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IIIT Vadodara
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CS405/CS803 Computer Vision
Lab#4: Geometric transformations

- This is as discussed in the class.
- Apply following geometric transformations on image(s) and comment on your results including properties of each transform.
- Consider appropriate (grayscale) image(s) to perform the tasks.
- Select suitable values, wherever necessary.
- $\{(x, y)\}$ are image coordinates and $\{(x', y')\}$ are corresponding transformed coordinates.

Q. 1: **Translation:** $\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} t_x \\ t_y \end{bmatrix}$

Q. 2: **Rotation:** $\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$

Q. 3: **Reflections:** (i) $x'_p = x_p$, $y'_p = -y_p$; and (ii) $x'_p = -x_p$, $y'_p = y_p$

Q. 4: **Similarity:** $\begin{bmatrix} x' \\ y' \end{bmatrix} = s \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} t_x \\ t_y \end{bmatrix}$, where s stands for uniform scaling.

Q. 5: **Affine:** $\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} t_x \\ t_y \end{bmatrix}$, i.e., nonuniform scaling.