Assignment A2: Pixels

CS 6640
Fall 2020

Assigned: 4 September 2020

Due: 17 September 2019

For this problem, handin the A2 report PDF as well as any Matlab functions used to address the problems.

Some notes:

- No scripts
- Functions must have CS6640 prefix
- Indent headers correctly (5 spaces indented lines) and put required info
- Do not exceed 72 characters per source line

1. Write a Matlab function which implements the log transform described in the text. Use the following header:

```
function I_out = CS6640_log_trans(I,c,sigma)
% CS6640_log_trans - log transform image (enhance dark regions)
% On inpput:
%     I (MxN array): gray level image
%     c (int): output scale (max value; use 0 for autoset)
%     sigma (float): input range scaling factor
% On output:
%     I_out (MxN array): transformed image
% Call:
```

```
%     I2 = CS6640_log_trans(im,0,2);
% Author:
%     <Your name>
%     UU
%     Fall 2019
%
```

2. Write a Matlab function which implements the exp transform described in the text. Use the following header:

```
function I_out = CS6640_exp_trans(I,c,alpha)
% CS6640_exp_trans - exp transform image (enhance bright regions)
% On inpput:
%     I (MxN array): gray level image
%     c (int): output scale (max value; use 0 for autoset)
%     alpha (float): input range scaling factor
% On output:
%     I_out (MxN array): transformed image
% Call:
%     I2 = CS6640_exp_trans(im,0,2);
% Author:
%     <Your name>
%     UU
%     Fall 2019
%
```

3. Consider image map1.jpg. Develop color histogramming techniques to segment the semantic areas of the image. That is, compute the rgb histogram in the neighborhood of each pixel, and use Kullbach-Leibler divergence to measure the distance from each of a set of histograms representative of the semantic regions in the map. Study and report on how the number of bins and window size (k) impact performance (both computaitonally and segmentation-wise). Describe the performance of these methods. Develop the three functions described by the Matlab headers given below to solve the problem.

```
function hc = CS6640_hist_color(im,num_bins)
% CS6640_hist_color - color histogram
```

```
% On input:
%     im (MxNx3 array): rgb/hsv image
%     num_bins (int): total number of binsfor each dimension
% On output:
%     hc (nx1 vector): linearized, normalized histogram
% Call:
%     hc = CS6640_hist_color(map1,8);
% Author:
%     <Your name>
%     UU
%     Fall 2020
%


function d = CS6640_KL_div(P,Q)
% CS6640_KL_div - Kullback-Leibler divergence
% On input:
%     P (nx1 vector): probability distribution 1
%     Q (nx1 vector): probability distribution 2
% On output:
%     d (float): SUM[ P(k)log(P(k)/Q(k))]
% Call:
%     d = CS6640_KL_div(hc1,hc2);
% Author:
%     <Your name>
%     UU
%     Fall 2020
%


function imo = CS6640_color_seg(im,ctrs,k)
% CS6640_color_seg - color segmentation of an image
% On input:
%     im (MxNx3 array): color image
%     ctrs (nx3 array): n color centers (one color triple per row)
%     k (odd int): size window to use
% On output:
%     imo (MxN array): segmented image
% Call:
%     imo = CS6640_color_seg(map1,ctrs,15);
% Author:
```

```
%     <Your name>
%     UU
%     Fall 2020
%
```