Dhirubhai Ambani Institute of Information and Communication Technology

Assignment 1

Ganesh Iyer
201311019

January 21, 2014

1 Image Resize

In this problem I wrote a function that resizes an image to the given size (M, N). We want to find a map such that for each $P(x, y)$ belonging to I, we get correspoding $P'(x', y')$ in I'. We define the notion of *Scaling Factor* $S_x = M/ImageWidth$ and $S_y = N/ImageHeight$. If I' were continuous we would have had $x' = S_x * x$ and $y' = S_y * y$ $\forall x, y \in I$. In this excercise we acheived this effect by (1) Individually applying the transformation and then resapmling it and (2)Using built-in functions for performing Affine Transformations wrote a program to resample (x',y') from Real space to Integer space. We implemented the Nearest neighbor with pixel replication algorithm to do the same.

1.1 Nearest neighbor with pixel replication

In this exercise the tranformation $x' = S_x * x$ and $y' = S_y * x$ was applied $\forall x, y \in I$. We then resample the new coordinates x' and y' using nearest neighbor method with pixel replication. Using nearest neighbor with pixel replication, We simply copy the intensity values, For all (x', y') in I', to that of its nearest neighbor to the corresponding (x, y) in I.

1.1.1 Using Affine Transforms

We can also scale images using the built-in functions available for performing affine transformations. These functions also provide a choise of the interpolating algorithm such as: Bilinear, Bicubic etc. We performed experiments with these algorithms, the results of which are reported in the subsequent sub-section. For scaling we used the following transformation matrix:

$$T = \begin{pmatrix} S_x & 1 & 0 \\ 1 & S_y & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

2 Image rotation

In this exercise, given an input image(I) and angle(θ), we had to generate an output Image(I')) which is the result of rotating I by an angle θ about the centre of the image. For this we used an affine transformation, with transformation matrix:

$$T = \begin{pmatrix} \cos(\theta) & \sin(\theta) & cx(1-\cos(\theta)) - cy(\sin(\theta)) \\ -\sin(\theta) & \cos(\theta) & cy(1-\cos(\theta)) + cx(\sin(\theta)) \\ 0 & 0 & 1 \end{pmatrix}$$

We use the Bicubic interpolation with this transformation