

ECG 782 Homework #1

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1. Getting started

- (a) Determine how you will use L^AT_EX:
 - I will be using TeXworks.
- (b) Download the “standard” test images from the Gonzalez and Woods website. ✓
- (c) Download the sample images from the class website. ✓
- (d) Indicate the method you have selected for L^AT_EX use. ✓
- (e) Generate your report using the article class. ✓

2. Histogram Equalization

- (a) Write a function `hist.eq.m` that performs histogram equalization on an intensity image. The function should take as inputs an intensity image and the number of gray level value bins. Create a separate m-file for this function.
- (b) Perform histogram equalization on the `jetplane` image using 256, 128, and 64 bins. Compare the original image and the histogram equalized images by plotting the corresponding histograms and images side-by-side in a 2×2 subplot matrix.
- (c) Perform the equalization in 32×32 blocks. Display the output image. You will find `blockproc.m` useful.

3. Basic Morphology

- (a) Threshold the image SJEarthquakesteampic.jpg to detect faces. Be sure to describe how you obtained your threshold. You may find this is easier in another colorspace such as HSV.
- (b) Use morphological operations to clean the image. Count the number of players in the cleaned threshold image.
- (c) Create an output image that has a bounding box around each face. Use regionprops.m. In your report, create an output figure with three images in a row. (a) is the face threshold image, (b) morphologically cleaned image, and (c) the color image with bounding box around face areas.
- (d) Repeat for barcelona-team.jpg. Explain the differences you found.

4. Filtering

- (a) Consider image DSCN0479-001.JPG as a perfect image. Add white Gaussian noise with variance 0.005. Smooth with a 3×3 and 7×7 box filter and a median filter. Compute the mean squared error (MSE)

$$MSE = \frac{1}{MN} \sum_m \sum_n (I_1(m, n) - I_2(m, n))^2$$

and the peak signal-to-noise ratio (PSNR)

$$PSNR = 20 \times \log_{10}(255/\sqrt{MSE})$$

for the noise reduced images. Compile results using a \LaTeX Table. Which filter has the best results based on the error measures? How do the results compare visually?

- (b) Repeat (a) with salt and pepper noise with noise density 0.05. Compile results using a \LaTeX Table.
- (c) Do the filtering again but this time on a real noisy image DSCN0482-001.JPG obtained at higher ISO. Compare the results visually only this time. Which filter works best for “real” noise? How much time does each type of filter require (use tick.m and toc.m)?