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CS 445 - Project 4: Image Based Lighting

Complete the claimed points and sections below.

Total Points Claimed **[60] / 210**

Core

1. Recovering HDR maps
   a. Data collection [ ] / 20
   b. Naive HDR merging [10] / 10
   c. Weighted HDR merging [15] / 15
   d. Calibrated HDR merging [15] / 15
   e. Additional HDR questions [10] / 10
2. Panoramic transformations [10] / 10
3. Rendering synthetic objects [ ] / 30
4. Quality of results / report [ ] / 10

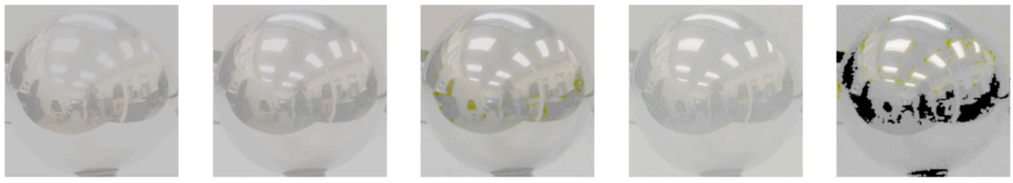
B&W

5. Additional results [ ] / 20
6. Other transformations [ ] / 20
7. Photographer & Tripod removal [ ] / 25
8. Local tone-mapping operator [ ] / 25

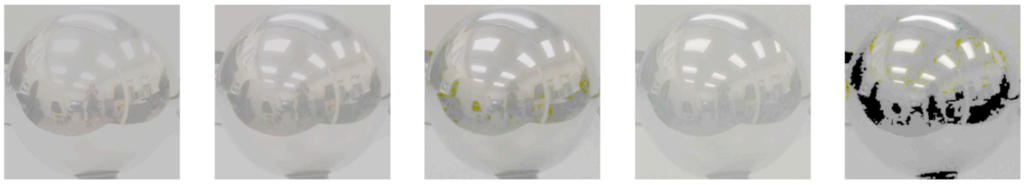
1. Recovering HDR maps

Include

- (a) Your LDR images (if you took your own)
- (b) Figure of rescaled log irradiance images from naive method



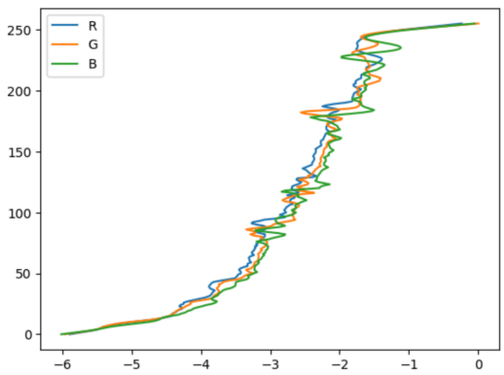
- (c) Figure of rescaled log irradiance images from weighted method



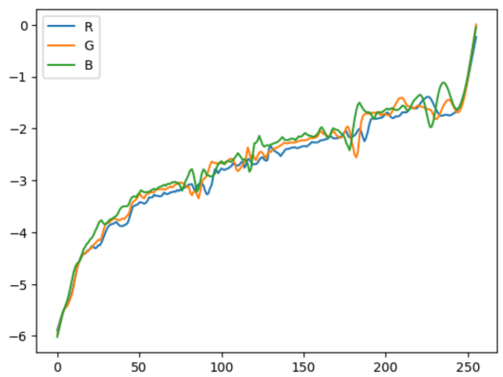
- (d) Figure of rescaled log irradiance images from calibration method

- (d) Plots of g vs intensity and intensity vs g

g vs intensity



intensity vs g



- (b-d) Figure comparing the three HDR methods

Naive method | weighted method | calibration method

- (b-d) Text output comparing the dynamic range and RMS error consistency of the three methods

naive:	log range = 6.462	avg RMS error = 0.324
weighted:	log range = 6.597	avg RMS error = 0.286
calibrated:	log range = 6.954	avg RMS error = 0.251

- (e) Answers to the questions below

Note if you claim credit for data collection, you must use your own images for parts 1-3

Answer these questions:

1. For a very bright scene point, will the naive method tend to over-estimate the true brightness, or under-estimate? Why?

   The naive method will tend to over-estimate the true brightness. This is because the naive method does not account for the non-linear response of cameras to different exposure levels. Bright areas in LDR images are often over-exposed, and without proper weighting or calibration, the naive method will simply average these over-exposed values, leading to an overestimation of brightness.

2. Why does the weighting method result in a higher dynamic range than the naive method?

   The weighting method results in a higher dynamic range than the naive method because it applies a weighting function to each pixel value based on its brightness. This function gives less weight to pixel values that are near the extremes of the brightness range (i.e., very dark or very bright), which are more likely to be under- or over-exposed, reducing the influence of unreliable pixels. It also gives more weights to pixels with values in the middle range, which better preserve the details in both shadows and highlights

3. Why does the calibration method result in a higher dynamic range than the weighting method?

   This is because it involves estimating the camera's response function to different exposures. This allows for the recovery of the true irradiance values of the scene, which are then used to construct the HDR image. By accurately mapping the recorded pixel values to actual light levels, the calibration method can capture a wider range of luminance with greater precision.

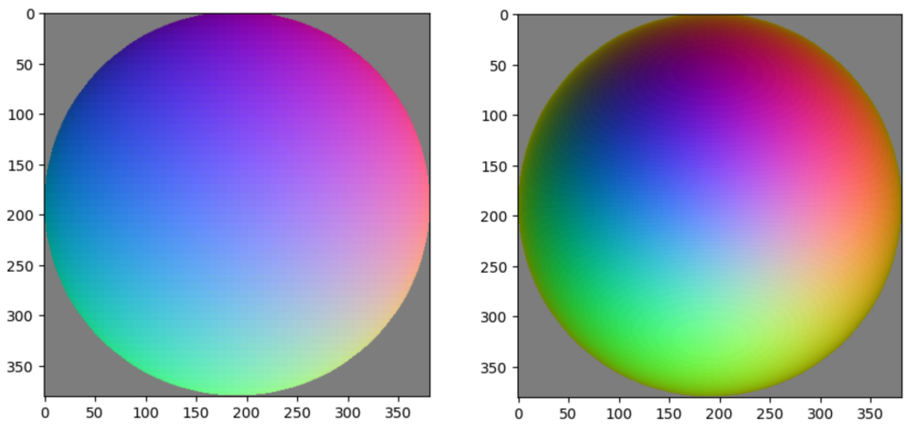
4. Why does the calibration method result in higher consistency, compared to the weighting method?

   This is because it uses the camera's response function to correct for the camera's non-linear response to light. This calibration ensures that the pixel values in the HDR image correspond more accurately to the actual light levels in the scene, leading to more consistent and realistic results across varying lighting conditions.

2. Panoramic transformations

Include:

- The images of normal vectors and reflectance vectors



- The equirectangular image from your calibration HDR result

3. Rendering synthetic objects

Include:

- Component images: (1) Background image; (2) Rendered image with objects; (3) Rendered image with local geometry (e.g. support plane); (4) Rendered mask image

- Final composited result

4. Quality of results / report

Nothing extra to include (scoring: 0=poor 5=average 10=great).

5. Additional results (B&W)

Include background image and final composited result image for: (10 pts each)
- New objects, same environment map
- New environment map, same objects

6. Other transformations (B&W)

Include (10 pts each)
- Angular environment map
- Vertical cross environment map

7. Photographer and tripod removal (B&W)

Include:
- Original LDR images
- Equirectangular image created from your own photos without photographer
- Explain your method

8. Local tone-mapping operator (B&W)

Include:
- Displayed HDR image, computed as linearly rescaled log of HDR image
- Your HDR image display improved by tone mapping
- Explain your method

Acknowledgments / Attribution

List any sources for code or images from outside sources