

Identifying Perceptual Problems of Images and Videos for Color-Blind Users

- A BLUE NOTE-

Željko Obrenović

Created: Sept 5, 2007

Last change: Sept 5, 2007

What is the research question?

- How to identify images and parts of the movies that are most problematic for color-blind users.

What is your approach?

- We use images (frames), and generate new images that simulate particular color disability. We then compare the color histograms of the original and simulated image. Our hypothesis is that the bigger the difference between the histogram, the more of color coded information has the image lost. We are particularly interested in finding how color diversity is affected, i.e. for color blind users it is not a problem that color looks others, but that it may look too similar to other colors, which may significantly affect perception of contrasts and shapes. Currently we are only comparing mean values of histograms.
- We are currently using algorithms that simulate three color disabilities (for description of these three disabilities see http://en.wikipedia.org/wiki/Color_blindness):
 - Deuteranope (a form of red/green color deficit)
 - Protanope (another form of red/green color deficit)
 - Tritanope (a blue/yellow deficit- very rare)
- The dichromat simulation code is based on an algorithm described by [Hans Brettel](#), Francoise Vienot and [John Mollon](#) in a paper that appeared in the [Journal of the Optical Society of America](#) Vol. 14, No. 10 pp. 26-47. ([pubmed](#); see also: [pubmed](#)). We use [ImageJ](#) library to do the transformations, and calculate the histogram of images. See also <http://www.vischeck.com/>.

Why do we need identification of perceptual problems in images and videos?

- To guide manual annotation, and create alternative presentations
 - Images that are problematic for perception can be additionally annotated, and this annotation can be used to create alternative presentation, or to better explain parts of the images that cannot be perceived. Currently, it is hard to get useful automatic annotation, and it has to be done manually. Manual annotation of the whole movie can be very time-consuming, but our solution can help annotator to focus on areas that are problematic for many users.
- To transform images:
 - Images can be transformed with filters that can increase the contrast and sharpness, or replace colors.
- To increase the awareness of the problems that people with color disabilities face.
- The approach can also be used to similar color problems that are the consequence of lighting conditions or device display limitations.

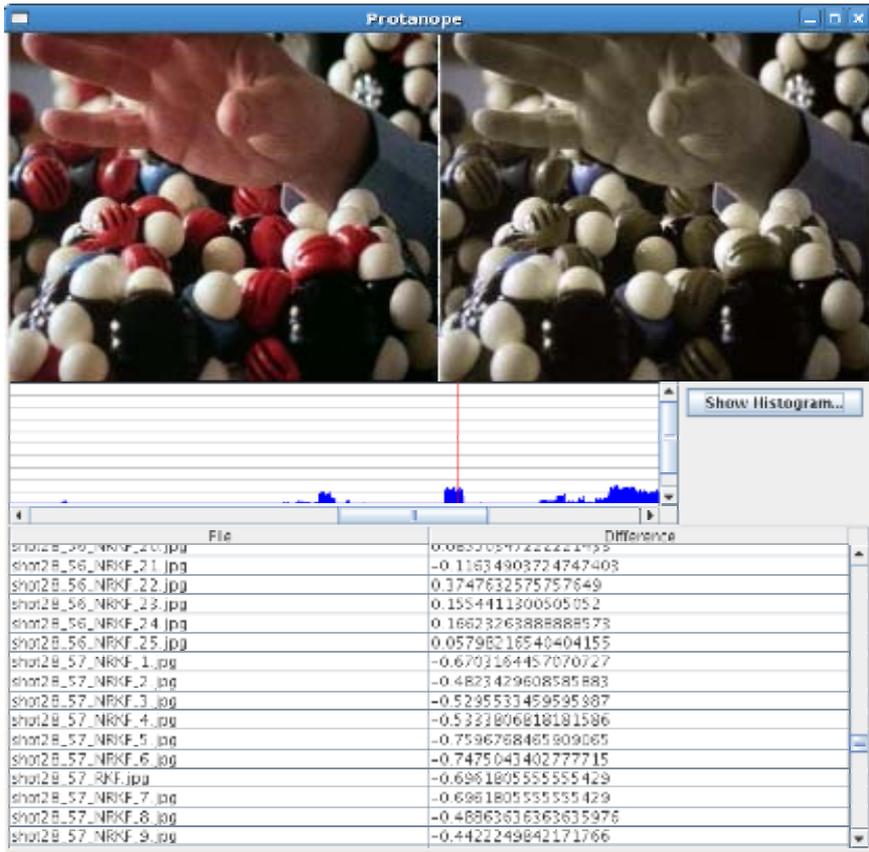


Figure 1. Our tool that displays original (left) and simulated (right) images, and shows the timeline with differences between the mean values of these two images. Tables in the lower part of the images shows the list of frames from TrecVID video created by K-Space partners. The image of the right side simulated protanope disability - a form of red/green color deficit.

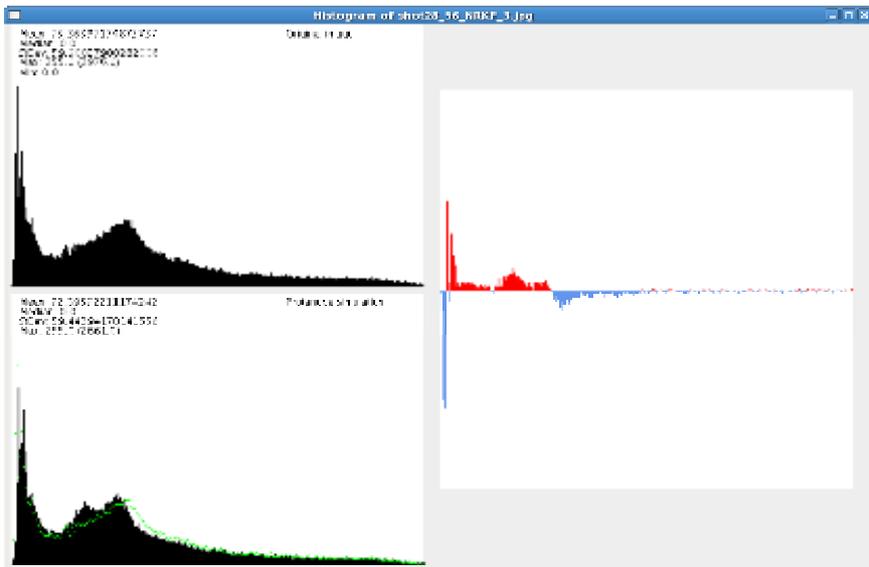


Figure 2. The differences between histograms of the original and simulated image.