DFX Project: HDR

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1. Project Description

The topic of this project is HDR (High Dynamic Range) image recovering. By taking multiple images of a scene, but with different amount of exposure time. We can recover the response function of our camera’s imaging process. With the response function, we can convert pixel values to radiance values. Thereby construct a High Dynamic Range Radiance Map.

1. Algorithms
2. )Image Alignment:

For images alignment, we implemented the Ward's [MTB (Median Threshold Bitmap) algorithm](http://www.csie.ntu.edu.tw/~cyy/courses/vfx/papers/Ward2003FRI.pdf). In which we convert our taken photos into grayscale images. And then use the median of intensities of each image as thresholds to create binary images. By shifting bit maps and XORing with each other. We can get the errors between maps. The shift with smallest error will be adopted as the shift of the image. Therefore achieve the goal of images alignment. After the shifting of pixels, we don’t crop the blank borders in the images since we used a tripod and the shifts are extremely small.

1. )Recover Response Function:

To recover the response function. We implemented the algorithm in Paul E. Debevec and Jitendra Maliks’ paper - Recovering High Dynamic Range Radiance Maps from Photographs. Since we already have the exposure time and the pixel values. We can recover a function g using this algorithm. Where g = ln(f^(-1)), and f is the function in the film reciprocity equation.

1. )Tone Mapping:

We implemented the dodging and burning. First, we calculate Lw by using the EMap.mat which is made before. Second we calculate average Lw. In the end, we can implement local operator and global operator respectively. In the local operator, we calculate Lsblur by using Gaussian. In the global operator, we calculate Ld by using Lwhite. Both operators have the formula in lecture slide, so that we can use it to generate two images (global and local).

1. Code Implementation

Our code is written in MATLAB. The main.m file includes all the processes before tone mapping. After running main.m, we can recover a HDR radiance map. And then we can run the tonemap.m by passing our radiance map as an argument. We will then receive two images as our final results.

1. Results
2. Summary