Assignment A3: Enhancement Filters

CS 4640
Fall 2019

Assigned: 15 September 2020

Due: 1 October 2020

For this problem, handin your lab report PDF and the Matlab .m files for the functions described by the headers below.

Some notes:

- Indent headers correctly (5 spaces indented lines)
- Do not exceed 72 characters per source line

None of the functions should write to the interpreter, draw, etc.

1. The Prewitt filter is linearly separable.

- Give the definition of the linear filters required to produce a $k \times k$ Prewitt Filter.
- Give the formulas for the number of multiplications and additions in the application of both the 1D separable and the 2D versions to an $M \times N$ image. These are a function of k.
- Implement both versions in Matlab, and compare their computation time cost (on the cell image) as a function of k, for $k = 3 : 100$. Note that Matlab functions *tic* and *toc* can be used to time the execution. Plot the results. Use the Matlab function *polyfit* to determine the coefficients for the multiplication and addition formulas so we can see the constants involved.

2. Try the zero-crossing edge detector (in Matlab functon *edge*) to segment foreground objects in peppers.png. Refer to Example 4.10 in the text, and specify the threshold so that all detected edges form closed curves. Use the MATLAB function *imfill* to fill the background. Try different size Gaussian kernels and assess the impact on segmentation performance. Report what you have tried and how you evaluate performance.

3. Develop the 16 Laws' texture energy filters (defined in the Shapiro-Stockman handout) and apply them to the gray level version of map1 and study whether they help identify interesting semantic regions in the image. Develop a Matlab function, CS6640_Laws, that computes a 16-channel output consisting of these energy measure images for a given input as described in the given header.

```
function energy = CS6640_Laws(im)
% CS6640_Laws - Laws' texture energy
% On input:
%     im (MxN array): gray level image
% On output:
%     energy (MxNx16 array): Laws energy measures
%       sorted by choosing pairs in the order L5, E5, S5, R5
% Call:
%     em = CS6640_Laws(map1g);
% Author:
%     <Your name>
%     UU
%     Fall 2020
%
```