Computer Vision (Spring 2019) Problem Set #1

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1a. Interesting Images

Image 1 - ps1-1-a-1

Image 2 - ps1-1-a-2

2a. Swapped Green and Blue

ps1-2-a-1

2b: Monochrome Green

ps1-2-b-1

2c: Monochrome Red

ps1-2-c-1

3a: Replacement of Pixels

ps1-3-a-1

4a: Image Stats

Min: 0
Max: 255
Mean: 82.604
Standard Deviation: 75.139

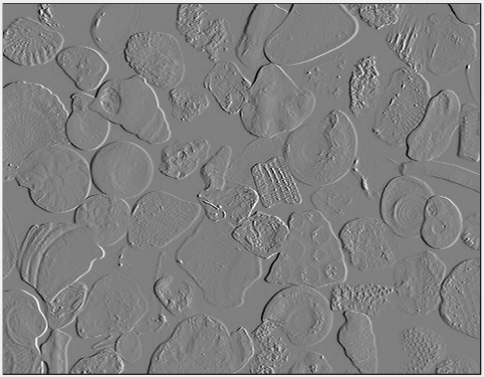
4b: Arithmetic Operation

ps1-4-b-1

4c: Shifted Image

ps1-4-c-1

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)

The green channel most resembles a grayscale conversion of the original
I believe this is because green is the closest to the average colors of the image.
The elements of green make up some of the blue (lower portion of the image) and yellow (left portion of the image)
In contrast, blue and red are two opposite colors. The blue channel does not contain colors of the red, and vice versa.
This makes it hard for the red and blue channels to represent this particular picture with yellow, green, red, white, and blue as a gradient.
A short read on https://medium.com/hd-pro/human-vision-and-digital-color-perception-91db3b19cc7f and
https://www.redsharknews.com/technology/item/4741-human-vision-and-why-the-colour-green-is-so-important lead to the finding that the human eye is more sensitive to green light.
The Bayer Array has an additional green sensor because of this reason.

6b. Discussion

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

Images are represented in a range of minimum and maximum values. Everything that is represented is relative to that range.
Depending on the range, a negative representation may be normal.
Negative values also appear occasionally as a result from subtraction operations.
For example, if a range of 0 to 255 are used to represent the image, then a negative value would be an error as it cannot be represented.
However, negative pixel values can be represented in signed and floating point representations of images.
It is important to maintain negative pixel values as everything in image processing is relative.
Maintaining the negative pixel values maintains greater fidelity of the image
This usually requires converting the image to allow a greater range to be expressed.
This may be done by converting the image into signed or floating point representations.

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?

With the same sigma value used in the Gaussian noise that was applied,
the blue channel looks cleaner to me.
As was discussed in 6a, it appears that the human eye is more sensitive to green channels
I was able to discern a difference in the noise at a sigma value of 15 for the green channel.
However, it took a much larger sigma value of 50 for me to discern a difference for the green channel.
This confirms that the human eye can pick out certain color channels more than others. How fascinating!