S. B. JAIN INSTITUTE OF TECHNOLOGY, MANAGEMENT & RESEARCH, NAGPUR.

Practical No. 4

Aim: Develop programs to apply the following 2-D transformation operation on the image.

1. Translation 2. Rotation 3. Scaling 4. Shearing 5. Reflection.

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Semester/Year: VII/IV

Academic Session:2025-2026

Date of Performance:

Date of Submission:

AIM: Develop programs to apply following 2-D transformations operation on the given image.

1. Translation 2. Rotation 3. Scaling 4. Shearing 5. Reflection.

OBJECTIVE/EXPECTED LEARNING OUTCOME:

The objectives and expected learning outcome of this practical are:

- To implement different 2D transformation operation on a given image.

THEORY:

1. **Translation**

Translation is the shifting of object's location. If you know the shift in (x,y) direction, let it be, you can create the transformation matrix as follows.

$$M = \begin{bmatrix} 1 & 0 & t_x \\ 0 & 1 & t_y \end{bmatrix}$$

$$\begin{bmatrix} u \\ v \end{bmatrix} = \begin{bmatrix} 1 & 0 & t_x \\ 0 & 1 & t_y \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$

2. **Rotation**

This technique rotates an image by a specified angle and by the given axis or point. The points that lie outside the boundary of an output image are ignored.

Rotation about the origin by an angle Θ is given by

$$\begin{bmatrix} u \\ v \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$

$$u = x \cos\theta + y \sin\theta$$
$$v = -x \sin\theta + y \cos\theta$$

3. **Scaling**

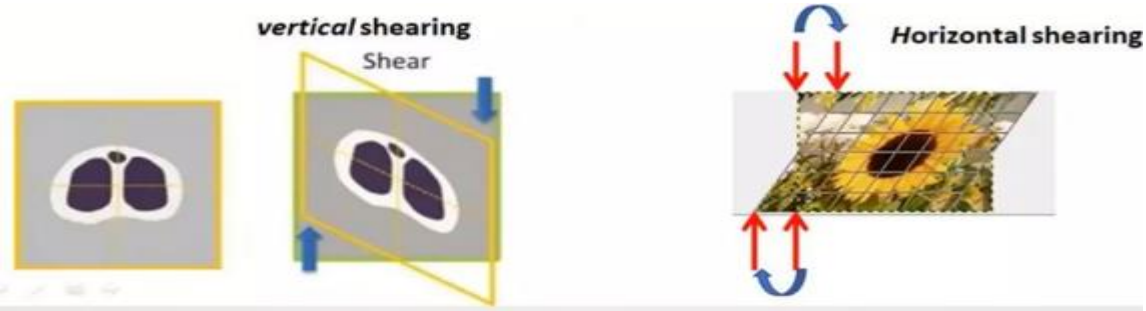
Scaling means resizing an image which means an image is made bigger or smaller in x/y direction. We can resize an image in terms of scaling factor,

$$\begin{bmatrix} u \\ v \end{bmatrix} = \begin{bmatrix} s_x & 0 \\ 0 & s_y \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix}$$

4. **Shearing**

Shearing an image means shifting the pixel value either horizontally or vertically. Basically this shits some part of an image to one direction and other part to the other direction. Horizontal shearing will shift the upper part to the right and lower part to the left.

Here you can see in gif. That upper part has shifted to the right and the lower part of the left.



5. **Reflection**

Image reflection is used to flip the image vertically or horizontally. For reflection along the x-axis, we set the value of Sy to -1, Sx to 1, and vice-versa for the y-axis reflection.

ALGORITHM:

PROGRAM CODE:

INPUT & OUTPUT:

Sr. No.	INPUT	OUTPUT
1.Translation		
2. Rotation		
3. Scaling		
4. Shearing		
5. Reflection		 

CONCLUSION: Successfully apply the 2D transformation translation, rotation, scaling, shearing

operation on given image.

DISCUSSION QUESTIONS:

1. What is 2D transformation in image formation?
2. What is shearing in 2D transformation?
3. What is rotation in 2D transformation?
4. What is reflection in 2D transformation?
5. What is translation in 2D transformation?

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