

## Lucas-kanade Solution



for all points  $(k, d) \in W$ :

$$I_x(k, d)u + I_y(k, d)v + I_t(k, d) = 0$$

matrix form:

$$\begin{bmatrix} I_x(1,1) & I_y(1,1) \\ I_x(k,1) & I_y(k,1) \\ \vdots & \vdots \\ I_x(n,n) & I_y(n,n) \end{bmatrix} \begin{bmatrix} u \\ v \end{bmatrix} = \begin{bmatrix} -I_t(1,1) \\ -I_t(k,1) \\ \vdots \\ -I_t(n,n) \end{bmatrix}$$

Solve linear system:  $Au = B$

$$A^T A u = A^T B$$

In matrix form:

$$\begin{bmatrix} \sum_w I_x^2 I_w & \sum_w I_x I_y I_w \\ \sum_w I_x I_y I_w & \sum_w I_y^2 I_w \end{bmatrix} \begin{bmatrix} u \\ v \end{bmatrix} = \begin{bmatrix} -\sum_w I_x I_t I_w \\ -\sum_w I_y I_t I_w \end{bmatrix}$$

$$A^T A u = A^T B$$

$$u = (A^T A)^{-1} A^T B$$

$$Au = B$$

$$A^T A u = A^T B$$