

Computational Cameras: Problem Set 2

Bingliang Zhang, UID 2242929, CMS G1

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Total time spent on this homework: 9h. The codes and images are sent by email to all TAs.

1 Cross-correlation

The resulting images are shown in figure 1

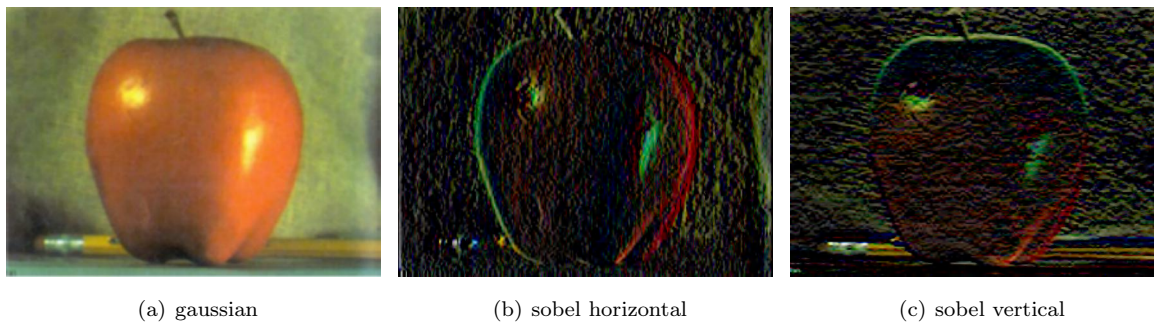


Figure 1: Cross correlation results.

2 Image pyramids

The pyramid for apple image is shown in figure 2.

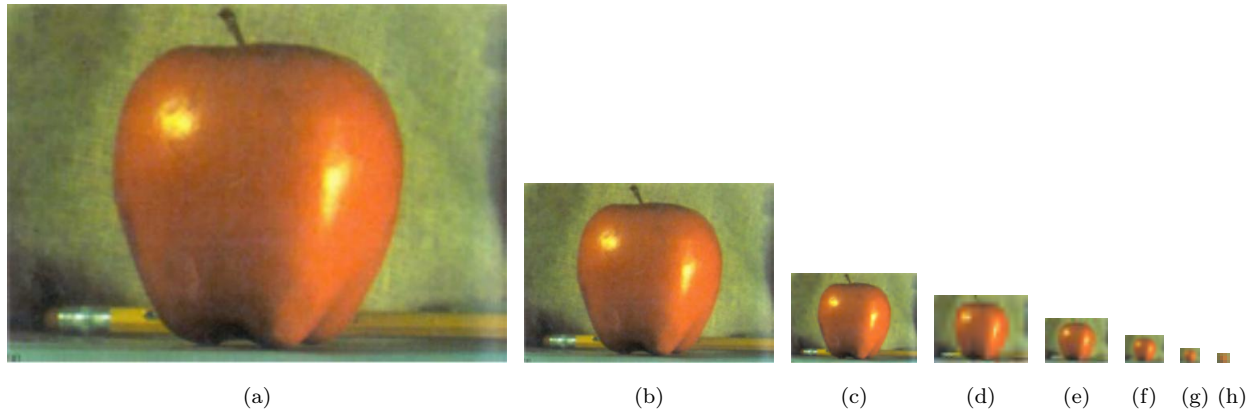


Figure 2: Gaussian pyramids of apple image.

The pyramid for orange image is shown in figure 3

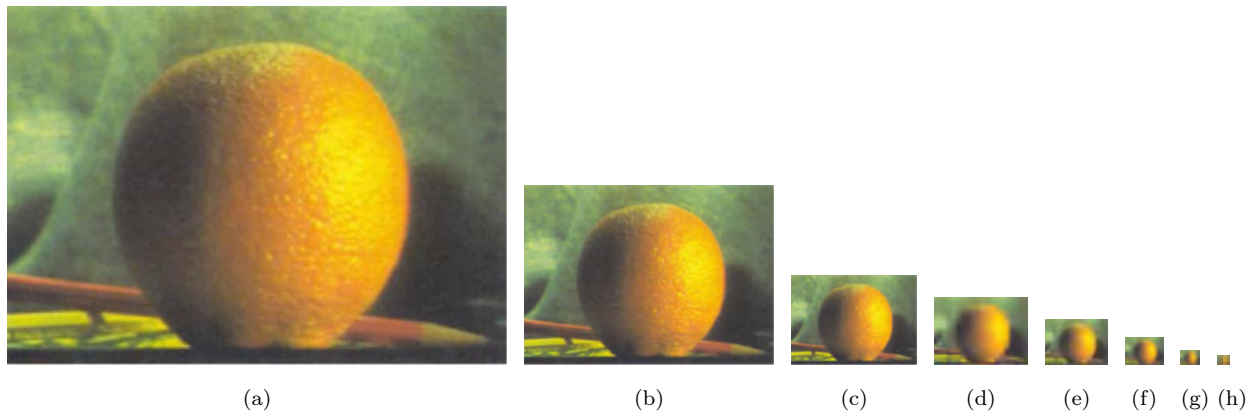


Figure 3: Gaussian pyramids of orange image.

3 Blending

The blending results are shown in figure 4



(a)

Figure 4: Orange-apple.

The blending with new images are shown in figure 5.



(a) original 1



(b) original 2



(c) blending

Figure 5: Blending with new images.

4 Using the PiCam

Four images from Pi is shown in figure 6. They are taken with `analog_gain=8`, `digital_gain=8` and exposure equal 1ms, 10ms, 20ms, 33ms.

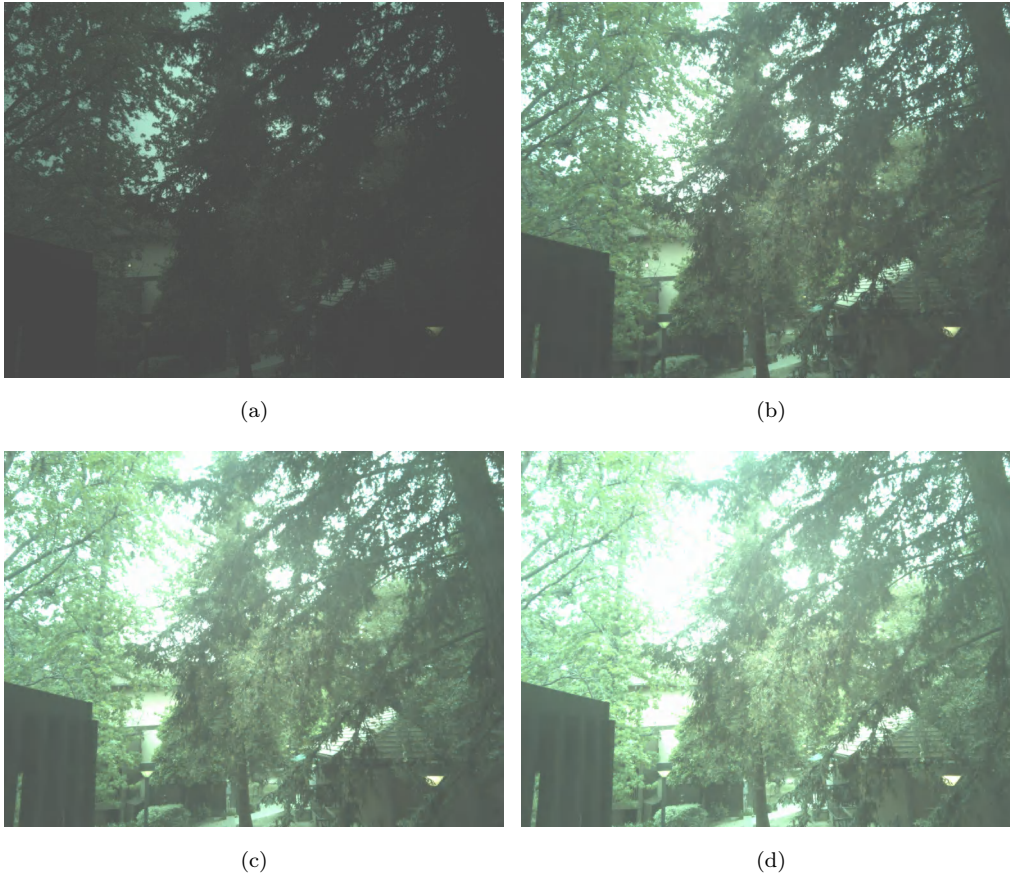


Figure 6: Pi images with different exposure time.

5 HDR imaging

The images rendered are displayed in figure 7. These were produced by normalizing with quantile values of 0.5, 0.6, 0.7, 0.8, and 0.9, ($I_{\text{image}} = \frac{I_{\text{image}}}{\text{quantile_value}}$) and then clipping them back to the range [0,1].

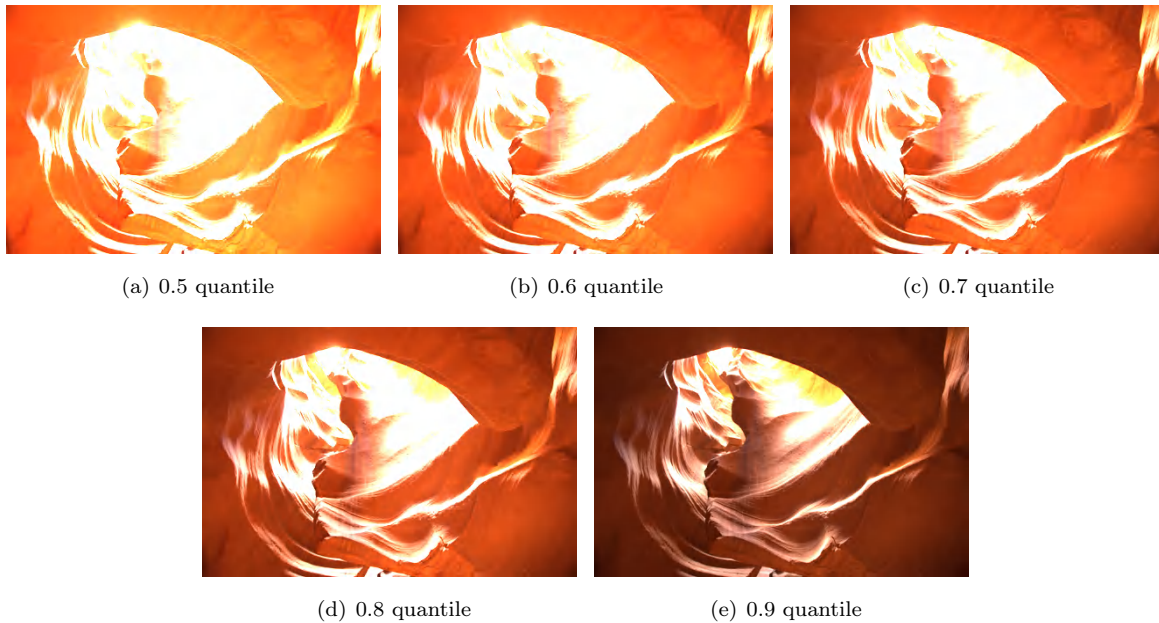


Figure 7: Rendered images of HDR canyon image.

Detail Comparison:

1. With lower brightness (higher quantile), the scene will have more visible details, such as the texture of rocks.
2. In a high brightness rendering, darker areas of the image are illuminated more, revealing details that are lost in darker renderings.

The rendered images of captured ones are shown in figure 8.

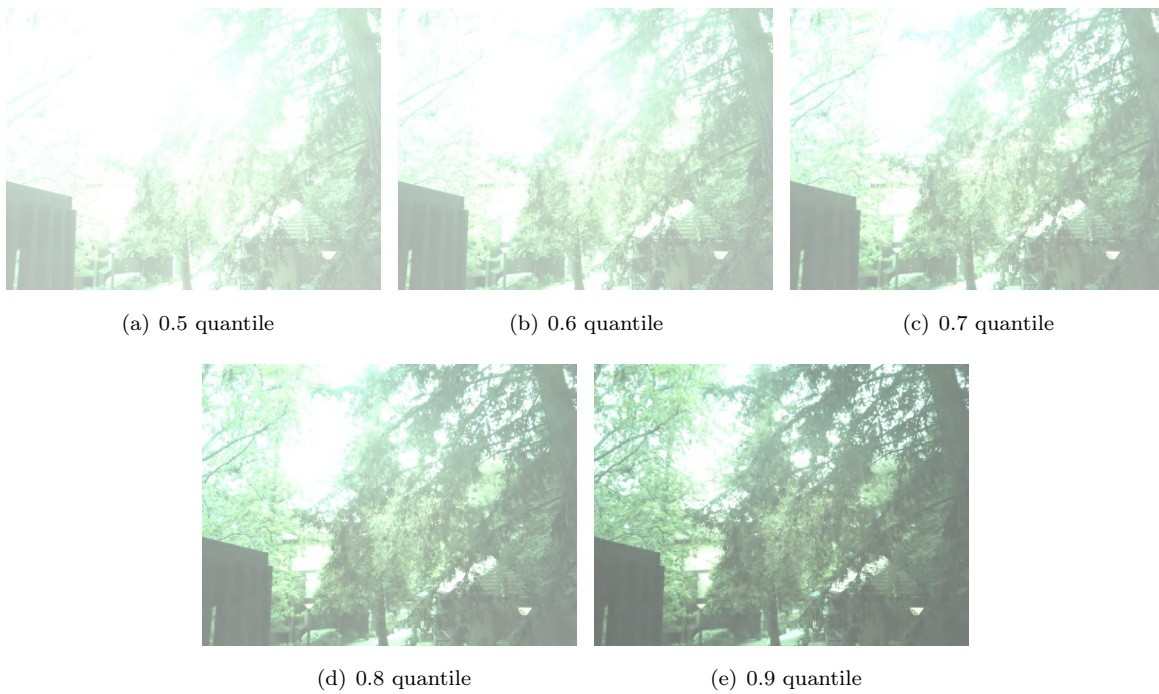


Figure 8: Rendered images of HDR captured Pi image.

6 Bilateral filtering

The resulting image is presented in figure 9. A higher value of σ_{domain} results in blurrier images. A higher value of σ_{range} results in less pepper noise in image.



Figure 9: The filtered image

7 Tone mapping

The results are shown in figure 10 and 11.



(a)

Figure 10: The canyon image after tone-mapping.



(a)

Figure 11: The captured image after tone-mapping.