Space Science Solutions Ltd; Light-field photography: assessment and proof of concept of robust and cost-effective imagers for space applications from microscopy to remote sensing

Project Summary

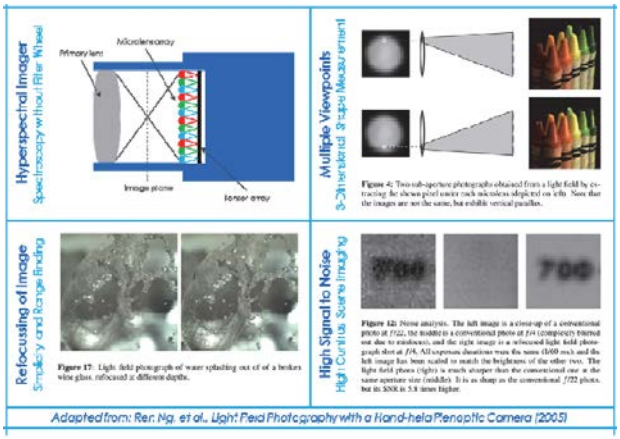
Light-field cameras employ a micro-lens array in the optical path to capture multiple dimensions of information about a scene within a single image exposure. Appropriate software processing then affords numerous advantages over conventional photography:

- *Post facto* refocussing of images
  → relaxes requirements upon mechanical focussing, precision, or choice and enables range finding and measurement
- Very high signal to noise
  → bright objects can be imaged simultaneously with faint objects without motion blur even if moving
- Lenslets can be filtered individually
  → enabling hyperspectral imaging without a mechanical filter wheel
- 3-D imaging via parallax allows shape measurement from all orientations of subject

Hence light-field photography shows great potential for rugged, mechanically simple and low mass/power space cameras. We will benchmark anticipated performance against conventional imagers for applications including remote sensing, range-finding and navigation, monitoring deployable structures, panoramic cameras, spectroscopy, microscopy etc.

We will also breadboard and test a system for measuring the size of lunar regolith scientific samples, as positioning for selection in an upcoming Lunar polar lander mission opportunity.

Promising applications will be discussed with a variety of potential customers in UK and Europe and a plan and timeline will be formulated for the next stages of development towards market.



Top left: example of a light-field camera with alternating band-pass filtered lenslets to allow hyperspectral imaging. Top right: Example of parallax obtained through reconstruction of upper and lower sub-images. Bottom left: Example of variable focus depth. Bottom right: Example of high signal to noise achievable.