DATA NORMALIZATION

2D

SIMILARITY TRANSFORMATION SUCH THAT THE CENTROID OF THE POINTS IS AT THE ORIGIN AND THEIR STANDARD DEVIATION FROM THE ORIGIN IS $\sqrt{2}$

CALCULATE MEAN AND VARIANCE OF EACH COORDINATE: μ_x, σ_x^2 AND μ_y, σ_y^2

$\sigma^2 = \sigma_x^2 + \sigma_y^2$ TOTAL VARIANCE

$$s = \frac{\sqrt{2}}{\sigma} = \left(\frac{2}{\sigma^2}\right)^{1/2}$$

$$\underset{\sim}{H}_s = \begin{bmatrix} s & 0 & -\mu_x s \\ 0 & s & -\mu_y s \\ 0 & 0 & 1 \end{bmatrix}$$

3D

SIMILARITY TRANSFORMATION SUCH THAT THE CENTROID OF THE POINTS IS AT THE ORIGIN AND THEIR STANDARD DEVIATION FROM THE ORIGIN IS $\sqrt{3}$

$\sigma^2 = \sigma_x^2 + \sigma_y^2 + \sigma_z^2$

$$s = \frac{\sqrt{3}}{\sigma} = \left(\frac{3}{\sigma^2}\right)^{1/2}$$

$$\underset{\sim}{H}_s \begin{bmatrix} s & 0 & 0 & -\mu_x s \\ 0 & s & 0 & -\mu_y s \\ 0 & 0 & s & -\mu_z s \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

DATA NORMALIZATION

P MATRIX

$x_i = P X_i$

2D NORMALIZING TRANSFORMATION

3D NORMALING TRANSFORMATION

$\tilde{x}_i = T x_i \qquad \tilde{X}_i = U X_i$

DATA NORMALIZED 3D POINTS

DATA NORMALIZED 2D POINTS

$\tilde{x}_i = \tilde{P} \tilde{X}_i$

$T x_i = \tilde{P} U X_i$

DATA NORMALIZED CAMERA PROJECTION MATRIX (ESTIMATE THIS)

$x_i = T^{-1} \tilde{P} U X_i$

$x_i = P X_i$ WHERE $P = T^{-1} \tilde{P} U$

DATA DENORMALIZED CAMERA PROJECTION MATRIX