Modifying Images for Color Blind Viewers

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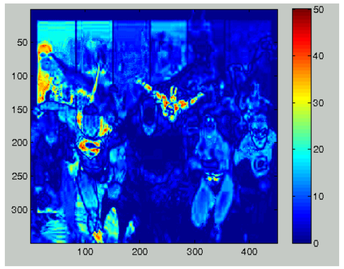
Motivation

Color blindness affects roughly ten percent of human males. It is possible for a woman to be color blind, however, because the main form of color blindness manifests as a defect in the X chromosome, most color blind individuals are men. Of those diagnosed with color blindness, over ninety-nine percent of them suffer from some sort of red-green deficiency, where they are unable to distinguish well between red and green. This project focuses exclusively upon Deuteranopia, a type of dichromacy where the patient has no “green” cones in his or her eyes.

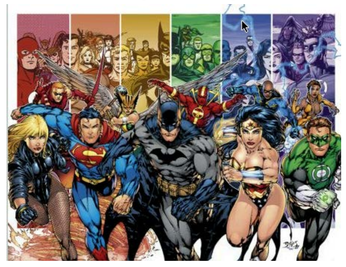
Daltonization

1. Convert image to LMS color space
2. Calculate information lost by viewer missing all M (green) cones
3. Shift lost information to colors visible to patient
4. Add shifted lost information back to original image

Delta E



Original Image



Daltonized Image

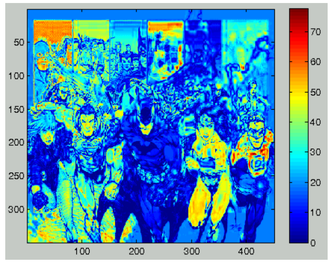
Original as seen by dichromat

Daltonized as seen by dichromat

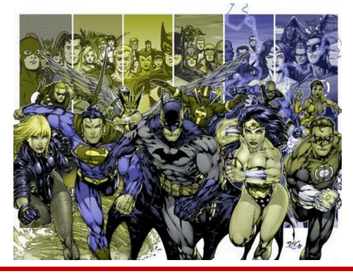
Enhancing Color Contrast

In RGB color space make reds more red and greens more green. Increase blue component of green pixels and decrease blue component of red pixels.

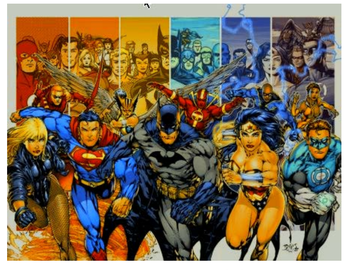
Delta E

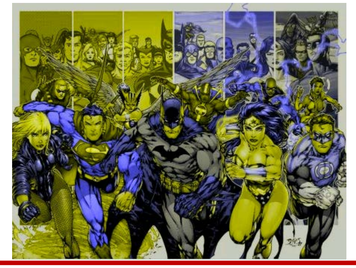


Original Images



Contrasted Images

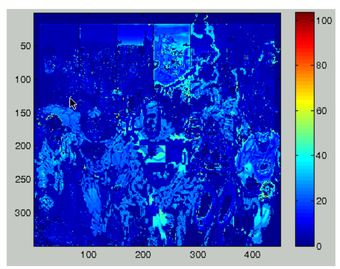




Color Correction

In LAB color space shift coordinate values such that colors are generally richer and blues and yellows are somewhat enhanced.

Delta E



Original Images

Shifted Images