DIP Fall 2024 #58195
HW1A
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5 September 2024

Intensity Transformations

Abstract:

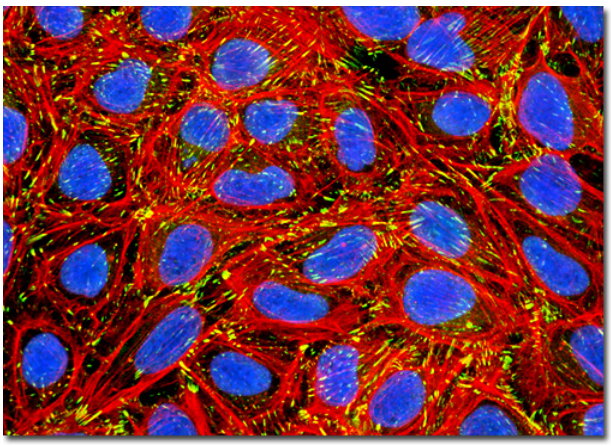
Images are represented in multiple formats: color, grayscale, 32bit, 8bit, etc. Transferring between these different image domains is essential when working with multiple image formats or applying different image operations. Converting color to RGB requires an aggregation of red, blue, and green values into a single grayscale value which encodes the color image values in a coherent way. Binarization, on the other hand, uses a threshold which returns a 0, or 255 depending on if the image pixel value is above or below the threshold value (single value for grayscale). The results of these operations show how when certain color information is removed, features such as edges can become more clear.

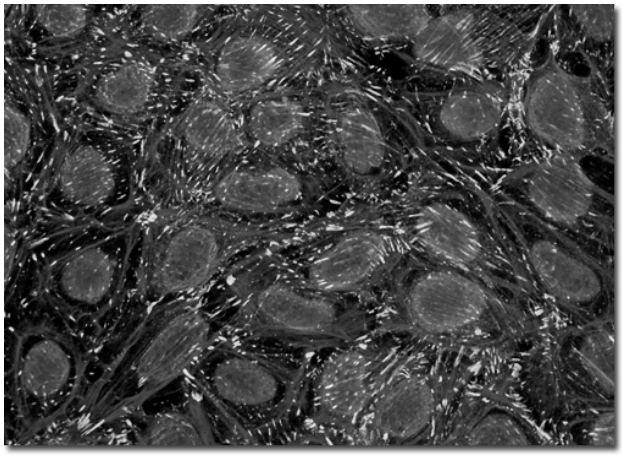
Introduction:

The goal of assignment HW1A is to get introduced to python image processing tools such as opencv, python functions that help with applying operations to these numpy opencv images, and exploring how simple operations like rgb to grayscale are performed or a threshold value can showcase various features in an image that could be useful for information extraction. The experiments to be performed are a simple grayscale conversion (multiplying each rgb pixel by a corresponding scalar and adding the result), and then 10 different threshold values to explore how different edges in the image are preserved or erased.

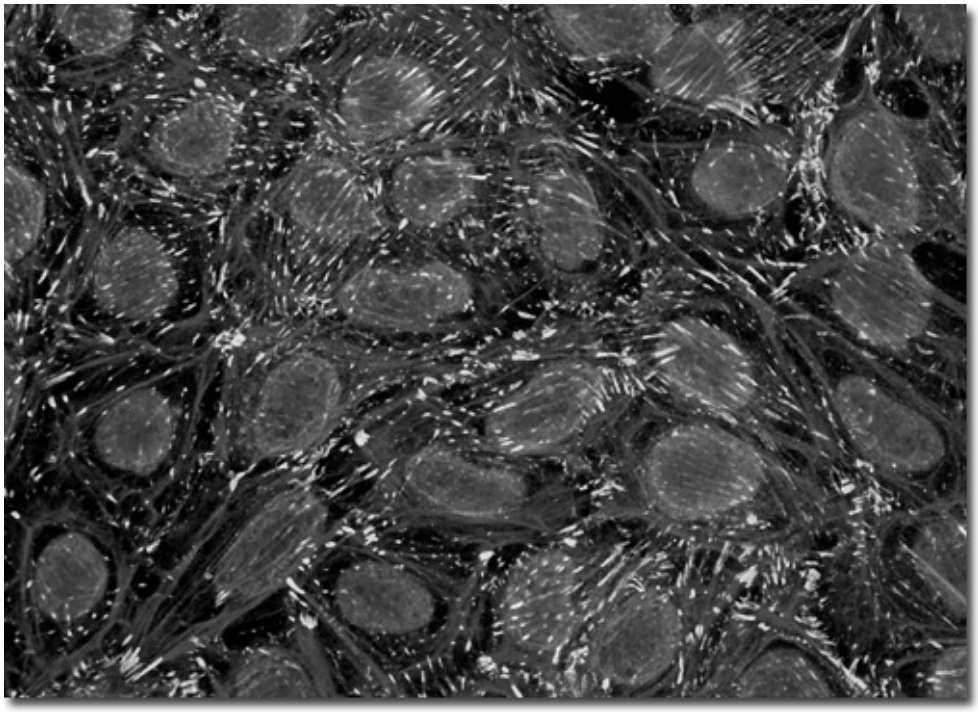
Experiments and Results:

RGB Test Image and Grayscale Image Out:

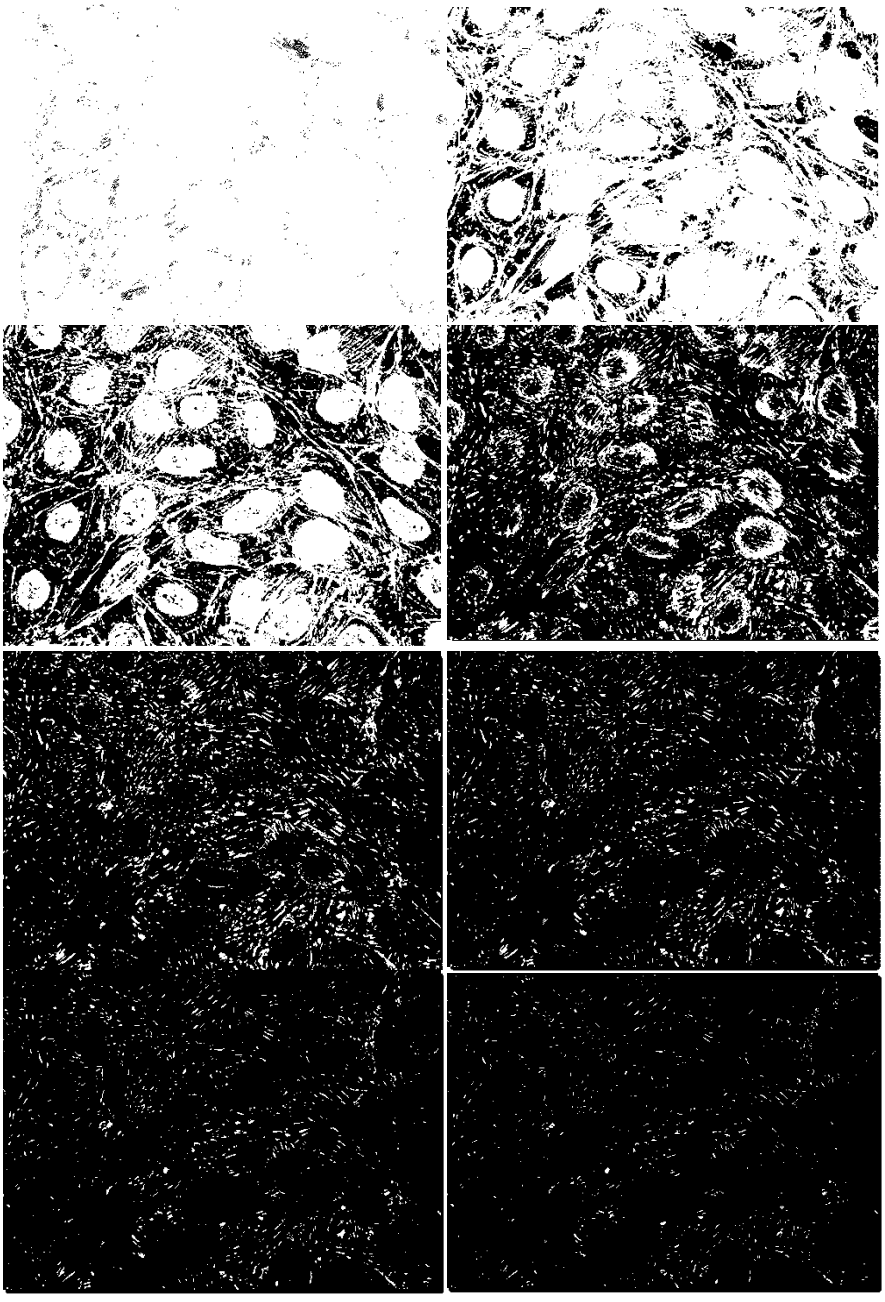




Input Grayscale for Binarization:



Threshold 0, 30, 60, 85, 113, 141, 170, 198:



Discussion/Conclusions:

The program ran as intended, but before getting the grayscale equation correct, I applied the scale operations to the image for each channel, but did not summarize them into a single grayscale value, resulting in a ‘dim’ rgb image. Thresholding seems to work almost as an x-ray to some degree, but instead of seeing through the object it showcases different feature edges as the threshold changes. For example, at threshold of 85, the main objects visible are the bone cells only, without a lot of noise or other features being present. A threshold of 60, however, shows only the outline of these cells, with no visible features of the actual cells. These are completely satisfactory results as this is expected behavior from a thresholding operation on a grayscale image. In fact, these results are the evidence for why this thresholding is used as a simple segmentation process for datasets.

References/Appendix: (As needed)

OpenCV Threshold Documentation:
https://docs.opencv.org/4.x/d7/d1b/group__imgproc__misc.html#ggaa9e58d2860d4afa658ef70a9b1115576a147222a96556ebc1d948b372bcd7ac59