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Forget About Focus: Simulating the Light Field Camera

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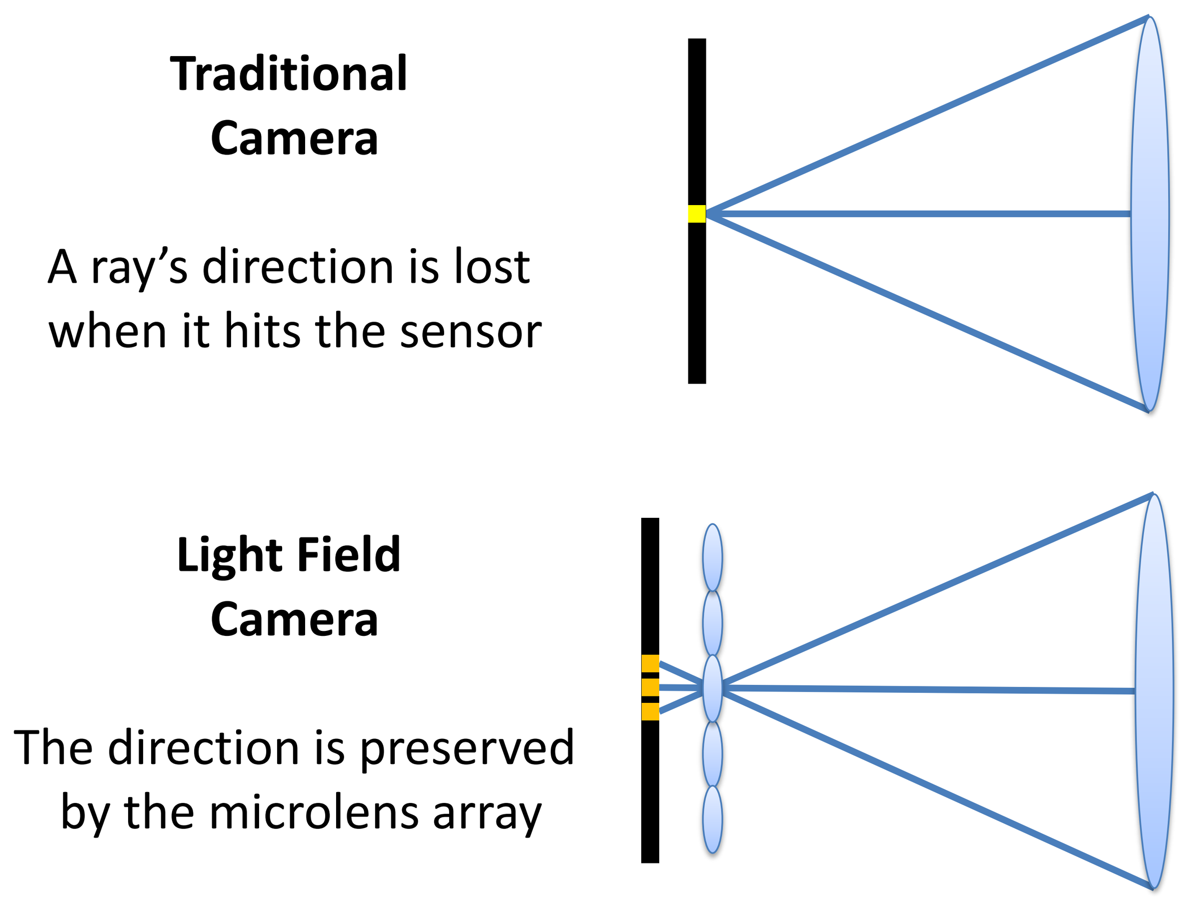
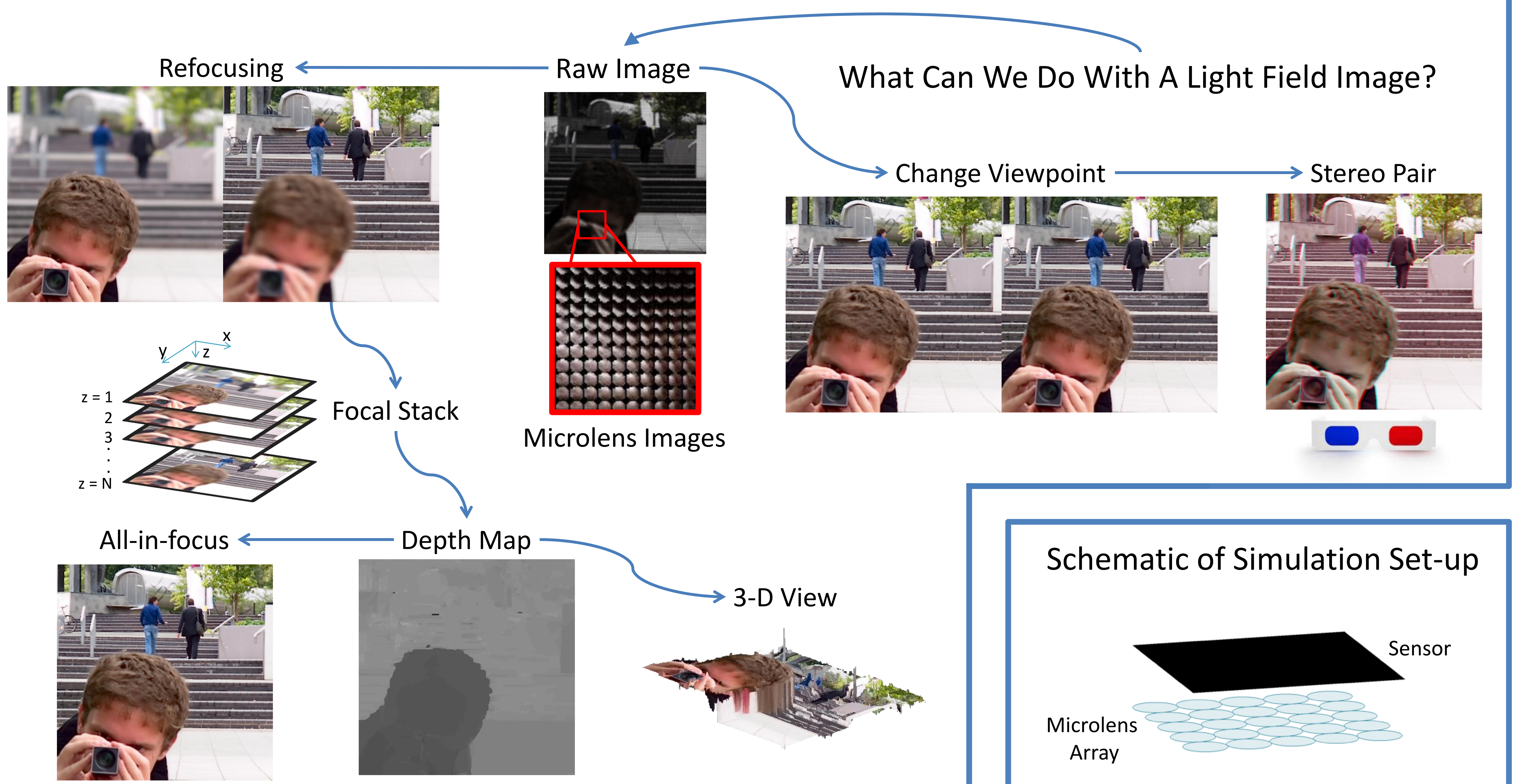
Introduction To Light Field Imaging



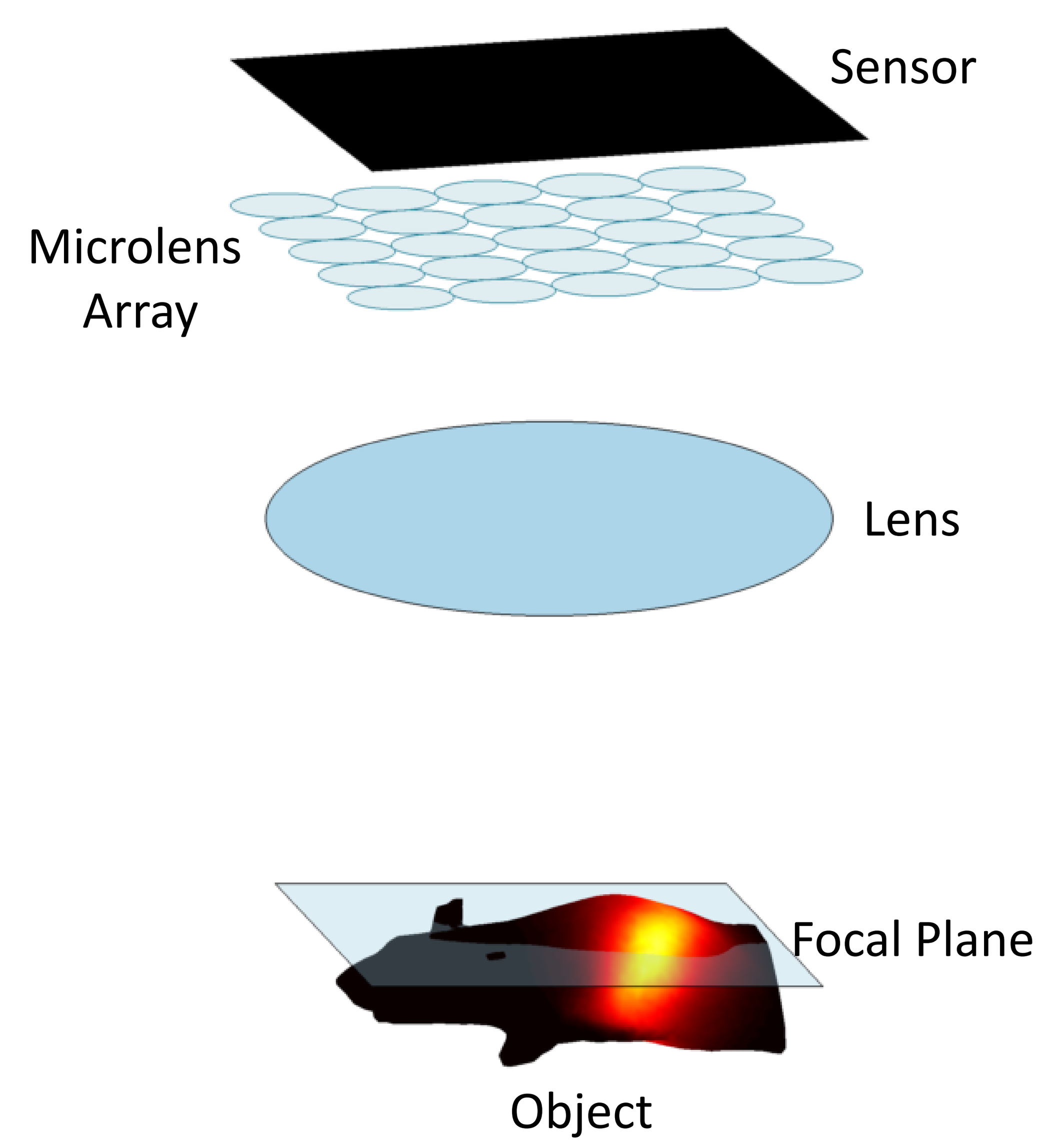
A **light field** camera **captures 3-D data** from a single image. This is because a **microlens array**, consisting of thousands of tiny lenses, splits rays coming from different directions onto different pixels. Knowing a ray's intensity and direction means from a single raw image we can **digitally refocus, change viewpoint, aperture, and estimate depths** within a scene. These abilities come at the expense of spatial resolution.

Biomedical imaging applications can benefit from light field cameras. In translucent scenes, such as in microscopy, the 3-D information captured allows for snap-shot volumetric imaging. The aim of this research project is to investigate how else light field technology can benefit biomedical imaging. By creating simulation software, and implementing methods to handle light field data, this investigation can be helped with computational experiments.

What Can We Do With A Light Field Image?



Schematic of Simulation Set-up



Designing, building, and optimising a light field camera can be challenging. We have created simulation and visualisation software tools to allow for virtual exploration of plenoptic cameras and data.

This allows applications to be investigated, an example being luminescence imaging. In cancer studies, cells can be adapted to emit light, and the 3-D information from a light field camera could help reconstruct internal source distributions, allowing a non-invasive imaging technique which allows us to locate cancer cells accurately in small animal studies.

References

[1] Ng, Ren, et al. "Light field photography with a hand-held plenoptic camera. "*Computer Science Technical Report CSTR* 2 (2005).
[2] Lytro, Inc. (Lytro) Mountain View, CA, USA.