Capturing light fields using spherical mirrors
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Motivation

- Camera arrays for Light Field capture
- Wide FOV Lighting Probes
- Uses only Single Camera
- No Camera Modification
- Low Cost
- Spatio-Angular Tradeoff
- Scene Dependent Calibration

The prototype system consists of Christmas balls mounted to a foam board. The board is supported on a firm plywood base.

Spherical mirror array serving as a set of virtual cameras

Technique

- Implemented Axial cone modeling and refocusing in MATLAB/C++
- Requires Calibration of camera position once on setup
- Surface imperfections in the Christmas balls resulting in a very blurry image
- Spatio-angular resolution trade-off
- Lower resolution in peripheral region
- Better Quality image with larger balls, but lower light field sampling
- Better results can be obtained using stainless steel balls (not used here due to the cost)

Related Work

- Catadioptric Imaging System (CIS) is a well studied branch in literature, which comprises of camera systems consisting on mirrors and lenses for increasing the effective field of view.
- A number of studies which uses spherical mirrors used as lighting probes for image based lighting or as multi perspective cameras for triangulation, 3D reconstruction and construction light fields.


Experimental Results

Digital refocusing from front to back (3x3 array). Note how the bottle gets out of focus and the camera gets in focus.