

ECE468/CS519: HOMEWORK 1

due 10/09/2015

Total points for:

- Undergraduate students (UG): 100 points
- Graduate students (G): 140 points

1) (UG:40pts / G:80pts) Problems from the textbook:

- 3.7 (10pts)
- 3.8 (10pts)
Hint: $\text{erf}(z) = \frac{2}{\sqrt{\pi}} \int_0^z \exp(-t^2) dt$, and $\text{erf}(-z) = -\text{erf}(z)$.
- 3.11 (20pts)
- 3.13 (40pts) – Only for graduate students

2) (UG and G: 35pts) Write a MATLAB code for zooming and shrinking an image using the bicubic interpolation. The input to your program is: (i) image, (ii) transformation parameters, and (iii) interpolation method. Use the image available on the class website as input. Your report should include:

2.1) (5pts) M-file with a well-commented code;

2.2) (10pts) Figure 1 showing the result when the input image is enlarged by 2.4 along rows, shrunk by 1.4 along columns, and rotated by 33.5 degrees clockwise. The caption of Figure 1.

2.3) (10pts) Figure 2 showing the inverse transform of the resulting image in Figure 1. The caption of Figure 2.

2.4) (10pts) Figure 3 showing the difference between the original (input) image and Figure 2. In the caption of Figure 3, comment on the meaning of bright and dark pixels of Figure 3.

(Hint: Use the following MATLAB commands: 'maketform', 'imtransform')

3) (UG and G: 25pts) Write a MATLAB code for computing an affine transform of an image. The input to your program is: (i) image, (ii) parameters of the affine transform, and (iii) interpolation method. Your report should include:

3.1) (5pts) M-file with a well commented code;

3.2) (10pts) Figure 4 showing the result when the input image is spatially transformed using the matrix T and the bilinear interpolation, where T is specified as

$$T = \begin{bmatrix} 0.3 & 0.1 & 0 \\ 0.5 & 1.9 & 1 \\ 0 & 0 & 1 \end{bmatrix}. \quad (1)$$

3.3) (10pts) Figure 5 showing the difference between the input image and the image that has been obtained by apply the inverse spatial transform T^{-1} to Figure 4 (apply zero padding if the images have different sizes); In the caption of Figure 5, explain the meaning of bright and dark pixels of Figure 5.

(Hint: Use the following MATLAB commands: 'maketform', 'imtransform')

IMPORTANT:

In your report, all figures must have captions. Each missing caption will be penalized with 5 points.