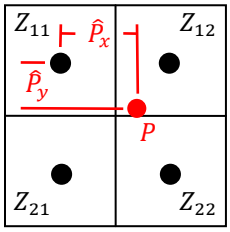
Bilinear Interpolation

Bilinear interpolation takes a weighted average of the four data points around the point of interest.



This method of bilinear interpolation requires that the points be evenly spaced and monotonic. First the normalized distances in the x-direction $(\hat{P}_x)$ and y-direction $(\hat{P}_y)$ must be calculated.

$$\hat{P}_x = \frac{P_x - X_{11}}{X_{12} - X_{11}}$$
$$\hat{P}_y = \frac{P_y - Y_{11}}{Y_{12} - Y_{11}}$$

If the spacing between the data points is 1, as in imagery, the normalization reduces to:

$$\hat{P}_x = P_x - \lfloor P_x \rfloor$$
$$\hat{P}_y = P_y - \lfloor P_y \rfloor$$

Where the $\lfloor\ \rfloor$ represents the floor of the value. To calculate the value of the data point at P, take the weighted average of the four pixels using the normalized distances.

$$P = (1 - \hat{P}_x)(1 - \hat{P}_y)Z_{11} + (\hat{P}_x)(1 - \hat{P}_y)Z_{12} + (1 - \hat{P}_x)(\hat{P}_y)Z_{21} + (\hat{P}_x)(\hat{P}_y)Z_{22}$$