

# ECE468: HOMEWORK 1

## due 10/12/2009

- 1) (30pts) Problems from the textbook: 2.10
- 2) (50pts) Write a MATLAB code for zooming and shrinking an image by bilinear and bicubic interpolation. The input to your program is: (i) image, (ii) zooming/shrinking parameters along the image rows and columns, and (iii) interpolation method. Use the image available on the class website as input. Your report should include:

2.1) (10pts) M-file with a well-commented code;

2.2) (10+10pts) Figure 1 showing the input image that is zoomed by 1.7 along rows and 2.4 along columns using: (a) bilinear interpolation, and (b) bicubic interpolation; The caption of Figures 1a and 1b.

2.3) (10+10pts) Figure 2 showing the input image that is shrunk by 4.3 along rows and 3.6 along columns using: (a) bilinear interpolation, and (b) bicubic interpolation; The caption of Figures 2a and 2b.

(Hint: Use the following MATLAB commands: 'imread', 'imshow', 'imwrite', 'meshgrid', 'interp2')

- 3) (50pts) 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) (10pts) M-file with a well commented code;

3.2) (10pts) Figure 1 and the caption: As input, use the image for Problem 2 that is available on the class website. Rotate this image by 45 degrees counter-clockwise, and display the result using the bilinear interpolation. The rotation should be implemented by using the following

spatial transform: 
$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = T_{\text{rotation}} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}.$$

- 3.3) (10pts) Figure 2 and the caption: As input, use the image for Problem 2 that is available on the class website. Transform this image by using the following spatial transform and bilinear interpolation:

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = T \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}, \quad (1)$$

where

$$T = \begin{bmatrix} 0.3 & 0.1 & 0 \\ 0.5 & 0.9 & 0 \\ 0 & 0 & 1 \end{bmatrix}. \quad (2)$$

- 3.4) (10pts) Figure 3 and the caption: As input, use the image generated in Figure 2. Apply the inverse spatial transform  $T^{-1}$  to Figure 2, and display the result using the bilinear interpolation.
- 3.5) (10pts) Figure 4 and the caption: Subtract Figure 3 from the original image used in (b) (apply zero padding if the images have different sizes); In the caption, explain why Figure 3 is different from the original image.

(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.