

Gebze Technical University
Computer Engineering Department
CSE464/564 Digital Image Processing
Fall 2019-2020
Homework 3 (v1)

This is your last homework for this semester.

Exercise 1 (35 points): Implement median filtering with the marginal strategy and vector strategy (using lexicographical ordering, bitmix ordering, and norm based ordering).

Perform median filtering using the aforementioned 4 versions, on at least 10 different color RGB images corrupted with various levels of salt and pepper noise. Report your findings in terms of MSE. Which one filters the image best by how much? Does their relative performance depend on the image? Or on the level of noise? Or on the filter size? Answer all questions and discuss your findings.

Exercise 2 (65 points): The Outex TC12 dataset contains 24 distinct textural materials, each with 20 samples acquired at 9 different orientations (0, 5, 10, 15, 30, 45, 60, 75 and 90 degrees). In particular, the training set consists of $20 \times 24 = 480$ samples obtained under 2856K incandescent CIE A illumination at an orientation of 0 degrees. Outex12, has 2 testing sets. The first of which (000) contains all 20 samples of all 24 materials at all 9 orientations, acquired under 4000K fluorescent TL84 illumination, thus making a total of $9 \times 20 \times 24 = 4320$ test images. Whereas its second test set (001) contains the same amount of images as tl84, acquired with the same settings except for the illumination source, which this time is 2300K horizon sunlight.

So we are talking about a dataset exhibiting both rotation and illumination type variance. The feature vectors that you should calculate from them should be invariant against those variations.

I recommend histogram equalization to counter the effect of illumination color and granulometry for describing the images, as well as local binary patterns. You are free to try alternative options.

Implement a nearest neighbor classifier based on the L2 distance using the aforementioned train and test sets. Conduct multiple training and testing sessions and calculate how well the various feature vectors can help classify these images. What is the effect of histogram equalization on classification performance? Experiment with the various parameters of both granulometry (number of filters, size of filters) and local binary patterns (radius, number of points). Present a thorough report of your findings in terms of classification accuracy.

Dataset link: https://drive.google.com/open?id=1YAxKreR9PI6XnJVGgh1SP_F6fRy6ejC

Good luck.

Note: you are expected to code everything on your own; except for the image loading part.

Note: the homework deadline is strict down to the minute, plan your submission carefully.