COLOUR IMAGE PROCESSING

(Assignment – 1: Write any one program)

Duration: 1 Week Total Marks: 20

1. Develop histogram stretching and histogram equalization operations on the L^* component of an image. In other words, you need to write a program that

   (a) converts an RGB image into an $L^*a^*b^*$ image

   (b) computes the histogram for the L^* component

   (c) stretches the histogram to 0 – 100 range

   (d) converts the $L^*a^*b^*$ colour back to RGB and display the image

   For histogram equalization, perform histogram equalization instead of stretching in Step (c). Histogram operations provided by CIPTK may be used in Step (c).

2. Develop a filter for extracting a specified colour based on HSV representation. Let the user specify a specific hue η and a hue *bandwidth* σ_η. The output value $V'(x,y)$ is given by

$$V'(x,y) = \begin{cases} V(x,y) & \text{if } H_{\text{diff}} \leq \sigma_\eta \\ V(x,y)\left(1 - \dfrac{H_{\text{diff}}}{1800}\right) & \text{otherwise} \end{cases}$$

   H_{diff} is given by

$$H_{\text{diff}} = \begin{cases} |H(x,y) - \eta| & \text{if } |H(x,y) - \eta| \leq 1800 \\ 3600 - |H(x,y) - \eta| & \text{otherwise} \end{cases}$$

   $H(x,y), S(x,y)$ and $V(x,y)$ are the HSV components at a pixel location (x,y). The H and S components of the output are the same as that of the input.

3. Implement the following vector edge detector. Let

$$\begin{aligned} g_{xx} &= |\frac{\partial R}{\partial x}|^2 + |\frac{\partial G}{\partial x}|^2 + |\frac{\partial B}{\partial x}|^2 \\ g_{yy} &= |\frac{\partial R}{\partial y}|^2 + |\frac{\partial G}{\partial x}|^2 + |\frac{\partial B}{\partial x}|^2 \\ g_{xy} &= \frac{\partial R}{\partial x}\frac{\partial R}{\partial y} + \frac{\partial G}{\partial x}\frac{\partial G}{\partial y} + \frac{\partial B}{\partial x}\frac{\partial B}{\partial y} \end{aligned}$$

   The edge magnitude at a pixel $F(x,y)$ is then given by

$$F(x,y) = \frac{1}{2}\left\{(g_{xx} + g_{yy}) + \cos 2\theta(g_{xx} - g_{yy}) + 2g_{xy}\sin\theta\right\}$$

   where

$$\theta = \frac{1}{2}\tan^{-1}\frac{2g_{xy}}{g_{xx} - g_{yy}}$$

4. Implement *Popularity algorithm* for quantizing an RGB image into user-specified number of colours.