

$[x_1 \dots x_n, y_1 \dots y_n] \rightarrow$  *Coordinates of selected points on image to be transformed*

$[x1_1 \dots x1_n, y1_1 \dots y1_n] \rightarrow$  *Coordinates of selected points on reference image*

$$\begin{bmatrix} x1_1 \\ y1_1 \\ \vdots \\ x1_n \\ y1_n \end{bmatrix} = \begin{bmatrix} x_1 & y_1 & 1 & 0 & 0 & 0 & -x1_1x_1 & -x1_1y_1 \\ 0 & 0 & 0 & x_1 & y_1 & 1 & -y1_1x_1 & -y1_1y_1 \\ \vdots & & & & & \vdots & & \vdots \\ x_n & y_n & 1 & 0 & 0 & 0 & -x1_nx_n & -x1_ny_n \\ 0 & 0 & 0 & x_n & y_n & 1 & -y1_nx_n & -y1_ny_n \end{bmatrix} \begin{bmatrix} h_{11} \\ h_{12} \\ h_{13} \\ h_{21} \\ h_{22} \\ h_{23} \\ h_{31} \\ h_{32} \end{bmatrix}$$

$$b = Ax$$

*Least Square Solution*

$$x = (A^T A)^{-1} A^T b$$

*Homography*

$$\begin{bmatrix} x'' \\ y'' \\ w \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} & h_{13} \\ h_{21} & h_{22} & h_{23} \\ h_{31} & h_{32} & h_{33} \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$