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February 14, 2020

ENSC 474

Assignment 2

This assignment required us to determine a geometric transform applied to an image and produce a different image using the inverse of this transformation. This particular transformation involves a general transformation of the Cartesian Grid to a Polar Grid, with a stretch in the theta axis. By inspection of the transformed image, theta is restricted to the first quadrant, which spans 0 to $\frac{\pi}{2}$, suggesting a stretch of a factor of 4.

Before applying the transformation, we have to account for the difference between the image origin which is in the top left corner, and the Cartesian origin which is in the bottom left corner. This was done by mirroring the image matrix across its middle row, essentially 'flipping' the image upside-down. This places both origins at the same geometric location.

By applying the inverse transformations $x = r \cdot \cos(\theta)$ and $y = r \cdot \sin(\theta)$ over the width for r and 0 to $\frac{\pi}{2}$ for θ, the image intensities plotted against the transformed axes yields the image seen on the right of Figure 1. Figure 2 shows the transformation of the original grid to demonstrate that the transformation is accurate.

In this assignment I failed to truly derive the transformation mathematically with respect to an arbitrary centre. Additionally, interpolation was circumvented by plotting the transformed image as a surface plot, but using the inverse transformation, we can obtain the intensity values interpolated to the transformed axes and construct the image this way.

Figure 1. Original and Transformed Images

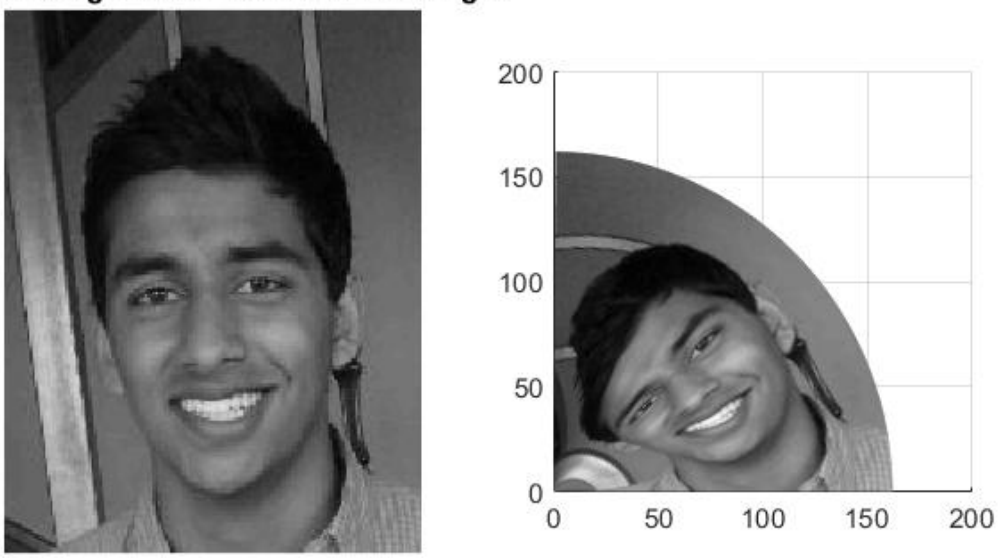

Figure 2. Original and Transformed Grids