Panorama Based on Light Field Images

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Introduction:

Light field camera captures an array of images by microlens near the detector while traditional camera just takes one 2D picture of a 3D scene via one single lens. Though the resolution is not as good as traditional camera, light field device still brings a lot of advantages in many ways [1,2]. For example, depth detection, post-focus, 4D feature detection or even animated thumbnail 3D camera shake are feasible from processing light field images. In the recent years, panorama is also developed as a picture containing a wide viewing angle which is usually achieved by stitching a couple of 2D images together[3,4]. Our project will look into rendering panorama pictures by stitching individual light field images which will both contains a wide viewing angle and has the ability to calculate a lot of depth related characteristic via MTALAB Light Field Toolbox.

Objective

Achieve panorama based on light field images

Methods

Firstly, multiple scene will be imaged by a well-known light field camera -- Lytro. Due to the requirement of the stitching algorithms to make a panorama, the Lytro camera should take a couple of images by rotating around an axis setting through the diameter of its lens. Thus, a mechanical design will also be included in the project. We plan to take 8-10 scene around the rotating axis in order to make sure there are enough features in the stitching process.

Secondly, we will stitch individual images to into one panorama. The stitching algorithms used here could be different from the classics one introduced in class. Feature extracted for stitching here should contain depth or relevant information specific for light field image.

Then, we will carry out light field calculations based on these images taken by Lytro camera. We will start from depth detection [5,6] but other more challenging tasks will be included depending on our progress. 4D feature extraction or 4D edge detection[7] can be one choice while using Light Field Toolbox to fix the illumination calibration can be another. Some potential methods to achieve these interesting topics are listed as references below.

We would like to use Matlab and Light Field Toolbox in the project while Android device will not be used. Consider timing of the project, we plan to work on mechanical design, imaging and stitching of the figures before mid November and then move on carrying out deep topics starting from depth detection. If time allows, we will also investigate 4D feature extraction or 4D edge detection before the deadline of December 7th.

Reference

[1] Yang, Jason C., et al. "A Real-Time Distributed Light Field Camera."*Rendering Techniques* 2002 (2002): 77-86.

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[4] Brown, Matthew, and David G. Lowe. "Automatic panoramic image stitching using invariant features." *International journal of computer vision* 74.1 (2007): 59-73.

[5] Wanner, Sven, and Bastian Goldluecke. "Globally consistent depth labeling of 4D light fields." Computer Vision and Pattern Recognition (CVPR), 2012 IEEE Conference on. IEEE, 2012.

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