

The random camera, the coded aperture camera, and other cameras

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Abstract

I'll describe two cameras and a comparison of many cameras. In the random camera, we use a "lens" which creates a pseudo-random relationship between incoming light rays and resulting sensor locations. We studied various properties (both good and bad) of the resulting camera and have built a prototype. The coded aperture camera is a conventional SLR camera but with a coded pattern of holes in the aperture. This gives a depth-dependent blur which is both easy to identify and easy to deblur, allowing us to estimate, from the captured image, both an all-focus image and (roughly) the depth everywhere. Finally, we analyze cameras as linear projections of the 4-d lightfield and develop a Bayesian framework to study how well any given camera can recover the incident lightfield from its data. This gives a common framework in which to compare the performance of ordinary lenses, stereo cameras, random cameras, lenticular arrays, pinhole cameras, coded aperture cameras, etc.

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