CSCE 489/689 - Computational Photography

Programming Assignment 4

Deadline: Mar. 20th

1 Goal

The goal of this project is to become familiar with light field images and achieve complex effects like refocusing and aperture change by simple operations such as shifting and averaging.

2 Starter Code

There is no starter code for this assignment. However, the input light field images as well as a few images of the expected results are provided here. Make sure you follow the structure of this package. Have your code in the "Code" folder and read the images from the "Images" folder.

3 Task 1

Here, you need to read in the light field images and extract the images from different viewpoints. The light field format is shown in Fig. 1. Both of the light fields have an angular resolution of 7×7 and a spatial resolution of 541×376. You need to extract the top left $(u, v$ = (1, 1)), top right $(u, v$ = (7, 1)), bottom left $(u, v$ = (1, 7)), and bottom right views $(u, v$ = (7, 7)). The expected result for the top left view is provided in the "Results" folder.

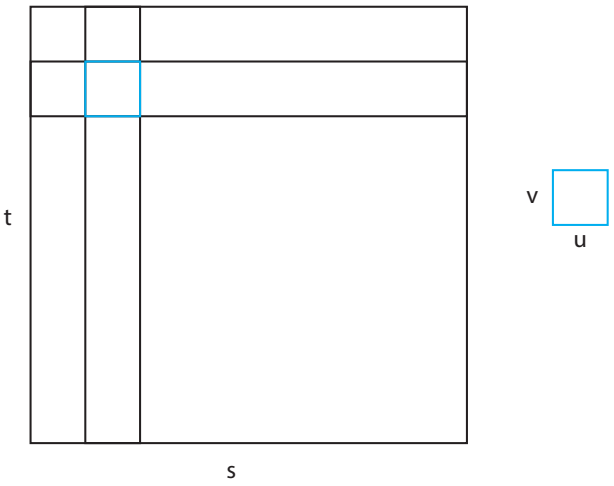

Figure 1: Light field image format

4 Task 2

Here, you have to adjust the aperture by averaging a subset of views. Specifically, you need to generate results with 4 different aperture sizes by averaging:

1. 7×7 views
2. central 5×5 views
3. central 3×3 views
4. central view; essentially output the image (4, 4)

The "Result" folder includes the expected result of the first case.

5 Task 3

The objects which are far away from the camera do not vary their position significantly when the camera moves around while keeping the optical axis direction unchanged. The nearby objects, on the other hand, vary their position significantly across images. Averaging all the images in the grid without any shifting will produce an image which is sharp around the far-away objects but blurry around the nearby ones. Similarly, shifting the images 'appropriately' and then averaging allows one to focus on object at different depths.

Use the method discussed in the class to generate refocused images. You need to generate 5 images by changing the shift parameter d from -2 to +2. The expected results corresponding to $d = 1$ are provided in the "Results" folder.

6 Write Up

Include all the requested results in your report. Describe how you implemented the assignment. Discuss any problem you faced when implementing the assignment or any decisions you had to make.

7 Graduate Credit

There are no additional requirements for graduate credit for this project.

8 Deliverables

Your entire project should be in a folder called "`firstname_lastname`". This folder should be zipped up and submitted through e-campus. Inside the folder, you should have the followings:

- A folder named "Code" containing all the codes for this assignment. Please include a README file to explain what each file does if you add any other files to the starter code.
- A report in the pdf format. **Make sure you write your name on top of the report. Also make sure the pdf file is under 5 MB.**

Make sure you exclude all the results and original images from your submission.

9 Checklist

Make sure you can check all the items below before submitting your assignment. You will lose 5 points for each item that cannot be checked.

- ☐ The root folder is called "`firstname_lastname`". Note _ between first and last name.
- ☐ Inside the root folder, there is a folder called "Code" that contains your source code. Also make sure the report is in the root folder.
- ☐ Your code reads the images from the "Images" folder.
- ☐ The folders "Images" and "Results" are not included (you only submit your codes and a report).
- ☐ Name written on top of the report.
- ☐ The report is in pdf format and the file is under 5 MB.

10 Ruberic

Total credit: [100 points]

[10 points] - Change of viewpoint (Task 1)
[30 points] - Aperture change (Task 2)
[50 points] - Refocusing (Task 3)
[10 points] - Write up