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Image Processing Fundamentals

Setup Environment and Preparation: I was able to upload the python code into my editor and successfully run each cell. I was able to verify that all libraries and sample images were executed without error.

Digital Fundamentals: Upon running this code cell, I could clearly see the test image and the graph that extrapolates how the computer interprets the data. When I ran the next code cell, I could see the RGB channels broken down individually. The graphs indicate that each color has a main zone while also being present in the other two color zones, but to a lesser degree. Converting the sample image to grayscale removed the saturated color data and significantly reduced the file data by 66%.

Basic Image Operations: I experimented with the brightness and contrast values with the grayscale images. I changed the brighter image from 50 to 90, darker image from -50 to -90, higher contrast image from 1.5 to 1.75, lower contrast image from 0.5 to 0.75. The contrast is now so high that one of the color zones has merged with the outer zone. That means its grayscale value is closer to the outer zone than to the inner zone.

Neighborhood Operations: This code cell broke the image matrix into an array using the numpy library. After establishing the arrays, the image was manipulated further with Gaussian blurring and edge detection. The horizontal and right side edges were combined and later the image was sharpened. This added a small bit of banding where the different grayscale values were in contact.

Advanced Processing Techniques: Continuing with the grayscale concepts, this code cell shows how the subtle value changes impact the histogram; lower contrast condensed the pixel intensity spikes on the graph.

Technical Understanding: I was surprised by how simple it is to use matrices to manipulate images. The math operations are tools that allow for different qualities of an image to be altered to suit a specific outcome. The blurring technique was challenging to understand until I could comprehend how the formula calls for a smooth transition from one zone to the next.

Connections and Applications: Each technique in this lab is fundamental to how Nano Banana manipulates pixels in generated images. Using the tools from this lab, I could code my own basic image processor, without needing Photoshop or another software. More advanced formulas could be used for detailed visual effects, like in movies. I could combine these advanced tools with traditional techniques to make images with optimal visual appeal, according to the AI image auditors in today's social media apps.

Personal Reflection: I'm interested in exploring complex visual effects with these image processing tools. This lab has demonstrated the power of math in computer vision and how accessible the concepts are. Modern photo apps are powered by algorithms that use these methods, so that's empowering for knowing what I can do with this new information. I would like to know how to apply these techniques to image sequences and video clips. That would add a time dimension to the data sets.

Conclusion: I changed the Contrast Enhanced box from 1.3 to 2.0 to make it look even more bleached and faded. I adjusted the Vintage Artistic box by adding a major boost to the green (1.05 to 2.5) and reducing the red (1.2 to 0.5) and blue (0.9 to 0.5) channels. My third change came earlier in the lab when I changed some of the basic operations on the grayscale image. I could use these techniques in the real world for color correcting images to my liking.