NN Interpolation

Given a matrix with the size 3×3, we want to resize to the size 6×6

$$\begin{bmatrix} 10 & 4 & 22 \\ 2 & 18 & 7 \\ 9 & 14 & 25 \end{bmatrix}$$

$$\begin{bmatrix} 10 & 10 & 4 & 4 & 22 & 22 \\ 10 & 10 & 4 & 4 & 22 & 22 \\ 2 & 2 & 18 & 18 & 7 & 7 \\ 2 & 2 & 18 & 18 & 7 & 7 \\ 9 & 9 & 14 & 14 & 25 & 25 \\ 9 & 9 & 14 & 14 & 25 & 25 \end{bmatrix}$$

1. Get row ratio and column ratio by using the formula below:

$$\text{row ratio} = \frac{\text{target row size}}{\text{original row size}}$$

$$\text{column ratio} = \frac{\text{target column size}}{\text{original column size}}$$

$$\text{row ratio} = \frac{6}{3} \quad = 2$$

$$\text{column ratio} = \frac{6}{3} \quad = 2$$

2. Create 2 evenly spaced values vectors starting from 1, one for row, another for columns (row-wise pixel position vector and column-wise pixel position vector).

$$\text{row}_{\text{ position}} = \begin{bmatrix} 1 & 2 & 3 & \dots & 6 \end{bmatrix}$$

$$\text{column}_{\text{ position}} = \begin{bmatrix} 1 & 2 & 3 & \dots & 6 \end{bmatrix}$$

3. Perform element-wise division for row-wise pixel position vector with height ratio and column-wise pixel position vector with column ratio. Then perform ceiling for every element in both vectors.

$$\begin{aligned}\text{row}_{\text{ position}} &= \left\lceil \frac{\begin{bmatrix}1 & 2 & 3 & \dots & 6\end{bmatrix}}{2} \right\rceil \\ &= \begin{bmatrix}1 & 1 & 2 & 2 & 3 & 3\end{bmatrix}\end{aligned}$$

$$\begin{aligned}\text{column}_{\text{ position}} &= \left\lceil \frac{\begin{bmatrix}1 & 2 & 3 & \dots & 6\end{bmatrix}}{2} \right\rceil \\ &= \begin{bmatrix}1 & 1 & 2 & 2 & 3 & 3\end{bmatrix}\end{aligned}$$

4. Perform element-wise subtraction by 1.

$$\text{row}_{\text{ position}} = \begin{bmatrix}0\\0\\1\\1\\2\\2\end{bmatrix}$$

$$\text{column}_{\text{ position}} = \begin{bmatrix}0 & 0 & 1 & 1 & 2 & 2\end{bmatrix}$$

5. Perform row-wise interpolation on every column of the original matrix using row-wise pixel position vector.

$$\begin{bmatrix}10 & 4 & 22\\2 & 18 & 7\\9 & 14 & 25\end{bmatrix} \xRightarrow[\text{row}_{\text{ position}}]{\text{row-wise interpolation}} \begin{bmatrix}10 & 4 & 22\\10 & 4 & 22\\2 & 18 & 7\\2 & 18 & 7\\9 & 14 & 25\\9 & 14 & 25\end{bmatrix}$$

6. Then perform column-wise interpolation on every row of the previous matrix using column-wise pixel position vector.

$$\begin{bmatrix}10 & 4 & 22\\10 & 4 & 22\\2 & 18 & 7\\2 & 18 & 7\\9 & 14 & 25\\9 & 14 & 25\end{bmatrix} \xRightarrow[\text{column}_{\text{ position}}]{\text{column-wise interpolation}} \begin{bmatrix}10 & 10 & 4 & 4 & 22 & 22\\10 & 10 & 4 & 4 & 22 & 22\\2 & 2 & 18 & 18 & 7 & 7\\2 & 2 & 18 & 18 & 7 & 7\\9 & 9 & 14 & 14 & 25 & 25\\9 & 9 & 14 & 14 & 25 & 25\end{bmatrix}$$