Outline

- Last week
  - Trichromatic color representation
  - HIS color spaces
  - Matlab tutorial

- This week
  - Color space (contd.)
  - Pseudocoloring
  - Reading: G&W 6.3
Understanding HSI from RGB

- Turn the RGB cube so that Black-White axis is vertical
- Each plane containing the B-W axis and any color point contains all the colors of the same hue
- Hue can be represented as an angle between the plane and a reference plane (e.g. Red)
- Color of the same hue can be made less saturated by mixing more grey colors
- Intensity can be measured by intersection with the B-W axis.

Formation of the HIS color cone

- Cross sections of the RGB cube along the B-W axis
- The cross section shape changes from triangle to hexagon to triangle
- Hue is represented by the angle from Red line
- Saturation is represented by the distance to the origin
- The hexagonal shape can be approximated by a circle or a triangle.
Colors on the HSI color cone

- Saturated colors on the outer points
- The maximum saturation values occur at the intermediate intensity levels.
- Distances between colors in the HIS space

\[ D(C_1, C_2) = w_1 \cdot \Delta H + w_2 \cdot \Delta S + w_3 \cdot \Delta I \]

- Weights depend on applications

Manipulations in the HSI space

- HSI values of primary/secondary colors
- HSI allows independent manipulations of colors

- Hue of Green & Blue set to 0.
- Saturation of Cyan reduced by half.
- Intensity of White reduced by half.
Pseudo Coloring

Related to colormap

Intensity Slicing

- How to decide the mapping function?
Example of intensity slicing

- Mapped to 8 colors
- Note the color variations in the left lobe of the radiation test pattern

Map gray level 255 to yellow
The rest to blue
255 corresponds to cracks or porosities in the weld

Gray level to color transformation

- How to design the transformation functions?
Example of Gray-Color Transformation

How does it work?
- 3 channels use sinusoidal functions with the same frequency but different phases.
- Adjust the frequency to obtain the best quality/information.
Pseudocoloring using multiple monochrome images

- Note the difference between human-made features (blue) and the bio-mass (red)

Sampling & Quantization

Reading:
G&W Sec. 2.4
Jain 4.5-4.8
Sampling – Spatial Resolution

- Concept of the Nyquist Rate (hand notes)

Quantization – Grey-Scale Resolution

- Varying # of bits per pixel
Tradeoff between gray-level resolution and spatial resolution

- Curves show isopreference points
- For low-, moderate-detail images, increasing $K$ or $N$ will help perceptual quality
- For high-detail images, increasing $N$ is more important.