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DIP . HW2

Q1) 1.1)

$$A_1 = \begin{bmatrix} 1 & 0 & 50 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \rightarrow \text{Translation Transformation}$$

$$A_2 = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \rightarrow \text{Scaling Transformation}$$

$$A_3 = \begin{bmatrix} \cos 30 & -\sin 30 & 0 \\ \sin 30 & \cos 30 & 0 \\ 0 & 0 & 1 \end{bmatrix} \rightarrow \text{Rotation Transformation}$$

1.2) a) Scaling transformation.

b) Rotation transformation

c) Sheer transformation.

1.3)

a) For A_1

A_1 is translated in x dir^n

$\therefore$ Translation matrix = $\begin{bmatrix} 1 & 0 & t_x \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

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to remove the inverse transformation we need to inverse translation matrix A_1

$$\therefore \quad A_1 = \begin{bmatrix} 1 & 0 & 50 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

determinant of matrix A_1 =

$$= 1 \times [1] - 0 \times [0] + 50[0]$$
$$= 1$$

Cofactor of the matrix :-

$M_{11} = 1 \quad M_{12} = 0 \quad M_{13} = 0$

$M_{21} = 0 \quad M_{22} = 1 \quad M_{23} = 0$

$M_{31} = -50 \quad M_{32} = 0 \quad M_{33} = 1$

$$\therefore \text{Cofactor Matrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ -50 & 0 & 1 \end{bmatrix}$$

$$\therefore \text{Adj } A_1 = (\text{Cofactor Matrix})^T$$

$$= \begin{bmatrix} 1 & 0 & -50 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\therefore A_1' = \frac{1}{|A_1|} \text{Adj } A_1 = \begin{bmatrix} 1 & 0 & -50 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

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∴ Multiply A_1' to the target image to get original image.

b) $A_2 = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

A_2 is the Scaling Transformation.

determinant of matrix A_2

$= 2[1] - 0[0] + 0[0]$

$= 2$

Cofactor of the matrix:-

$M_{11} = 1$ $\quad M_{12} = 0$ $\quad M_{13} = 0$

$M_{21} = 0$ $\quad M_{22} = 2$ $\quad M_{23} = 0$

$M_{31} = 0$ $\quad M_{32} = 0$ $\quad M_{33} = 2$

∴ Cofactor Matrix $= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$

∴ Adj $A_2 = [\text{Cofactor Matrix}]^T$

$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$

∴ $A_2' = \dfrac{1}{|A_2|} \text{Adj } A_2 = \begin{bmatrix} 1/2 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

∴ Multiply A_2' to the target image to get original image.

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c) $A_3 = \begin{bmatrix} \cos 30 & -\sin 30 & 0 \\ \sin 30 & \cos 30 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

A_3 is the rotation transformation

determinant of A_3 matrix

$= \cos 30 [\cos 30] + \sin 30 [\sin 30] + 0 [0]$

$= \cos 30^2 + \sin 30^2$

$= 1$

Cofactor matrix

$M_{11} = \cos 30$ $\quad M_{12} = \sin 30$ $\quad M_{13} = 0$

$M_{21} = -\sin 30$ $\quad M_{22} = \cos 30$ $\quad M_{23} = 0$

$M_{31} = 0$ $\quad M_{32} = 0$ $\quad M_{33} = 1$

$= \begin{bmatrix} \cos 30 & -\sin 30 & 0 \\ +\sin 30 & \cos 30 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

Adj A_3 = (cofactor Matrix)^T

$= \begin{bmatrix} \cos 30 & \sin 30 & 0 \\ -\sin 30 & \cos 30 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

$A'_3 = \frac{1}{|A_3|} \text{Adj } A_3 = \begin{bmatrix} \cos 30 & \sin 30 & 0 \\ -\sin 30 & \cos 30 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

∴ Multiply A'_3 to target image to get original image.

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Q3) 3.1) Code
3.2) Code.

3.3) Comparitavely Gausian pyramid images are much better than Subsampling images.
~~As~~ In subsampling the row and coloumns are removed so the value of the ~~pixels~~ ~~of the~~ neighbouring pixels remains the same, while is gaussing pyramid, when Subsampling is done, gaussen filter is applied and the pixels ~~are~~ ~~be~~ values ~~are~~ ~~better~~ of the neighbouring pixels are approximately ~~bea~~ bought to the Same level, which creates a smoothning effects and the image when zoomed look better as we cant tell the difference between the neighbouring pixels, where as in Subsampling no Smoothing is done. So when zoomed we see distorted pixels.

∴ Images produced by Gausian pyramid are better than just Subsampling images.