COS 426: PRECEPT 2

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Assignment 1: Image Processing

• Structure of the assignment
• Implementation of filters operations
  – Luminance
  – Color
  – Filter
  – Dither
  – Resampling
Structure

• Interactive Mode
  – Photolist (edit it in Gui.js)
  – morphLines

• Batch Mode
  – Gui to Batch
  – Brightness Animation
  – newTab
    • Multiple parameters
    • Multiple images
    • Gif
    • Art
Morph Lines

- Read two images and create your own morph lines correspondence.
- You could modify your morphlines by including &marker = yourmakerfile to load it in.
- Read JSON in your code
  
  ```python
  linek = lines.initial[k]
  - linek.x0, linek.y0, linek.x1, linek.y1,
  ```
Implementation

• Graphica Obscura

\[
\text{out} = (1 - \text{alpha})\times\text{in0} + \text{alpha}\times\text{in1}
\]

- brightness:

- problem: it does not make great use of the full range of the slider
Brightness

Ratio < 0:
interpolate with black

Ratio > 0:
interpolate with white

See wiki_GIMP_contrast_brightness
Contrast

- Map [-1, 1) to [0,∞) by
  \[ \text{Ratio} = \tan((\text{Ratio}+1) \cdot \pi/4) \]

interpolate with gray

See [wiki_GIMP_contrast_brightness](https://wiki.gimp.org/wiki/GIMP_contrast_brightness)
Saturation

- Map $[-1, 1]$ to $[0, 2]$ by
  \[ \text{Ratio} = \text{Ratio} + 1; \]

interpolate with grayscale image

See [wiki_GIMP_contrast_brightness](https://wiki.gimp.org/wiki/Contrast_Brightness)
Gray

• Either way is ok:
  – Luminance (standard for certain color spaces):
    \[0.2126 \times R + 0.7152 \times G + 0.0722 \times B\]
  – Luminance (perceived option 1):
    \[0.299 \times R + 0.587 \times G + 0.114 \times B\]
Gamma Correction

$$V_{out} = \text{Math.pow}(V_{in}, \gamma)$$

- $V_{in}$ is the rgb values in $[0,1]$, the result pixel is $V_{out} \times 255$
\text{innerR} = 0.5 - 0.5 \times \text{value}[0];
\text{outerR} = 0.5 + 0.5 \times \text{value}[1];

\textbf{Example: } \text{value}=[0.5,0.5], \text{innerR}=0.25, \text{outerR}=0.75

Pixel outside \text{outerR} \text{ is black}

Pixel inside \text{innerR} \text{ is clear}
White balance

• First, map RGB to [0,1]
• RGB -> LMS
• divided by $L_w M_w S_w$
• LMS -> RGB
• Map back to 0-255
Histogram equalization

Before

After
Histogram Matching

• Tips: Choose a reasonable reference image

reference image: town
reference image: flower

reference image: town
reference image: flower
Gaussian Filter

• Tips:
  – Weight should be normalized.
  – Border pixels
  – Create new image
Edge

• **Tips:**
  – Weight should not be normalized.
  – Border pixels
  – Create new image

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Sharpen

• Tips:
  – Weight could be normalized.
  – Border pixels
  – Create new image
Median

- RGB vs Luminance
Bilateral

• Color sigma
  – calculate the distance in rgb [0,1]
• Weighted should be normalized
• Make two sigmas more equalized
Dither

• First check your results in grayscale.
• Random – make sure you have positive and negative random noise.
• Floyd – border pixels
Sampling

- Create a new image
- Rotation:
  - Set the alpha of outside pixel as 0
- Swirl:
  - For the outside pixels, find its nearest pixel inside the photo.
More tips

• Don’t worry about minor difference with results in example page.
  – contrast, quantize, random…
  – Just make sure your results are reasonable.

• Which rgb range this operation should process in. [0,1] or 0-255?

• Need to create new images?

• No 256
Q&A