Seminar 6

Use MATLAB and choose your own RGB or grayscale PNG or JPEG images. Give the source of each image and identify the object or feature you study. You may reuse a suitable image in several problems.

Problem 1. False Color and Pseudocolor

Choose an RGB image with distinct color features. Use `im2double` to obtain RGB values in $[0, 1]$ and denote the three channels by R, G, and B.

Tasks

1. Make a false-color image with `cat(3,B,R,G)`. Display it using `image`.
2. Display the original green channel G using a sequential colormap and color limits $[0, 1]$. Add a colorbar.

Question Choose one feature. What determines its color in each display?

Problem 2. Selecting Blue Pixels in HSV

Choose an RGB image containing a blue region.

Tasks

1. Use `rgb2hsv` to obtain the hue H and saturation S at each pixel. Make a mask for $0.55 \leq H \leq 0.75$.
2. Add the condition $S \geq 0.30$ to make a second mask. Display the original image and the two masks.

Question Where do the two masks differ?

Problem 3. Coloring an Astronomical Image

Choose an image of an astronomical object. Prepare its grayscale array X, using `rgb2gray` for an RGB input, and convert it to $[0, 1]$ with `im2double`. The supplied Andromeda image `M31_grayscale.png` is an example of a suitable input.

Tasks

1. Display X in grayscale with color limits $[0, 1]$.
2. Apply `copper` or `parula`. Use the same limits and add a colorbar.
3. Open `colormapeditor` and move one color marker. Save the edited display with its colorbar.

Question Which feature is most affected by the palette edit?

Problem 4. Pseudocolor of Image Gradients

Use the grayscale astronomical image X from Problem 3.

Tasks

1. Compute the horizontal and vertical gradients using `[Gx,Gy] = gradient(X)`. Form the gradient magnitude at each pixel,

$$D(i,j) = \sqrt{G_x(i,j)^2 + G_y(i,j)^2}. \tag{1}$$

   In MATLAB, use `hypot(Gx,Gy)`.

2. Plot D with a sequential colormap and a colorbar. Compare it with the grayscale image.

Questions Which edge stands out in the gradient map? What does a large value of D indicate?

Problem 5. Channel Scaling in a False-Color Image

Use the false-color composite from Problem 1. Its output red channel contains the original blue array B.

Tasks

1. Increase the red contribution by forming

$$B_{\text{scaled}}(i,j) = \min\big(2B(i,j),\, 1\big). \tag{2}$$

   Build a second composite with `cat(3,Bscaled,R,G)`.

2. Show the two composites side by side. Compare one bright region and one faint region.

Questions How does the color change when the red contribution increases? Which input values of B map to the maximum red value?

Submission Requirements

1. The MATLAB source code and the source of each input image.
2. The requested figures, with colorbars for the scalar maps.
3. Brief answers to the questions.