Assignment 1 Report
2/8/24
Ryan Quirk, Charles Anderson CS 473

<u>Section 1</u>

Question 1:

Inverse of the translation transform matrix: $\begin{bmatrix} 1 & 0 & -T_x \\ 0 & 1 & -T_y \\ 0 & 0 & 1 \end{bmatrix}$

Question 2:

If the original transform matrix of a rotation transform is: $\begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$. Then the inverse of the matrix is: $\begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$. All the inverse is doing is rotating the matrix by -θ instead of θ. Notably the inverse of the rotation matrix is also the transpose of the original matrix.

Question 3:

The inverse of the x-axis reflection matrix is: $\begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$. This is the same as the original reflection matrix. This is intuitive, because if you are trying to undo a reflection all you need to do is reflect the image once more.

Question 4:

Using the inversion formula for a 2x2 matrix you can calculate the inverse of the shear transform matrix. These calculations can be found below (for a shear in the x-axis):

$$\begin{bmatrix} 1 & r_x \\ 0 & 1 \end{bmatrix}^{-1} = \frac{1}{1-0}\begin{bmatrix} 1 & -r_x \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & -r_x \\ 0 & 1 \end{bmatrix}$$

This inverse makes sense, because you need to subtract the sheared value added to the x coordinate. If $x' = x + r_x y$ then $x = x' - r_x y$. Following this sense for the y-axis yields the following inverse matrix: $\begin{bmatrix} 1 & 0 \\ -r_y & 1 \end{bmatrix}$.

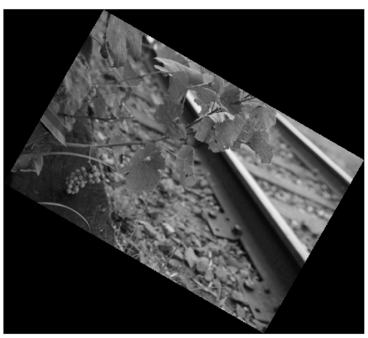
Section 2

Results:

Image 1

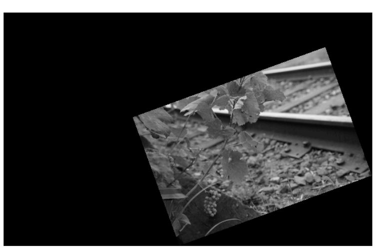
1

2

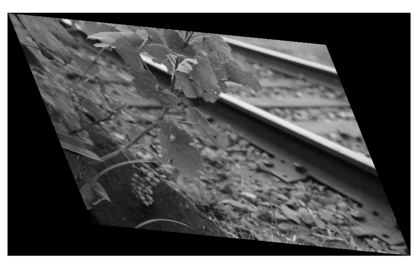


3

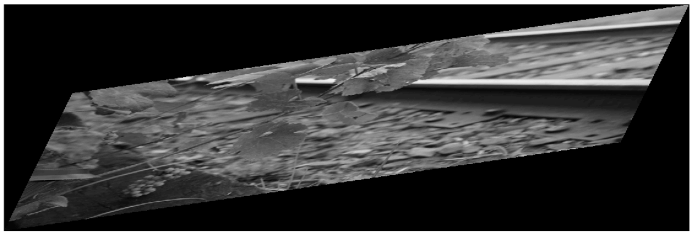
4



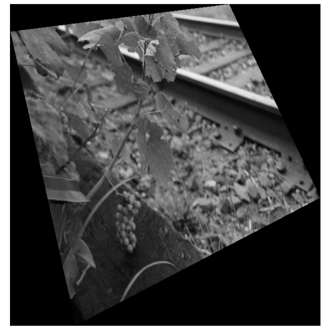
5



6



7



8

9

Image 2

1

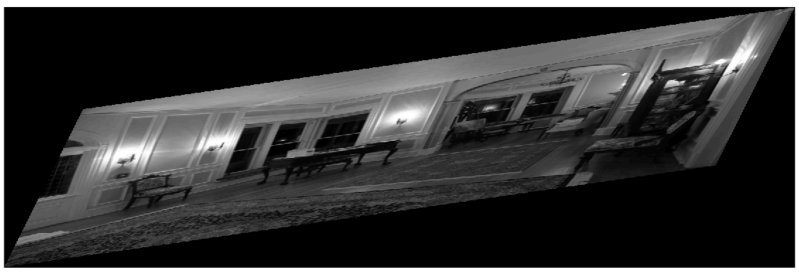
2

3

4

5

6

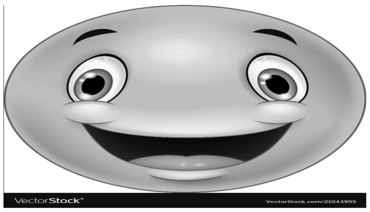


7

8

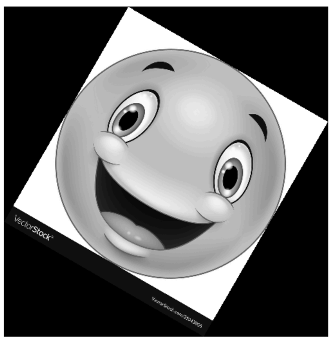
9

Image 3



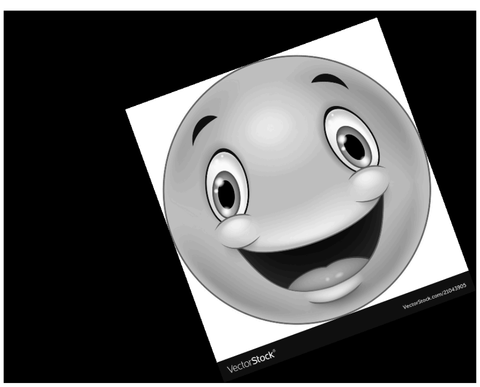
1

2

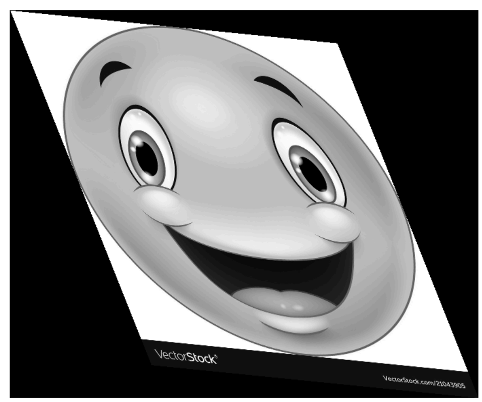


3

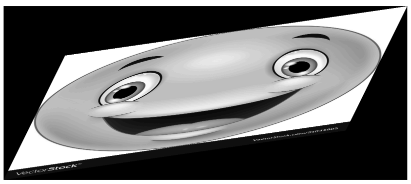
4



5

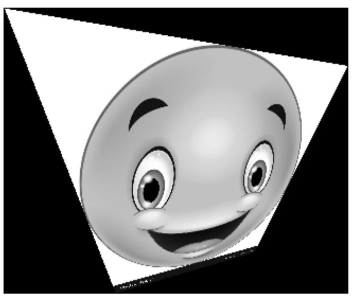


6



7

8



9