Computer Vision Homework 1 Report

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Usage

python3 rgb2gray.py <input image>

Example:

python3 rgb2gray.py 0a.png

The output images will be “0a_y.png”, “0a_y1.png”, “0a_y2.png”, and “0a_y3.png”.

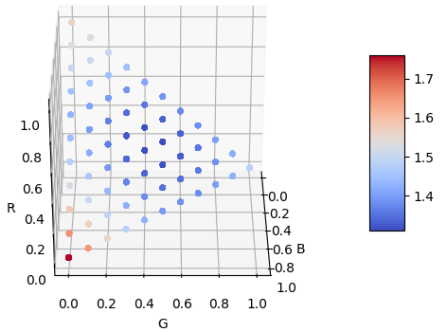
Implementation of local minima selection

Given a point (b_0, g_0, r_0), its neighbors are:

$$(b_0 - d, g_0 + d, r_0), (b_0 - d, g_0, r_0 + d)$$
$$(b_0 + d, g_0 - d, r_0), (b_0, g_0 - d, r_0 + d)$$
$$(b_0 + d, g_0, r_0 - d), (b_0, g_0 + d, r_0 - d)$$

where $d = 0.1$ in this homework.

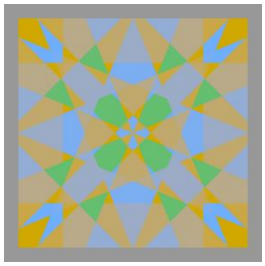
To search for local minima, a dictionary is created. The keys are BGR parameters while the values are costs. For each point, if its cost is less than all of the neighbors, then it is a local minimum and is recorded in a list. The cost of its neighbors can be easily obtained with the help of the dictionary. In case of edge points, when a given parameter does not exist in the dictionary, an infinity value will be returned so that the algorithm will not be affected.



➢ Cost plane of 0c.png ($\sigma_s = 1$ $\sigma_r = 0.1$)

Result

■ Input Images

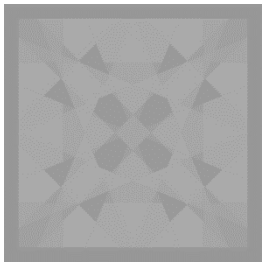



The luminance generated by a physical device is generally not a linear function of the applied signal. A conventional CRT has a power-law response to voltage; luminance produced at the face of the display is approximately proportional to the applied voltage raised to the 2.5 power. The numerical value of the exponent of this power function is colloquially known as *gamma*. This nonlinearity must be compensated in order to achieve correct reproduction of luminance.

As mentioned above (*What is lightness?*), human vision has a nonuniform perceptual response to luminance. If luminance is to be coded into a small number of steps, say 256, then in order for the most effective perceptual

■ Conventional RGB2GRAY Conversion

$$Y = 0.299R + 0.587G + 0.114B$$

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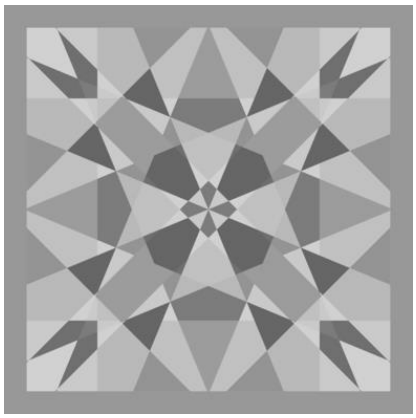
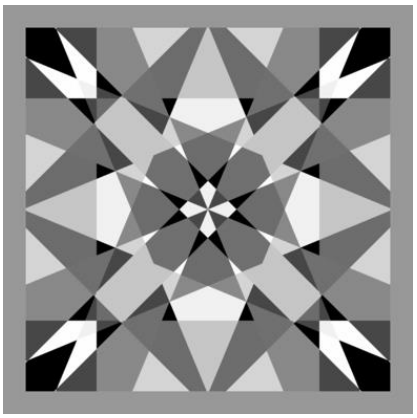
■ Advanced RGB2GRAY Conversion

1. 0a.png



$(w_b, w_g, w_r) = (0,0,1)$



$(w_b, w_g, w_r) = (1,0,0)$

◆ Number of votes

(w_b, w_g, w_r)	Vote
$(0,0,1)$	9
$(1,0,0)$	9

2. 0b.png

$(w_b, w_g, w_r) = (0,0,1)$

$(w_b, w_g, w_r) = (0,0.2,0.8)$

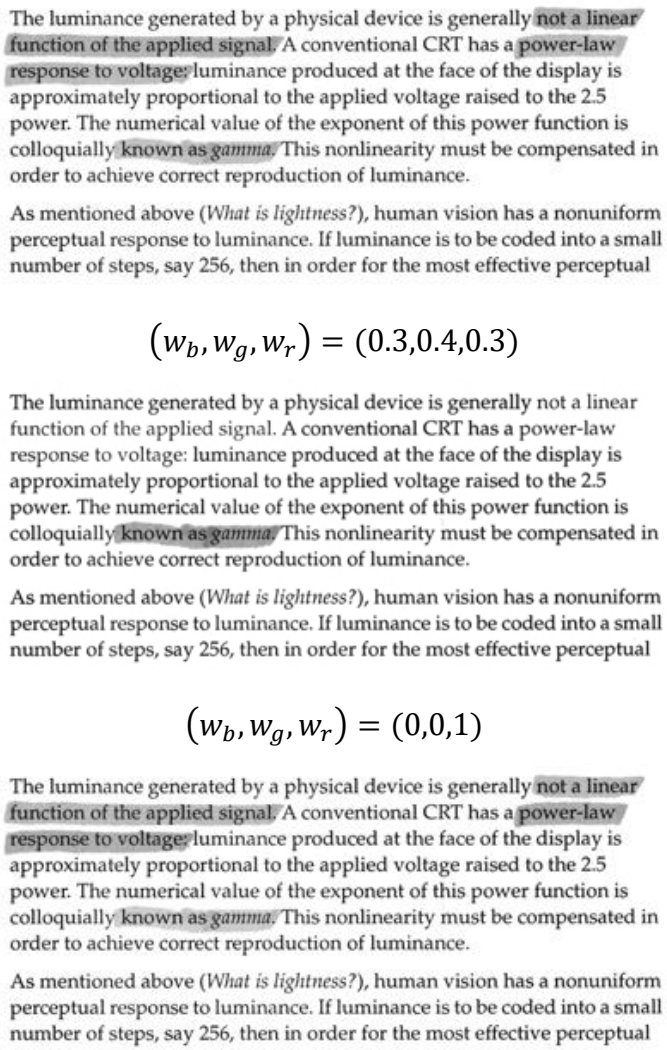
$(w_b, w_g, w_r) = (0,1,0)$

$(w_b, w_g, w_r) = (0.1,0.2,0.7)$

- Number of votes

(w_b, w_g, w_r)	Vote
(0,0,1)	3
(0,0.2,0.8)	3
(0,1,0)	2
(0.1,0.2,0.7)	2
(0,0.3,0.7)	1

3. 0c.png



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$$(w_b, w_g, w_r) = (0.3,0.4,0.3)$$

$$(w_b, w_g, w_r) = (0,0,1)$$

$$(w_b, w_g, w_r) = (0.2,0.5,0.3)$$

- Number of votes

(w_b, w_g, w_r)	Vote
(0.3,0.4,0.3)	3
(0,0,1)	2
(0.2,0.5,0.3)	2
(0,0.1,0.9)	1
(0.1,0.5,0.4)	1
(0.2,0.6,0.2)	1
(0.3,0.3,0.4)	1

Discussion

When searching for local minima, points on the edge is easier to be selected than points in the middle of the plane because edge points only need to be compared to two or three points while ordinary points have six neighbors. Hence, the voting result may not be fair. In addition, while the weights are discretized, the real local minimum may be in the middle of these points. This makes the votes be distributed to its neighbors and therefore yields an inaccurate result.