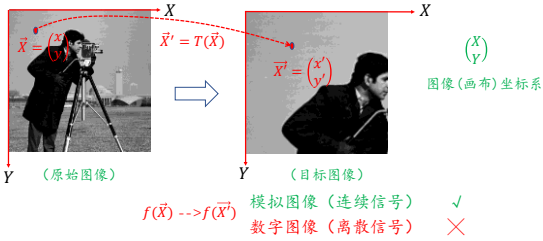


图像几何变换(Geometric Transform)

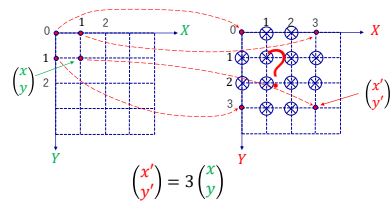


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图像插值(interpolation)问题



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仿射变换(Affine Transformation)

$$\mathbf{X}' = \mathbf{A}\mathbf{X} \rightarrow \begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

$$\begin{cases} x' = a_{11}x + a_{12}y + a_{13} \\ y' = a_{21}x + a_{22}y + a_{23} \end{cases}$$

覆盖: 平移、旋转、缩放等组合

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平移 (Translation)

$$\begin{cases} x' = x + t_x \\ y' = y + t_y \end{cases} \quad \mathbf{A} = \begin{bmatrix} 1 & 0 & t_x \\ 0 & 1 & t_y \end{bmatrix}$$

$$\begin{pmatrix} t_x \\ t_y \end{pmatrix} = \begin{pmatrix} 15 \\ 30 \end{pmatrix}$$



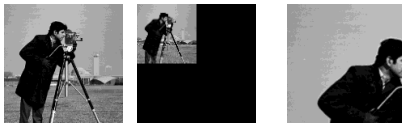
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缩放 (Scaling)

$$\begin{cases} x' = s_x \cdot x \\ y' = s_y \cdot y \end{cases} \quad \mathbf{A} = \begin{bmatrix} s_x & 0 & 0 \\ 0 & s_y & 0 \end{bmatrix}$$



$$s_x = s_y = 0.5$$

$$s_x = s_y = 2.0$$

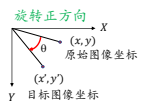
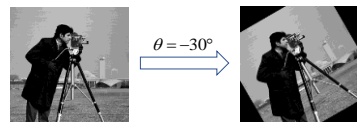
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旋转 (Rotation)

$$\begin{cases} x' = \cos \theta \cdot x - \sin \theta \cdot y \\ y' = \sin \theta \cdot x + \cos \theta \cdot y \end{cases} \quad \mathbf{A} = \begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \end{bmatrix}$$

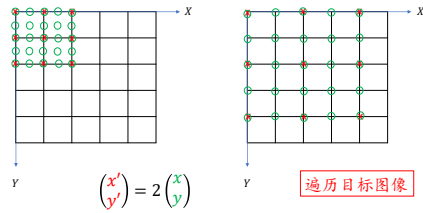


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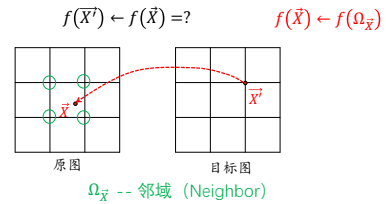
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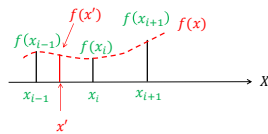
程序实现几何变换的遍历问题



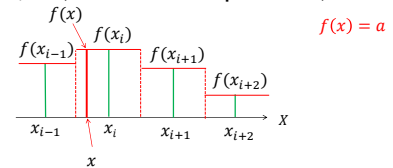
插值 (Interpolation)



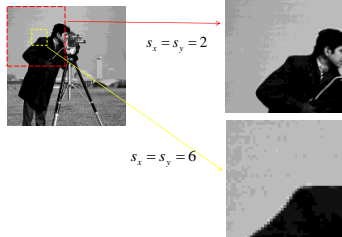
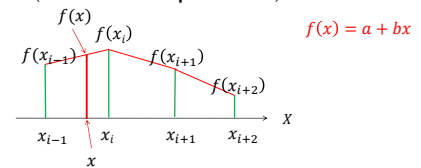
插值原理



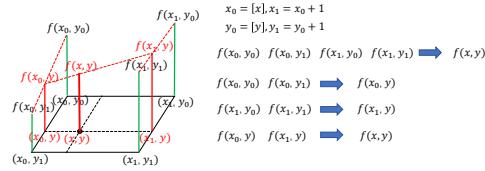
最近邻插值 (Nearest Interpolation)



线性插值 (Linear Interpolation)



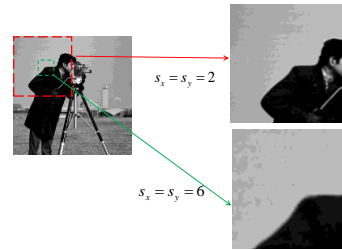
双线性插值 (Bilinear Interpolation)



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