

FCV Homework #1

Problem 1. For the image `pepper.jpg`, perform the following operations and compare their results with the original image.

- 1) Add a constant value of 50. What is the effect of this operation?
- 2) Set all pixels in the range [120,180] to 50
- 3) Compute the \log_{10} of the image. What is the effect of this operation?

Problem 2. For the image `bridge2.gif`

- 1) Read the image and display it.
- 2) Process the normalized image using the following functions
 - a. $T(r) = c \log_{10}(r+1)$.
 - b. $T(r) = 10^{cr} - 1$.
 - c. Linear stretching over the entire dynamic range.

In each case, you need to display the resulting image and compute following statistics: minimum, maximum, mean, and standard deviation.

Compare the results you obtained visually and discuss their relation with the numbers you obtained.

Problem3.

For the image `building1.gif`

- 1) Read the image and display it.
- 2) Compute the following statistics of the image: minimum, maximum, mean, median, and standard deviation. Also, determine the number of pixels that have a gray level value of 128.
- 3) Try adding a constant value of 50 to the image, display and compare it to the original image. Re-compute the values in (2) for the new image. Discuss your results.
- 4) Try to modify the pixel values in the image using

$$g(x,y) = \frac{255}{\max(f(x,y)) - \min(f(x,y))} [f(x,y) - \min(f(x,y))]$$

where $f(x,y)$ is the original image. Display and compare the output image with the original image and with the image obtained in (2). Also, recompute the values found in (2). Discuss your results.

Problem 4.

The image `hw1sp2012Prob2.gif` contains two square objects. Pixels in the first square have the intensity of 150 while those in the second square have the intensity of 220. Read the image and do the following:

- 1) The small square is to be translated by 40 pixels in both directions.
- 2) The large square is to be rotated by 60 degrees counter clockwise.

Write the code to perform these transformations. Show the image before and after transformation on the same figure. Remember that the transformations are applied to the objects and not to the entire image. In

other words, you should shift the point of origin to the center of each object before applying the transformation.

Problem 5.

For the image *skeleton.gif*, try to modify the normalized image using the following functions

- 1) $g(x,y) = e^{cf(x,y)}$
- 2) $g(x,y) = \text{clog}_{10}[(f(x,y)+1)]$
- 3) $g(x,y) = \begin{cases} f(x,y) & f(x,y) < 0.1 \\ 2 * f(x,y) & \text{otherwise} \end{cases}$

Show the results in each case. Which function produces the best result in your opinion? Discuss your results.

Problem 6.

Resize the image *pepper.jpg*, with scale factor 0.5 . (Delete one row of each two rows and one column of each two columns)

Resize the obtained image with scale factor 2 using the following interpolation methods:

- a) Nearest Neighbour
- b) Bilinear
- c) Linear

In each case show the resized image, original image and difference image (between original image and resized image).