Computer Vision
Spring 2021
Problem Set #1

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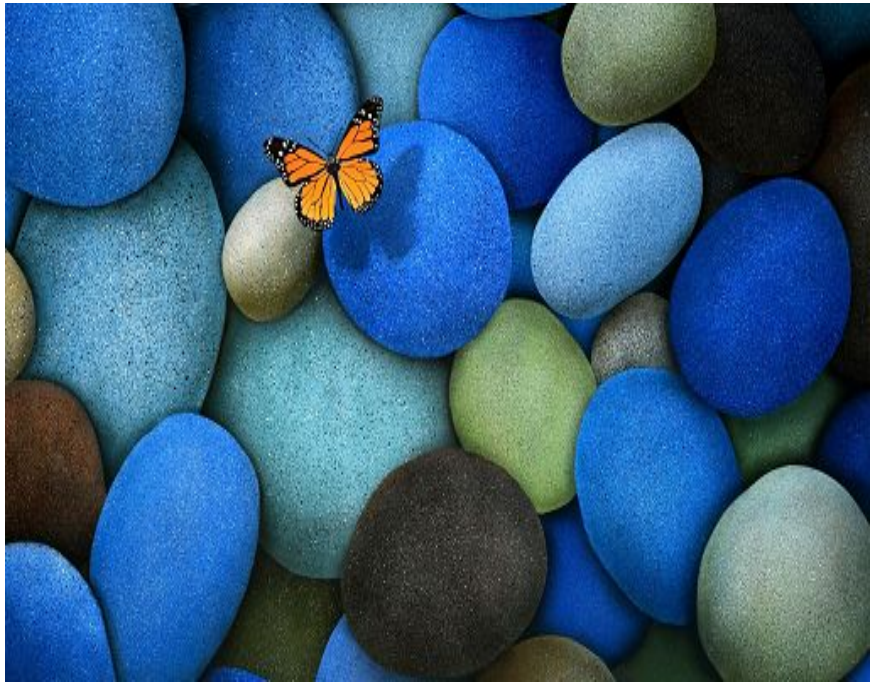
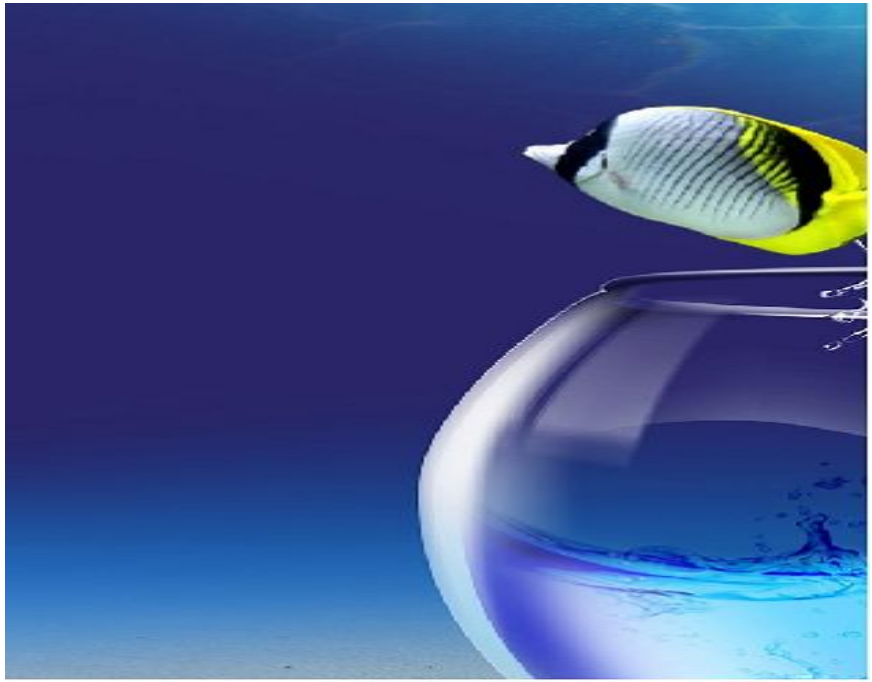
1a: Interesting Images

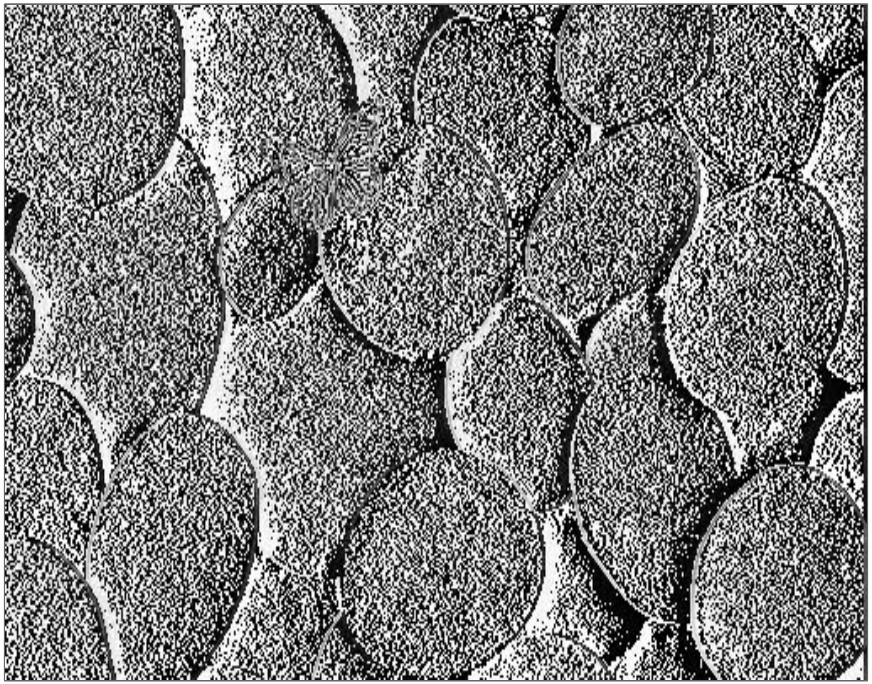


ps1-1-a-1



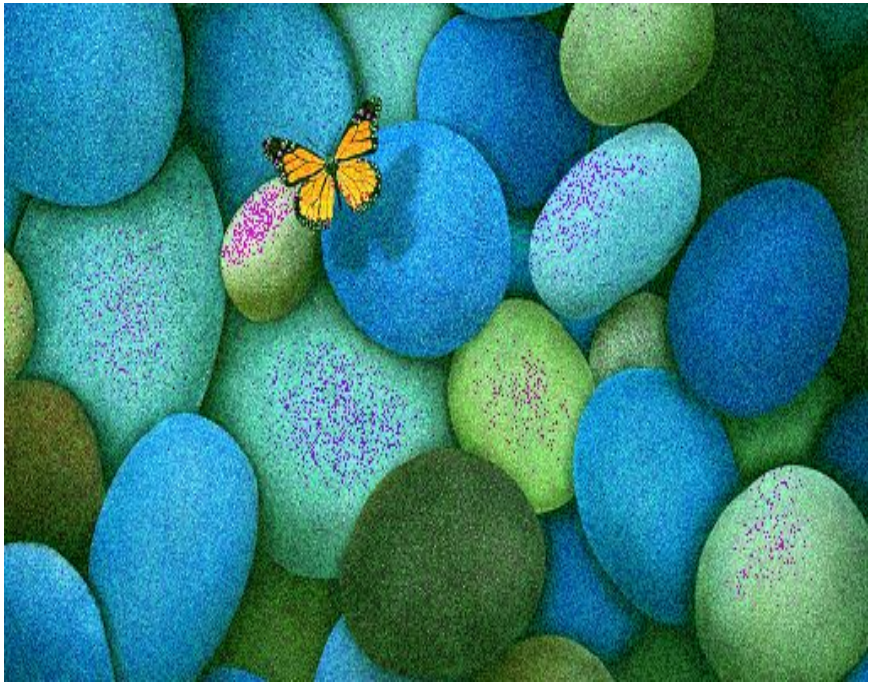
ps1-1-a-2

4d: Difference Image



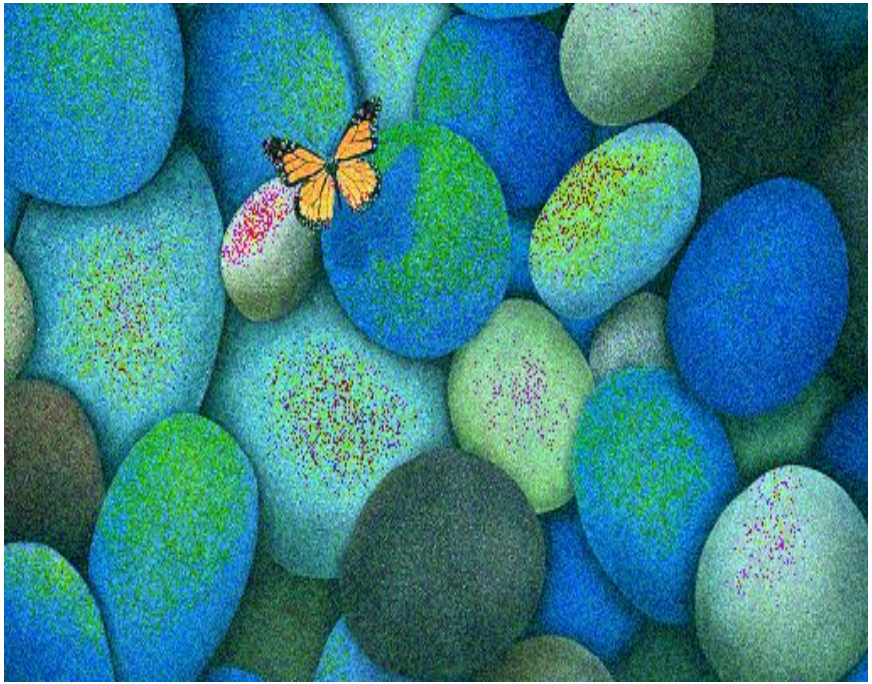
ps1-4-d-1

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 grayscale conversion of the original.

Green

Why do you think this?

The formula used by OpenCV for calculating grayscale luminosity is

Y = 0.299 Red + 0.587 Green + 0.114 Blue

As you can see higher weightage has been given to green channel because human eyes are more sensitive to Green color, due to which grayscale closely resembles the green monochrome

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 same behaviour would be exhibited for other images too, because green channel is given higher weightage when calculating the luminosity for grayscale, because human eyes are more sensitive to green color.

6b: Discussion

What does it mean when an image has negative pixel values stored?

Pixel may have a negative value due to the following reasons

1. Negative values in the image means that pixel value projects outside of the triangle formed by the RGB primaries used for encoding the image.
2. Images can have negative values pixel when certain operations like subtractions are performed.

Why is it important to maintain negative pixel values?

It is important to maintain negative values to get the scale and calculations right, and the image should be normalized only while displaying

6c: Discussion

In question 5, noise was added to the green channel and also to the blue channel. Which looks better to you?
Blue channel looks better
Why?
Because human eyes have a peak sensitivity at 555 nm which falls in the green region, due to which any noise in the green channel is more prominent compared to blue channel therefore blue channel looks better
What sigma was used to detect any discernible difference?

For Green channel : 20
For Blue Channel : 40

7a: Hybrid Images

ps1-7-a-1

7b: Hybrid Images

Explain how the cut-off frequency impacts the final hybrid image

At a low cut off frequency(1) we see more of the puppy and as we increase the cut off frequency(5) kitten starts to emerge. This is because at low cut off frequency we are able to see high spatial frequency of the puppy image and as we increase the cut off frequency the high frequency from the puppy fades off and we notice high spatial frequency of the kitten(low spatial frequency is subtracted from the original image).

Reference

1. D. (2016, December 11). *Negitive pixel values?* Community - ACESCentral.

   https://community.acescentral.com/t/negitive-pixel-values/586