Transferring Color to Greyscale Images

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Problem: Coloring of Greyscale Images

- There is no exact, objective solution to adding chromatic values to a greyscale image
  - This occurs because it is possible for two pixels which are of different colors (different red, green, and blue values), when desaturated, to have the same greyscale value, or luminosity
- Current systems allow for coloration by the user, and require tedious amounts of manually specifying colors for regions

Motivation

- Adding color to an image to enhance visual appearance
- Perceptually enhancing the content in scientific images
- Reducing the amount of work done by the user
  - Other systems require the user to hand-color individual regions of the image

Solution

Figure 1: Colors are transferred to the second image without user intervention. Source image courtesy © Ian Britton - FreeFoto.com

The color “mood” of the source image (left) is transferred to the destination image (center) to produce a target image (right)

Solution

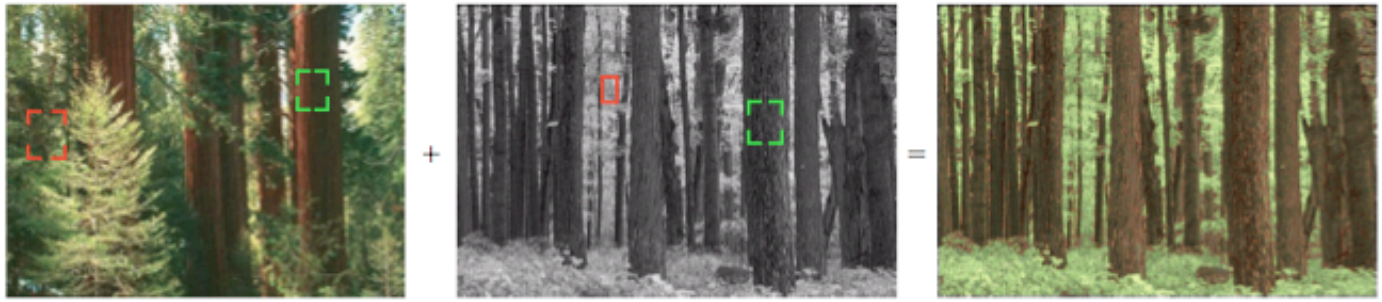
- The general algorithm
  - First convert each image into the $l\alpha\beta$ color space
    - l represents a luminance channel
    - α represents a yellow-blue channel
    - β represents a red-green channel
  - Then iterate through each pixel of the greyscale image to find the best color match in the source image
  - Finally the color information is transferred to the greyscale image to form the target image

Swatches

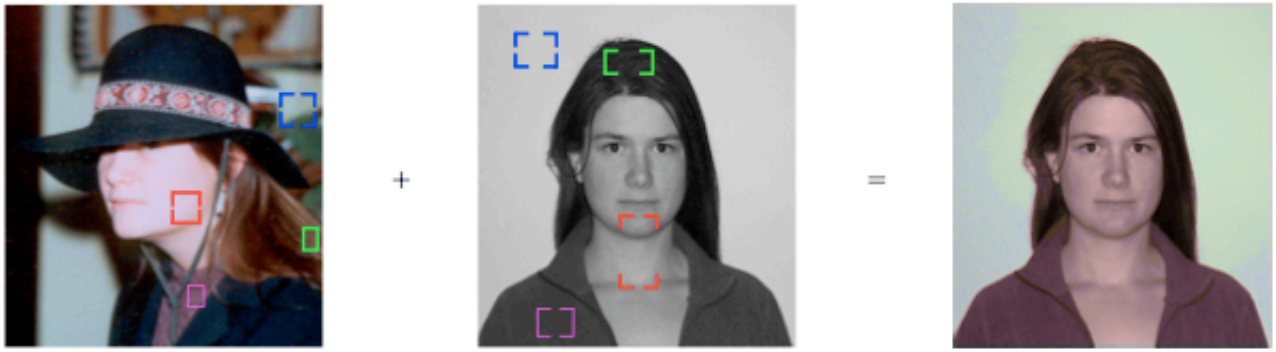
- Swatches allow more user interaction in the choice of colors to be transferred
- They also decrease the chance that the target image could be corrupted by a source image with largely differing color properties in certain locations

Swatch Examples

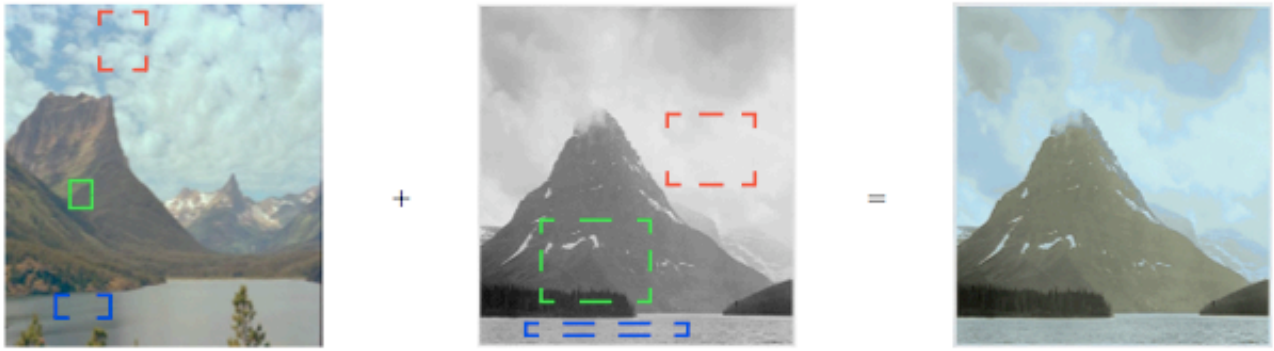
(a) Foliage image mapped using a swatch for the bark and the leaves. Source image courtesy of Adam Superchi. Target image courtesy of http://philip.greenspun.com.



(b) The results of colorizing a photograph of a face. Four swatches were used for the hair, skin, shirt and background with a 11x11 neighborhood size for the L_2 metric. Images courtesy of Lela.



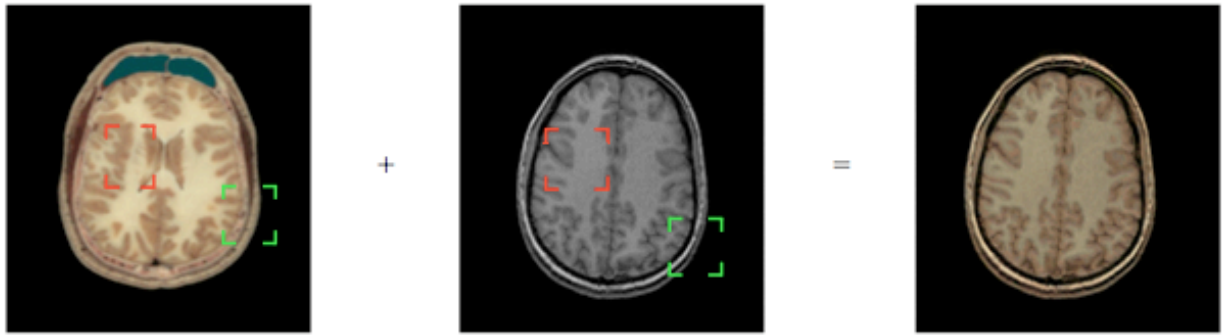
(c) The results of colorizing an Ansel Adam's photograph. A total of 3 swatches were used. Source image courtesy of Paul Kienitz.



Swatch Examples

(d) A Landsat 7 satellite image (converted to greyscale) was colorized with another Landsat satellite image using the global matching procedure.

(e) One slice of a colorized MRI volume. We used a color cryosection from the Visible Human Project dataset and two swatches. By using swatches, we could avoid transferring the color of the blue gel.



(f) A scanning electron microscopy (SEM) image colorized with a photograph of an ant using the global matching procedure.

Conclusion

- Swatches are not always sufficient for specifying faces and the differences between skin and lips, and also hair and clothing
- This approach is fast and user friendly
  - Ranging from 15 seconds to 4 minutes depending upon the number of swatches, the neighborhood size and the size of the image
- With higher resolution images and larger neighborhood sizes results can be further improved