Project Title: Curate and publish the world's first multi-pose light field dataset

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Motivation/Background:

Conventional 2D imaging is formed by integrating electromagnetic signal over a range of light fields, however, without registering the field information. In contrast, light field imaging offers powerful new capabilities by recording not only the intensity but also light field information. Therefore, the high-dimensional data sets that contain rich scene information can be digitally postprocessed for generating a series of images enableing, for example, post-capture refocus, change of view point, 3D data extraction, change of focal length, and focusing through occluders [1].

A plethora applications such as VR and AR capture and display, robotic vision, and VFX for film making are benefiting from the development of light field imaging. While the light field imaging is still suffering from lower image resolution and the sensor pixel sizes are approaching their physical limits, improving imaging processing algorithmic solutions are of fundamental importance. Therefore, collecting and publishing the world's largest light field dataset while including multiple views of each scene can provide a valuable platform for seamlessly bridging optical imaging, image processing, computer vision, and computer graphics.

Relate Work

Light field imaging is a highly active research field and is gaining more and more attention across many different fields. Light field images can be captured by commercially available camera – Lytro. Previous work in light field imaging are mostly limited by a single shot of a scene [2-3]. Therefore, the collection and sharing of a large amount of dataset can provide the opportunity of more advanced imaging processing and detecting [4, 5].

Project overview

In this project, I will curate and publish the world's largest (>4000) light field dataset (captured with a Lytro Illum plenoptic camera), and the first to include multiple views of each scene. I will analyze the vital statistics of the dataset, with opportunities to build open-source tools for automated analysis and to facilitate use of the imagery. The dataset will enable a broad range of research including the application of machine learning to light fields.

Milestones/Timeline:

Sorry that I believe for this part I need to discuss more details with Donald.

But I am expecting a lot can be done for statistical analysis of the different light fields for each scene.

Examples are: How many examples are in each category, histograms of focus, zoom, and depth ranges, how many images per scene, and so on.

There is also an opportunity for more advanced processing, detecting and reporting on the presence of occlusion, specular, saturation, dimly lit areas, or other challenging content.

References:

[1] Ivo Ihrke, et al, "*Principles of light field imaging-brief revisiting 25 years of research*", Signal processing for computational photography and displays, 2016
[2] Ren Ng, et al, "*Light field photography with a hand-held plenoptic camera*", Stanford University Computer Science Tech Report CSTR 2005-02, April 2005.
[3] Donghyeon Cho, et al, "Modeling the calibration pipeline of the Lytro camera for high quality light-field image reconstruction", ICCV2013
[4] Hani Altwaijry, et al, "Learning to detect and match keypoints with deep architectures", British Machine Vision Conference (BMVC), York, UK, 2016.
[5] Donald Gilbert Dansereau, "*Plenoptic signal processing for robust vision in field robotics*", PhD Dissertation, The University of Sydney, 2014