

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Department of Electrical and Computer Engineering

ECE 418 IMAGE PROCESSING

Problem Set 7
Spring 2008

Issued: Thursday, March 6, 2008

Due: Thursday, March 13, 2008

Problem 7.1

Suppose a 256×256 -pixel image has been over-exposed, so that the majority of its pixels are either white or black, with few in between. In particular, suppose the histogram is

$$H(g) = \begin{cases} Ke^{-a(255-g)} & 128 \leq g \leq 255 \\ Ke^{-ag} & 0 \leq g \leq 128 \end{cases}$$

for some constants K and a .

- (a) Construct a point operation $\tilde{g} = P(g)$ so that $\tilde{H}(\tilde{g})$ is constant.
- (b) In order to evaluate quantization effects, consider the following special case of $H(g)$, obtained when $a = \ln 2$:

g	$H(g)$
0	16384
1	8192
2	4096
3	2048
\vdots	\vdots
252	2048
253	4096
254	8192
255	16384

Apply the $P(g)$ that you developed in part (a). Sketch the resulting histogram $\tilde{H}(\tilde{g})$, showing the results of quantized pixel values.

Problem 7.2

This problem considers the hue-saturation-value representations of some common colors. The text doesn't describe HSV color space, but many common references (both in the library and on the web) describe it adequately.

(a) What are the HSV coordinates of the color red,

$$\begin{bmatrix} r \\ g \\ b \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

(b) What are the HSV coordinates of the color yellow,

$$\begin{bmatrix} r \\ g \\ b \end{bmatrix} = \begin{bmatrix} 1/2 \\ 1/2 \\ 0 \end{bmatrix}$$

(c) What are the HSV coordinates of the color white,

$$\begin{bmatrix} r \\ g \\ b \end{bmatrix} = \begin{bmatrix} 1/3 \\ 1/3 \\ 1/3 \end{bmatrix}$$