

Light-field algorithm for single-exposure imaging through a fiber bundle.

General information

- The algorithm was developed in MATLAB environment.
- The algorithm was developed based on reference: Optical fiber bundles: Ultra-slim light field imaging probes. Please also cite this paper if you use this code for your project.
- Two sample datasets are provided in folders: single_layer, and multi_layer.
- The function files are put in folder: files

How to use

There are 5 major files for this algorithm, and each file stands for a different intermediate step. Please run these files in sequence.

1. Digital_filter_aperture.m: Digital aperture filtering. For different datasets, make sure to choose the correct path for their reference images. The detected cores could have centroid-off from the measured image. We need to manually adjust parameters: adjust_x, adjust_y, until the cores of two images matched. A dataset file: full&small including two apertured images will be saved.
2. raw_refocusing.m: Light-field refocusing by shift-and-add technique. Two files: lightfield.tif and focal_stacks.tif are generated showing the perspective shift animation and refocused light field stacks. The tif files can be played in Fiji ImageJ.
3. Simulated_psf.m: Preparing simulated PSFs for deconvolution.
4. deconvolution.m: Deconvolution for light-field focal stacks. A window size $ws = 17 \times 17$ was set here. For imaging objects with greater axial distances $> 80 \text{ um}$, larger ws would be needed, but it would also largely increase the computational time.
5. Deconv_focal_stacks.m: xz-MIP is plotted and Con_final Image.tif is generated showing the deconvolved focal stacks of the target volume. The tif files can be played by Fiji ImageJ.

Note: We run the algorithm on an Intel(R) Xeon(R) Gold 6258R CPU, 768GB RAM. The digital aperture filtering may take up to 4 minutes, the digital refocusing and psf simulation take up to 2 minutes, and the deconvolution may require greater than 15 minutes (largely depends on the volume and complexity of the images)

Contact

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