

EE6130: Advanced Topics in Signal Processing (Jan-May 2021)

Computational Imaging & Displays

Assignment 2: Light Field Processing

Deadline: April 6th, 2021

Instructions:

- The assignment can be done using either MATLAB or Python.
- The codes have to be commented well for understandability.
- You should submit a brief report on how you have arrived at the results.
- The required algorithms have to be implemented on your own.

Light Field Image Processing:

The goal of this assignment is to process images captured using a Light Field camera. Use any one light field data from [EPFL Light-field data set](https://www.epfl.ch/labs/imaging/datasets/light-field/) and extract the subaperture views using the Matlab Light field Toolbox (LF Toolbox).

<https://in.mathworks.com/matlabcentral/fileexchange/49683-light-field-toolbox-v0-4>

Perform the following on the 5D Light Field data:

1. Display a single image which shows a grid of the different views captured using the light field camera.
2. Digital Refocusing:
 - a. Implement digital refocusing via image shifting and display a GIF animation in which the focus progressively changes from the foreground to the background.
3. Image Aperture Modification:
 - a. Display the central view image of the light field.
 - b. Change the Depth of Field (DoF) of the image by digital image aperture modification. Create a GIF animation which shows change of DoF progressively.
4. Depth Estimation:
 - a. Estimate the depth of the scene from Light Field data using any of the LF depth estimation algorithms.
 - b. Display the depth map of the central view image.

Extraction of light field views :

1. Go to the [EPFL Light-field data set](#) and download any 4D LF MAT file .
2. If you have chosen Bikes , on extracting the contents of the downloaded zip file, you should be getting a Bikes.mat file .
3. In line 5 of extractimages.m , replace with the name of your .mat file .
4. Similarly , make appropriate name changes in lines 70, 72 and 76 (2 places) .
5. The code takes a while to run , at the end of which you should be getting all the sub-aperture views extracted as individual images in your folder.

Useful References:

1. [Light Field Photography with a Hand-held Plenoptic Camera](#)

<https://graphics.stanford.edu/papers/lfcamera/lfcamera-150dpi.pdf>

2. [Camera array](#)

http://graphics.stanford.edu/papers/CameraArray/CameraArray_Sig05.pdf

3. [Digital Light Field Photography](#)

<https://stanford.edu/class/ee367/reading/Ren%20Ng-thesis%20Lytro.pdf>

4. [Decoding, Calibration and Rectification for Lenselet-Based Plenoptic Cameras](#)

<http://www-personal.acfr.usyd.edu.au/ddan1654/PlenCal.pdf>

5. [Accurate depth map estimation from a lenslet light field camera](#)

<https://ieeexplore.ieee.org/document/7298762>

<https://github.com/Vincentqyw/Depth-Estimation-Light-Field>