Homework 6 Written

1) Bilateral Filtering vs. Linear Convolution.

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Bilateral

→ non-linear filter that considers spatial proximity & intensity similarity of neighboring pixels

→ computes a normalization factor for each output pixel to account for spatial distance & intensity difference between center pixel & neighbors

→ more expensive that standard convolution

Linear

→ output pixels are weighted sums of the neighboring pixels in input image

⇒ linear filter

→ computational complexity is proportional to size of filter kernel & size of input image

→ To address the burden of computational complexity, we can approximate the bilateral filter by using seperable filters.

⇒ Decomposing the bilateral filter into 2 1D filters (spatial & intensity)

2) HDR Tone Mapping Issues

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① Loss of Brightness / Intensity information
② Loss of Detail ⇒ Clipping
③ Contrast Compression due to Linear Mapping ⇒ Innaccurate perception

3) What is a pixel? How big is a pixel?

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Pixel → a discrete point in an image representing a single color value
Size → digitally speaking, the size of a pixel is (1/width, 1/height) where width & height correspond to the digital image size. Thus, the pixel takes a rectangular like shape

4) What does each filter do?

a) $H_a = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

→ This filter in effect will only capture the uppermost center pixel within the 3x3 region. It could be a crude estimator for detecting edges where there is a sharp change in intensity.

b) $H_b = \frac{1}{12}\begin{bmatrix} 1 & 2 & 1 \\ 1 & 2 & 1 \end{bmatrix}$

→ This filter essentially acts as a box filter acting as a weighted average filter. This will have the effect of smoothing / blurring the image

c) $H_c = \begin{bmatrix} -1 & -1 & -1 \\ 0 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix}$

→ This filter in effect takes the image derivative in the y-direction of the image. It will show us the more prominent horizontal edges of the image.

5) HSV color space Diagram

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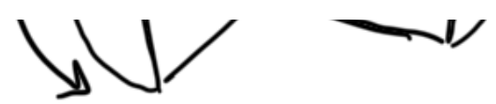
HSV → Hue, Saturation, Value



Hue → type of color (R, G, B); represents dominant wavelength of light
0° – 360°

Saturation → intensity of color 0 → 1 (percentages)

Value → brightness; how light or dark color is
0-1 (percentage)