Light Field Occluder Removal

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Motivation

Occlusions are a common problem in photography, arising from accidental sources (dirty lenses, occluding objects) or systemic restrictions (fixed cameras).

An occlusion represents missing data in an image, and multiple photographs, in the form of a light field, can also provide the necessary information to synthesize the missing components of the image.

Related Work

Image In-painting

This project uses texture synthesis and image in-painting techniques [1] with additional information from the light field in order to remove occlusions.

Obstruction-Free Photography

While this project focuses primarily on synthesizing unknown parts of the image, occlusion detection is also vital. The obstruction-free photography technique introduced by Xue, *et al*. [2] can be applied to light field data to detect and remove occlusions.

References

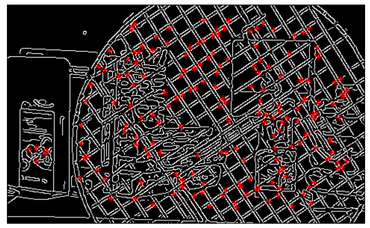
[1] A. Efros and W. Freeman. "Image quilting for texture synthesis and transfer," In Proc. SIGGRAPH 2001, Los Angeles California, August, 2001.

[2] T. Xue, M. Rubinstein, C. Liu, W. Freeman. “A computational approach for obstruction-free photography,” in ACM Transactions on Graphics (TOG) 34 (4), 79.

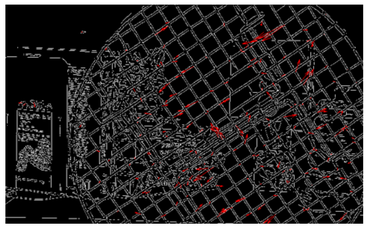
[3] L. Yatziv, G. Sapiro, and M. Levoy, "Lightfield completion," in Int'l Conf. on Image Processing, 2004.

Technique

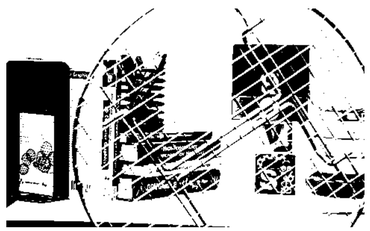
Occlusion Detection [2]



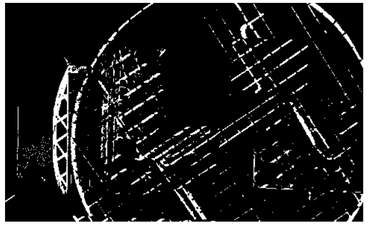
Edge Detection



Sparse Motion Field



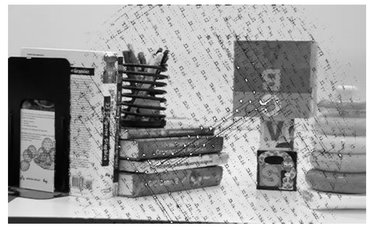
Background Layer



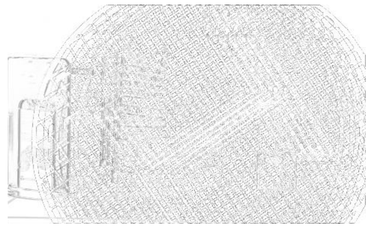
Occlusion Layer

The obstruction-free photography technique uses edge detection to generate a motion field, then constructs a projection matrix to align the background component of each image.

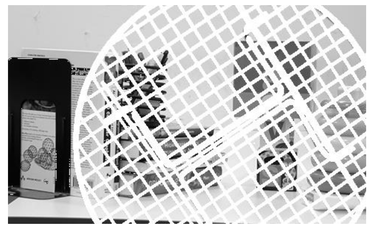
Median Filter [3]



Median Image



Confidence



Original Image

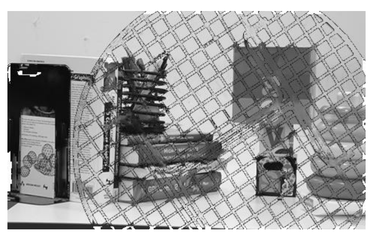
Synthesized Image

A median image is calculated using the light field image stack. A per-pixel confidence is also calculated. The confidence and median image are used to propagate synthesis throughout the stack.

Experimental Results

Average

Spatial Coherence



Median

Median + Confidence