

# Exercise 1a: Handling LFs in Matlab



In this exercise you will use the Light Field Toolbox to load some common light field formats and apply basic linear filters.

## Toolbox Installation

Download the light field toolbox from the mathworks website

<https://www.mathworks.com/matlabcentral/fileexchange/49683-light-field-toolbox-v0-4> or <http://dgd.vision/LF2018/LFToolbox0.4.zip> . Unzip to a new folder and open the documentation file `LFToolbox.pdf` . Follow Section 2 to set up the toolbox paths.

## A Tour

Follow the tour in Sections 3.1, 3.2 and 3.3 of the toolbox documentation. This includes:

- Downloading samples
- Decoding lenslet-based images and loading gantry-style images
- Rectifying lenslet-based images
- Applying basic linear filters - step through the demos carefully and take note of the the different spatial-domain, frequency-domain, 2D and 4D filtering functionality
- Visualizing light fields interactively with the mouse

*Note: When the toolbox rectifies a light field it produces a plenoptic intrinsic matrix assuming a plane separation  $D=1m$  and employing the relative two-plane parameterization.*

The light fields are indexed in the order  $[j, i, l, k, c]$ , corresponding to the continuous spatial-domain light field dimensions  $[t, s, v, u]$ , with the final index corresponding to r,g,b colour channels and a weight channel.

**Visualize:** Load a Lytro light field and visualize it as slices in  $i,j$ ; in  $k,l$ ; and as epipolar slices in  $i,k$ ; and in  $j,l$ . Visualize the weight channel in these slices also. Hint: `LFDisp` automatically squeezes, centers, e.g. `LFDisp(LF)` and `LFDisp(LF(5, :, 100, :, :))` both work.

## Questions

1. Inspect the plenoptic intrinsic matrix for a rectified Lytro image. Does it correspond to a camera array plenoptic intrinsic matrix? Where does it differ from one?
2. Can you force the rectification process to yield a plenoptic intrinsic matrix that does correspond to a camera array? How? Why might you want to do this? (Hint: see Sect 5.2 of the toolbox manual)
3. Which is faster for applying linear focus: two separate 2D filters, or a single 4D filter? Why?
4. What's the purpose of the fourth colour channel? What causes its appearance? What's the impact of removing this information when filtering?