Image Processing for Artistically Inclined High-School Students

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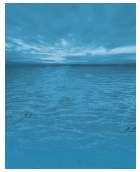
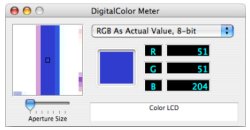
Objective

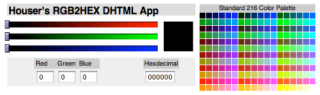
•High schools focus on teaching Math and Science concepts without understanding the importance.
•If students had a better perception of where some of what they learn is applied in the real world, it would heighten their interest in these subjects.
•This is especially the case with musically and artistically inclined students who are turned off by science, technology, engineering and math (STEM).
•Therefore, we have designed a lab to **reinforce math and science** concepts and **stimulate an interest for image processing technology for artistic students**


Digital Images and Color

As a part of this lab, students are introduced to digital images and the concept of color. A relationship between numbers and color intensities is established to help students understand the concept of color wavelengths. To do so, we use the following tools:

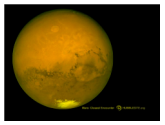


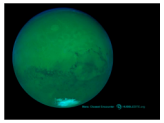


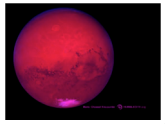
•The DigitalColor Meter illustrates the combination of the primary colors to generate other colors
•The Color Palette demonstrates the same showing a large variety of colors from the color spectrum.

Tinting An Image

Students are introduced to the additive and subtractive color models after which, they will use **Matlab®** to tint a colored image by switching off one of the channels. This helps them visualize the difference between the additive and subtractive color models and their various applications.


Yellow Tinted Image


Cyan Tinted Image


Magenta Tinted Image

Thresholding

Thresholding illustrates image segmentation in its simplest form.
In this activity, students get the opportunity to work with grayscale and color images whereby they set a threshold and images above the Threshold are turned to the highest color intensity. This gives them an idea of some of the operations in various image editing softwares such as Photoshop.



Images generated using three different thresholds

Edge Detection

The objective of edge detection is to distinguish between the foreground and the background in an image. Basic math concepts such as computing the difference or the average values of color intensities of pixels are used to detect the edges of an object in an image.


Original


Adjacent Pixel Comparison Threshold: >10 difference is denoted


Average of 3-pixel Adjacent Comparison (threshold 10)

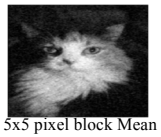
Edge Detection using the difference between pixel intensities and the average of 3-pixel intensities

Denoising a Corrupted Image

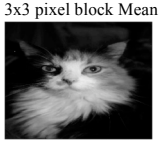
In this activity, Gaussian or Salt and Pepper noise will be added to an image and students will remove the noise using basic math concepts such as mean and median to restore the corrupted image.


Gaussian Noise Original


3x3 pixel block Mean


5x5 pixel block Mean


Salt-and-Pepper Original


3x3 pixel block Median


5x5 pixel block Median

Removal of Salt And Pepper noise from an image using the median of pixel intensities

Conclusion

•High School students are encouraged to use the concepts and skills learned in class and apply them to digital images through the medium of **Matlab®**.
•This helps illustrate these concepts and stimulate an interest in the field of image processing
•"Now I know what Edge Detection means in Photoshop." – Olivia, High School Student

Acknowledgements

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