**Project 1: High Dynamic Range Imaging**

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**Introduction**

High dynamic range (HDR) images have much larger dynamic range than traditional images' 256 brightness levels. In addition, they correspond linearly to physical irradiance values of the scene. Hence, they have many applications in vision.

In this project, we build an application that can assemble an HDR image from a set of images. Step 1, images will be captured in different shutter speeds. Step 2, we use Ward’s MTB algorithm to align the images. Step 3, we find the response function which will be used to convert the whole image. Step 4, we use Debevec’s algorithm to construct HDR radiance map then write result to a HDR image. Finally, we use Drago’s tone mapping algorithm to convert HDR image to a regular image.

# **Capture Images (Emily and Giang)**

We took pictures of three scenes (17 images of each scene): 1 at Bascom Hall and 2 at the Capitol. Then we decided to choose the 2nd scene.



**Figure 1:** Bascom Hall – The first scene



**Figure 2:** State Capitol Building – The 2nd scene



**Figure 3:** State Capitol Building – The 3rd scene

# **Write a program to assemble an HDR image**

## **Import photos (Emily)**

Description……

## **Sample the images (Emily)**

Description….

## **Develop gSolve (Emily)**

using the sampled pixels and weight function

## **Write HDR image (Giang)**

We implements the HDR algorithm in Paul E. Debevec's paper [1]. We use a set of images as input, then build a radiance map. Result is written to a Radiance RGBE file (.hdr). We develop 2 MATLAB scripts:

* **convertToHDR.m**: build a radiance map from a set of images
* **write\_rgbe.m**: write HDR image to disk

# **Develop radiance map using tone mapping. (Giang)**

We load our radiance map into Photomatix Pro 5.0, then tone map it into a usual image.



**Figure 4:** Image created by tone mapping our radiance map in Photomatix

# **Bonus**

## **Image alignment (Giang)**

For image alignment, we implement the MTB algorithm in [2]. After the image alignment, the positions of the pictures are the same. We tested the algorithm in 2 images:

 

**Figure 5a:** Picture A before aligned **Figure 5b:** Picture B



**Figure 5c:** Picture A after aligned

As we see, picture B has a white gap at its top (the white line). Hence, picture A is moved down after aligned (the black line). We develop 1 MATLAB script:

* **alignImages.m**: build a radiance map from a set of images

## **HDR tonemapping (Emily)**

# **References**

1. Paul E. Debevec, Jitendra Malik, Recovering High Dynamic Range Radiance Maps from Photographs, SIGGRAPH 1997.

2. Greg Ward, Fast Robust Image Registration for Compositing High Dynamic Range Photographs from Hand-Held Exposures, jgt, 2003.