

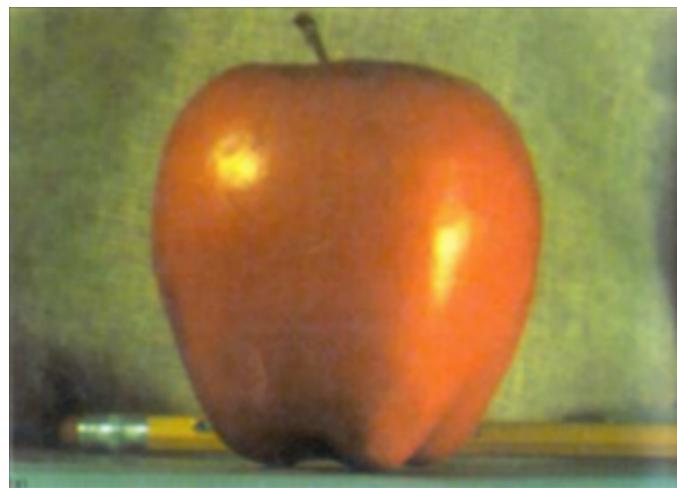
CS101-C: PS2

Mingshu Liang

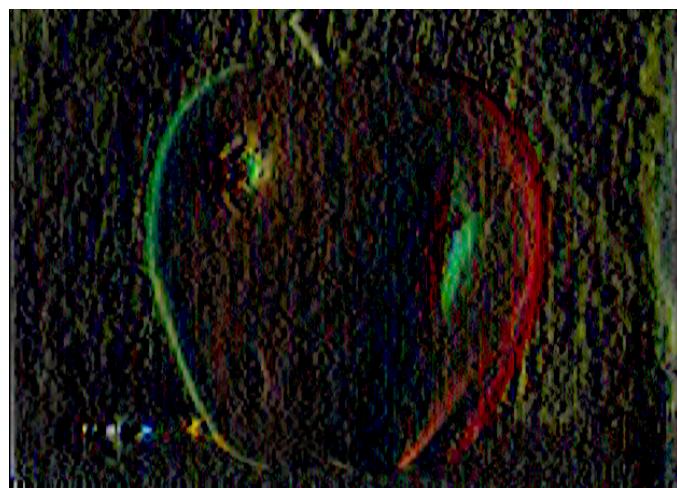
April 27, 2020

1. Cross-correlation

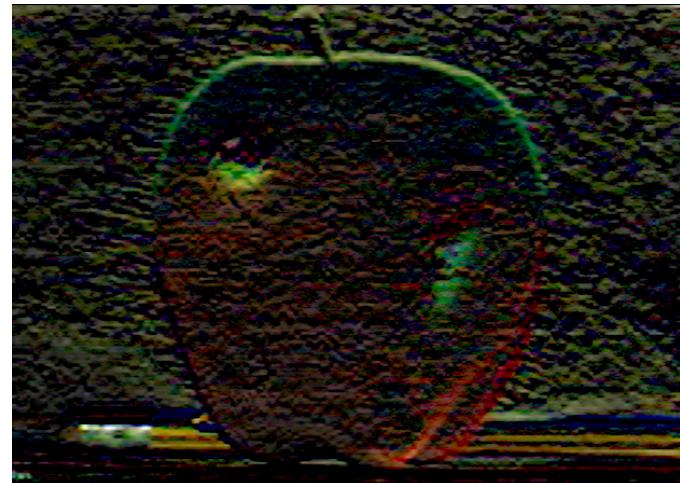
Filtered images are as following:



Gaussian Kernel



Sobel Horizontal Kernel

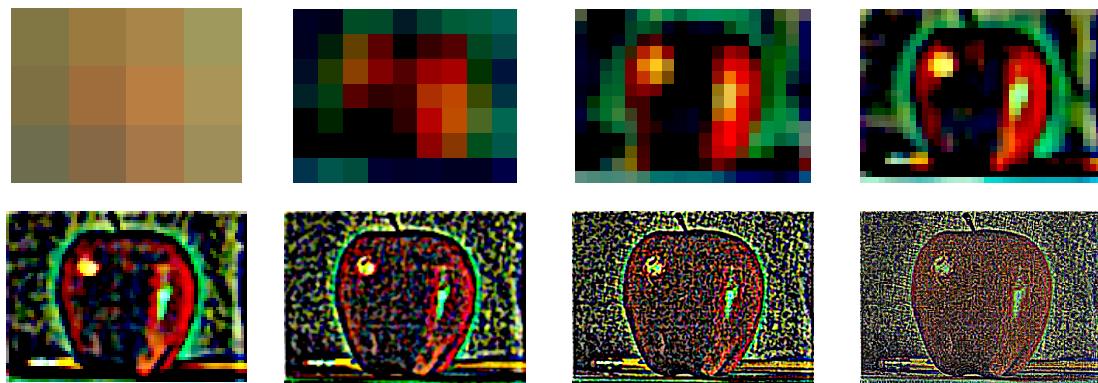


Sobel Vertical Kernel

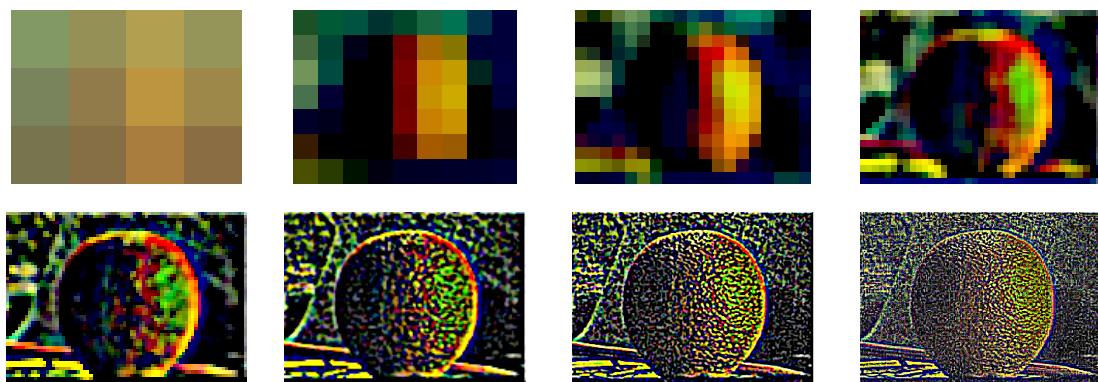
2. Image pyramids

The first image in a Laplacian pyramid is the corresponding smallest Gaussian filtered image. And dynamic range is manually set (detail in code).

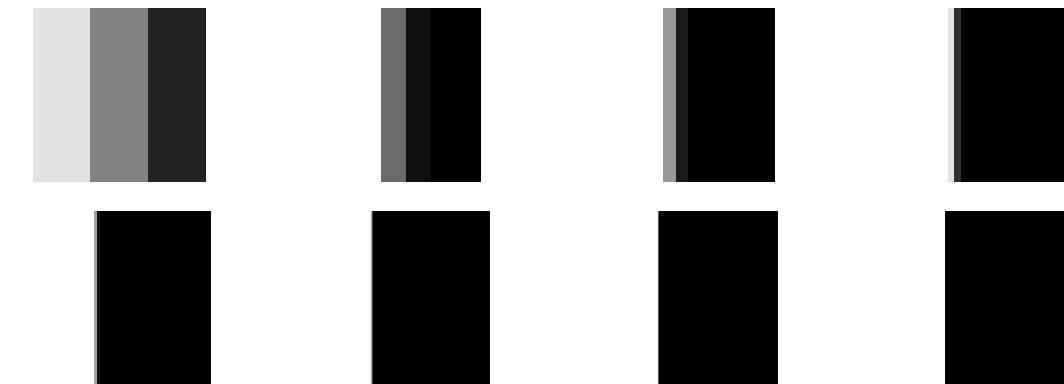
Laplacian pyramids of 'apple.png':



Laplacian pyramids of 'orange.png':



Gaussian pyramids of 'mask.png':

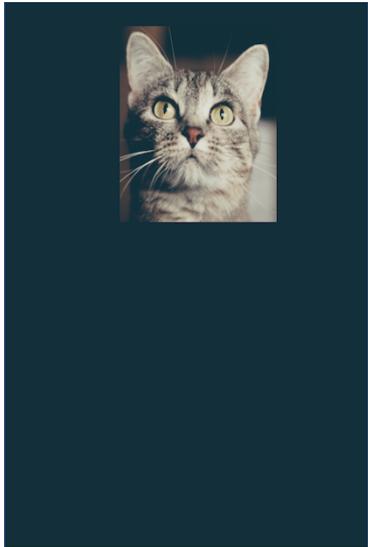


3. Blending

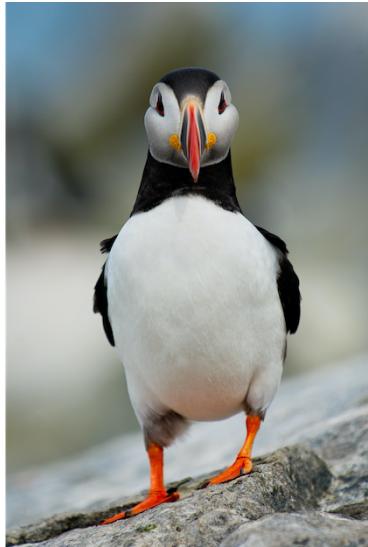
The image blending an apple and an orange is as following:



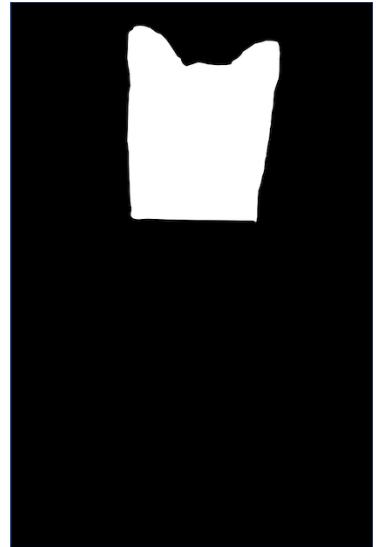
I blend a cat image and a bird image using my own mask. They are showed below:



Cat



Bird



My mask

The blending result is as following:



4. Using the PiCam

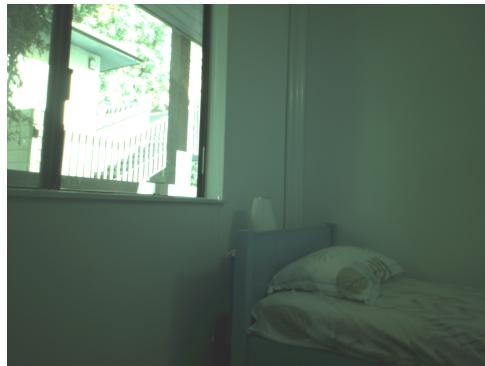
I took 4 images with exposure time 1ms, 4ms, 16ms, and 32ms respectively. Images with reasonable dynamic ranges are as following:



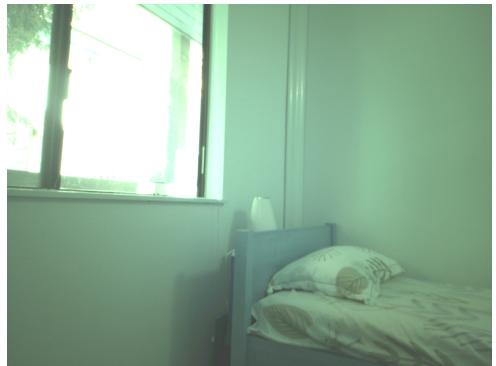
exp 1ms



exp 4ms



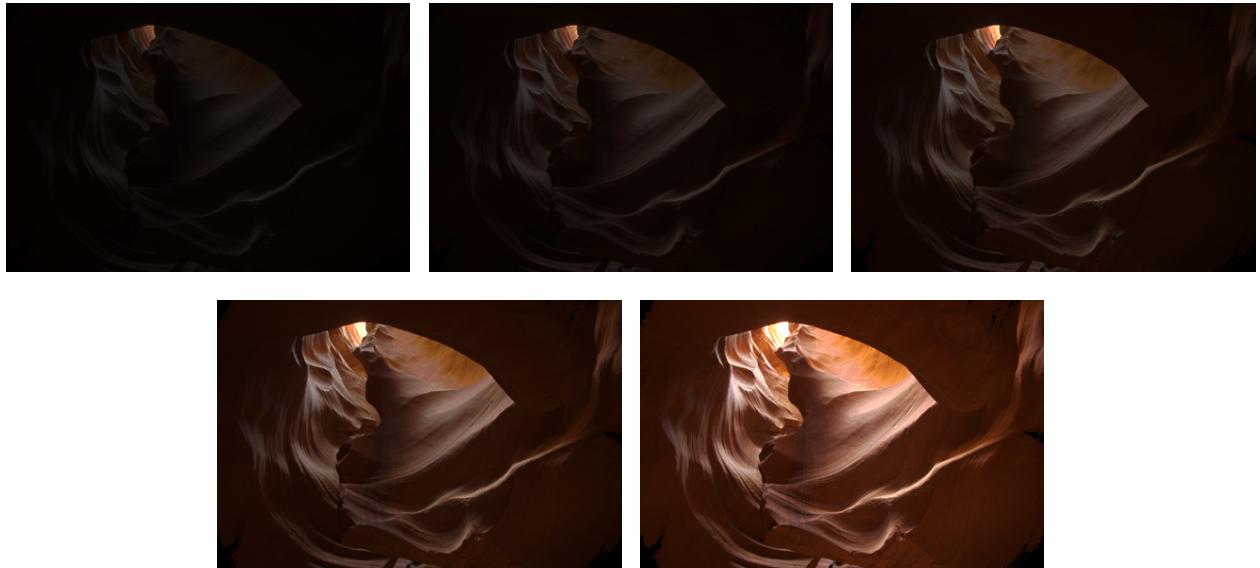
exp 16ms



exp 32ms

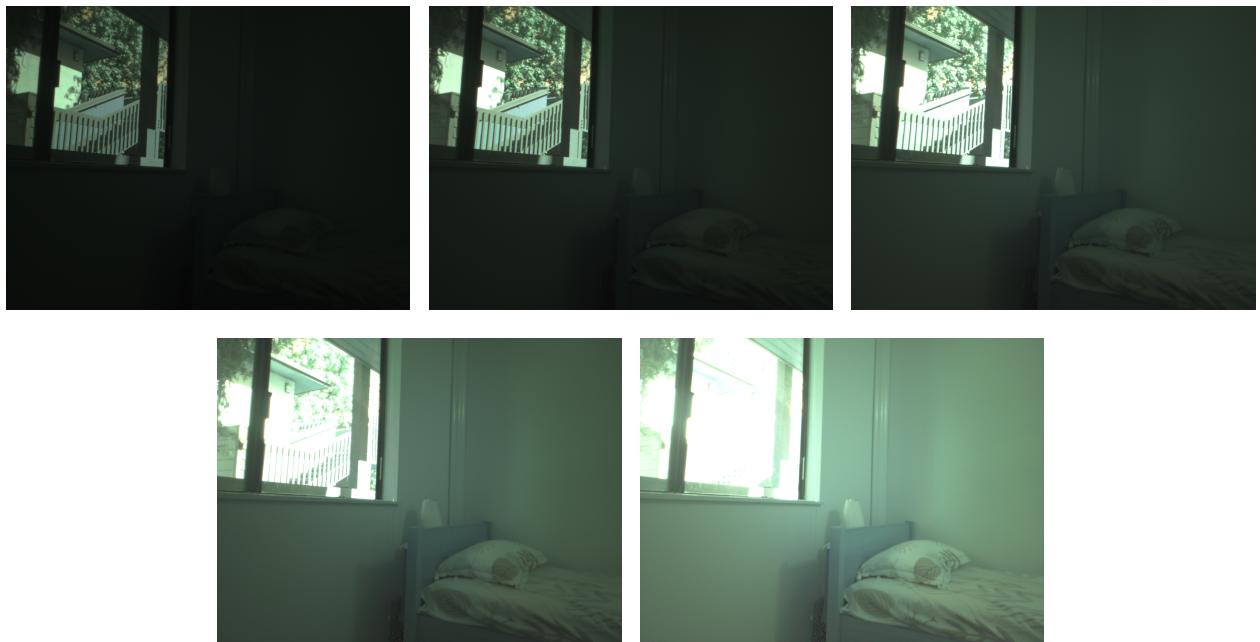
5. HDR imaging

Five canyon images with different brightness are as following:



Details at corners of the image can't be observed in the first 2 low brightness image but can be observed in the other 3 images. Details at the cave entrance can only be observed in the first 3 low brightness images, otherwise they are over-exposed.

Five PiCam images with different brightness are as following:



Details about the bed can't be observed in the first 2 low brightness image but can be observed in the other 3 high brightness images. Details outside the window can only be observed in the first 2 low brightness images, otherwise they are over-exposed.

6. Bilateral filtering

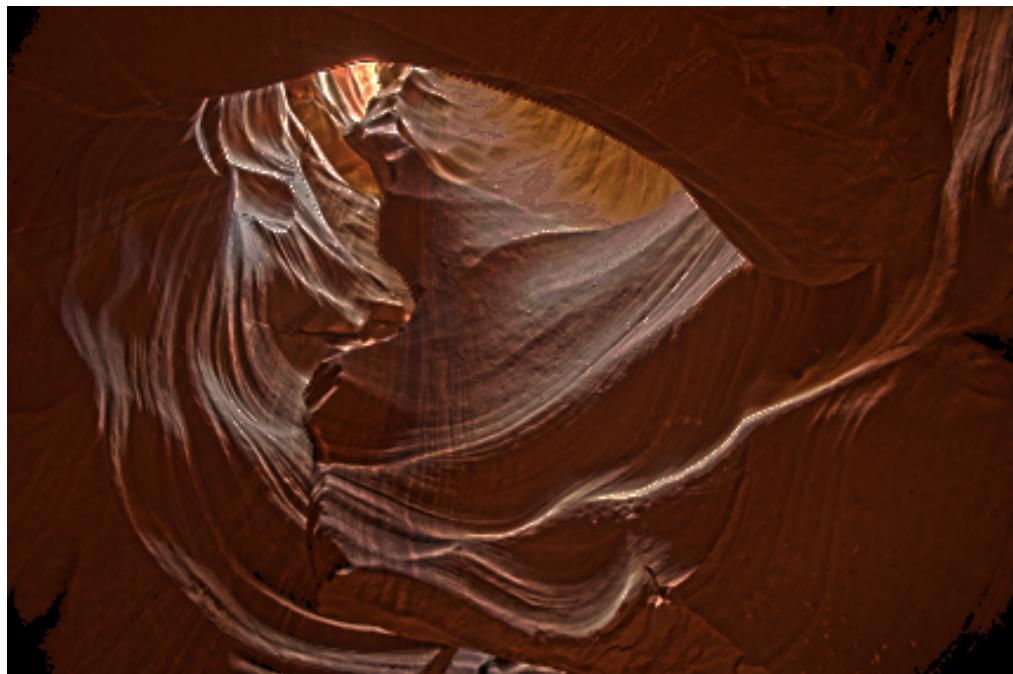
The filtered image is as following:



In general, large σ values will average more pixels thus will denoise better but will also make image blurrier. Small σ values will preserves sharper edges but also preserve more noise. Another thing to be noted is that given a relatively small σ_{range} value, sharp edges can always be preserved no matter what σ_{domain} value is.

7. Tone mapping

The canyon result is as below:



The PiCam image result is as below:



8. ICCP

Session attended: 2.C

Presentation selected: WISHED: Wavefront imaging sensor with high resolution and depth ranging

The presentation is about phase imaging and distance acquisition. Current phase sensors have the trade-off between resolution and dynamic range. Optical modulation gives extremely high resolution but suffers from sever wrapping problem. While MHz modulation have reasonable dynamic range but low resolution. This paper overcame the wrapping problem by phase imaging with two wavelength, which is equivalent to a synthetic beat wavelength. By setting the two wavelength close, the beat wavelength can be large, thus both high resolution and large dynamic range are preserved. Phase images under each wavelength were acquired by Gerchberg-Saxton (GS) algorithm. They imaged transparent, translucent and opaque objects and proved resolution up to $9\mu m$.