Assignment 1, ECE350/CSE340
25th August
Deadline: 1st Sep Midnight

Input image is provided in another file.

Q1. Theory. Derive an expression of bi-quadratic interpolation. The biquadratic equation can be obtained by changing the limits to 0 to 2 in bicubic case. You should write down the expression in terms of matrices. Finally show the expression for obtaining the coefficients. [1]

Q2. Theory. Given 2x2 image

$$\begin{bmatrix} \mathbf{5} & 10 \\ 10 & 20 \end{bmatrix}$$

Interpolate it by a factor of 1.5 on both X and Y.
Clearly mark the dimension of output image, mark the output grid. Show where the output coordinates map to input grid for atleast 3 coordinates. For the output co-ordinate (1,1), show the interpolated pixel value using bilinear interpolation. Bold font means origin. [2]

Q3. Write a code (python/matlab) for bilinear interpolation which takes two inputs - image and interpolation factor. You should clearly show the input image, interpolation factor, and output image. During the demo, you shall be asked to input a given image and any interpolation factor. You cannot use any inbuilt functions which simply take input and interpolation factor, and give the output image. [2]

Q4. Write a code (python/matlab) for geometric transformation which takes two inputs - image (I) and transformation matrix (T). You should display the input image I, T, and output image O. You must use bilinear interpolation. During the demo, you shall be asked to input a given image and any transformation matrix. You cannot use any inbuilt functions which simply take input and T, and give the output. Use the following transformation- rotate first by 45deg, then scale by a factor of 2 on both X and Y-, and translate by a 30pixels on both X and Y. You should compute a joint transformation matrix which will give T, and then use it for transformation. Note, you must take the output grid sufficiently large so that the input image is properly transformed. That is, you must take negative X, Y co-ordinates too. You cannot use any inbuilt functions which simply take input and T, and give the output image. [2.5]

Q5. Use the images from Q4. Let I be the reference image, and O be unregistered input image. Using I and O, determine the points which map between I and O. Using these points compute transformation matrix Z. Use inv(Z) to register O. You should clearly display – I, O, Z and registered image. Note registered image and I should be aligned. Again no inbuilt functions that do this directly. [2.5]