Image Alignment with Hand-Held Photos to Produce HDR Images Project Proposal

Audrey Lee & Lycia Tran

Motivation

High Dynamic Range (HDR) images are images that balance lighting within an image to more accurately match what is perceived by the human eye. In recent years, the average person uses their mobile phone to capture images, and while most phones seem to have their own “HDR Mode”, these HDR images do not seem to be significantly better or more balanced [1]. The goal of this project is to see if we can produce better and more balanced images than the current iPhone implementation by capturing a series of RAW iPhone images using different exposure times to produce our own HDR image.

Proposed Project

We propose to implement our own image alignment and HDR image pipeline to improve the quality of hand-held photos. Since we will be capturing a set of images with different lengths of exposure times using an iPhone, we will need to first align the set of images properly using an image alignment algorithm and then use that algorithm to improve hand-held photos that might not be well aligned due to shaking of the camera. After aligning the images, we will implement the HDR algorithm and the tone mapping to correct the lighting and show the dynamic range of the image.

We propose to capture RAW images with our phones, and if we cannot access the RAW images, we can implement a simulated blur to the images.

The camera blur reducing algorithms we are considering are the Lucy-Richardson algorithm and an approach that uses color priors. The Lucy-Richardson algorithm is an iterative procedure for recovering an underlying image that has been blurred by a known point spread function [2]. The other method uses color priors to deblur images by the concept that any pixel color can be represented as a linear combination of two colors. These colors can be represented as a piecewise smooth function and be derived as follows:

$$I = \alpha P + (1 - \alpha) S$$

The gradient priors are typically enforced between neighboring pixels in an image. And these interactions can be modeled using a Markov Random Field (MRF) [3].

Timeline

Week 1:

- Researching different methodologies and implementation strategies
- Proof-of-concept testing
- Implementing the chosen image alignment algorithm
- Capture set of test images using an iPhone

Week 2:

- Testing and debugging
- Continuation to improve the algorithm

Week 3:

- Project poster is completed and is ready to present
- Project report is completed by the end of this week

References

[1] W. Gordon, “How to use HDR mode when taking photos,” Lifehacker, https://lifehacker.com/what-is-hdr-and-when-should-i-use-it-in-my-photos-5991508 (accessed Feb. 23, 2024).

[2] Iterative methods of richardson-lucy-type for image deblurring, https://www.math.kent.edu/~reichel/publications/rlt.pdf (accessed Feb. 24, 2024).

[3] N. Joshi, C. L. Zitnick, R. Szeliski, and D. J. Kriegman, Image Deblurring and denoising using color priors - Neel Joshi, http://neelj.com/projects/twocolordeconvolution/two_color_deconvolution.pdf (accessed Feb. 24, 2024).