Computer Vision (Spring 2021) Problem Set #1

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1a. Interesting Images

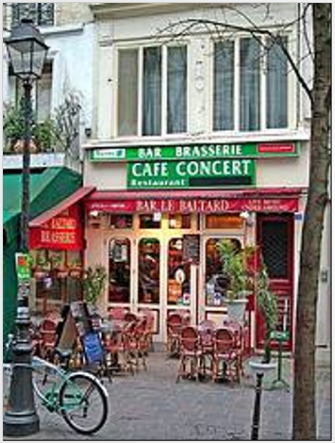


Image 1 - ps1-1-a-1

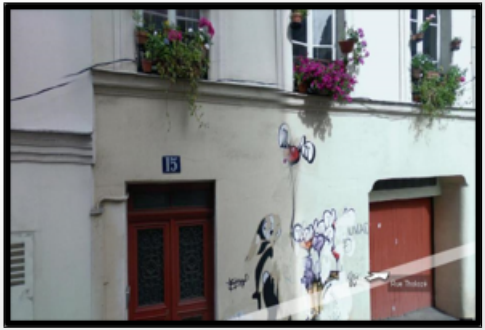
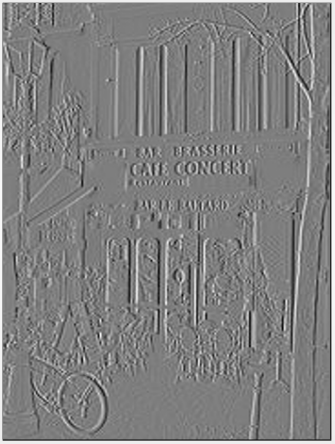


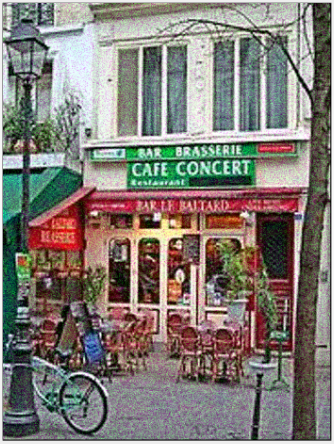
Image 2 - ps1-1-a-2

4d: Difference Image



ps1-4-d-1

5a: Noisy Green Channel



ps1-5-a-1

5b: Noisy Blue Channel

ps1-5-b-1

6a. Discussion

Between all color channels, which channel, in your opinion, most resembles a gray-scale conversion of the original. Why do you think this? Does it matter for each respective image? (For this problem, you will have to read a bit on how the eye works/cameras to discover which channel is more prevalent and widely used)

I think between all channels, the green channel most resembles a gray-scale conversion of the original because the grey-like color is more similar to or closer to green channel than red or blue channels. Importantly, green is the most sensitive to the human eye. Also, green pixels are double of red or blue pixels in camera. Therefore, green channels are likely to be used. In the case of very less green pixel in picture, it is better to use the main color channel in the picture accordingly, i.e red or blue channel.

6b. Discussion

What does it mean when an image has negative pixel values stored? Why is it important to maintain negative pixel values?

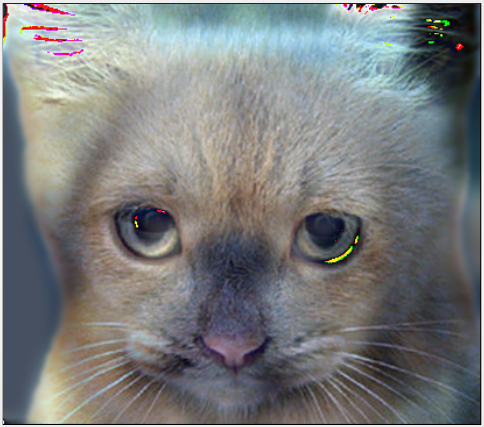
Negative values stored in pixel means that there are some colors outside range of RGB coordinates. It is important to maintain negative pixel values because, in real life, there are many types of colors that cannot be represented by RGB, or outside of the RGB range. In addition, arithmetic calculation can come up negative result, which requires to maintain negative pixel values.

6c. Discussion

In question 5, noise was added to the green channel and also to the blue channel. Which looks better to you? Why? What sigma was used to detect any discernible difference?

In question 5, I think noise added to blue channel looks better because the noise on blue channel looks less visible than on green channel. Green channel is the main channel with more values stored in pixels, so adding noise to green channel will more likely affect or change the picture. Green values mainly determine the picture's luminance. I use sigma = 32 to detect discernible difference on green channel, and sigma = 64 to detect discernible difference on blue channel. A bigger sigma makes noise easier to detect.

7a: Hybrid Images



ps1-7-a-1

7b. Hybrid Images

Explain how the cutoff-frequency impacts the final hybrid image

A hybrid image is created by combining the results of two separate images: one with low-pass and one with high-pass filters. The filter varies, such as Gaussian filter, or blur filter, to remove undesired frequencies resulting in different things at different distance. In another word, the hybrid image is the sum of the cutoff-frequency of the low resolution image and the cutoff-frequency of the high resolution image. Specifically, the cutoff frequency is a variable to adjust each image because it represents frequencies that will be removed from each image. Therefore, cutoff-frequency could impact the final hybrid image by determining how much high frequency in high resolution image along with how much low frequency in low resolution image. In the range from 5 to 10, a cutoff-frequency may produce bad result for this image but could be the best for another picture.