Queens College
Department of Computer Science
CSCI 381/780 Image Processing

Homework #2

Due Date: December 15st

1. Capture two images, that will be used for processing, (one underexposed, and one overexposed) using your cell phone or digital camera and generate their corresponding gray level images (e.g., *gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)*).
   - Apply the gamma transformation to these two gray level images to correct their appearance.
   - Test several parameters of gamma until obtaining the best results and plot the histograms of both original and corrected images.

2. Apply Histogram equalization to the two images captured previously. You can use build-in functions like *cv2.equalizeHist(img)*.
   - Show resulting images and their histograms.

3. Implement the algorithm of exact histogram matching using the following kernels:

$$w_1 = [1] \qquad w_2 = \frac{1}{5}\begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 0 \end{bmatrix} \qquad w_3 = \frac{1}{9}\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

   - You can use build-in functions like cv2.filter2D(gray, -1, kernel) for implementing the convolutions.
   - Use as reference for the output histogram a uniform distributed function, and apply your algorithm to the two images used previously for processing.
   - Show the resulting images and their corresponding histograms.
   - Compare the results obtained in (1), (2), and (3).
4. Select one image that was previously improved, and apply to this image the following operators:
   a. Smoothing spatial filtering (Gaussian and Box Kernels)
   b. First-order derivative (Robert and Sobel Kernels)
   c. Second-order derivative
   d. Unsharp and Highboost filtering
   - Show the images obtained after using the previous operators.

Submit homework by December 15th a document with all your results, comments, and code.