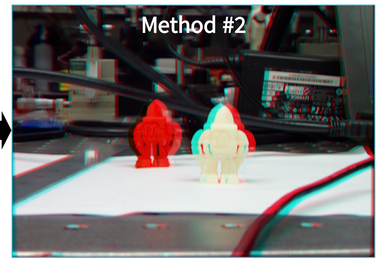
Generate Left and Right Perspective Images (Displace-ment based on Depth Map)



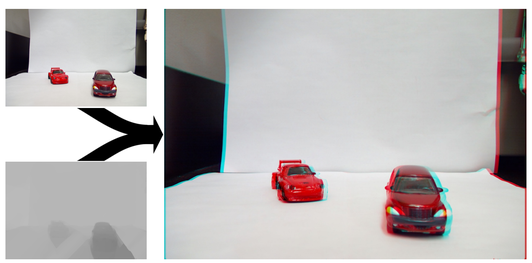
Detect Holes

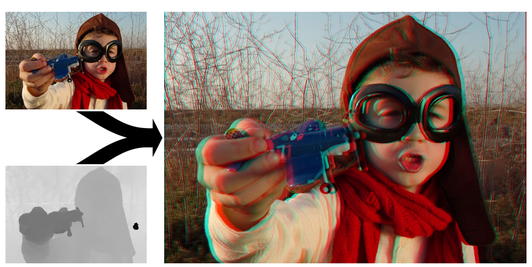


Fill Holes and Generate Anaglyph



Results





Summary

- Both methods produced desirable results
- Image processing algorithm is robust under different imaging conditions, but requires an accurate depth map estimation
- Future work requires development of an accurate depth map estimator

References

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