

Lecture-5

Other Optical Flow Methods

Important Issues

- Local vs Global optical flow
- What motion model?
- What function to be minimized?
- What minimization method?

Minimization Methods

- Least Squares fit
- Weighted Least Squares fit
- Newton-Raphson
- Gradient Descent
- Levenberg-Marquadet

Lucas & Kanade (Least Squares)

- Optical flow eq

$$f_x u + f_y v = -f_t$$

- Consider 3 by 3 window

$$f_{x1} u + f_{y1} v = -f_{t1}$$

$$\vdots$$

$$f_{x9} u + f_{y9} v = -f_{t9}$$

$$\begin{bmatrix} f_{x1} & f_{y1} \\ \vdots & \vdots \\ f_{x9} & f_{y9} \end{bmatrix} \begin{bmatrix} u \\ v \end{bmatrix} = \begin{bmatrix} -f_{t1} \\ \vdots \\ -f_{t9} \end{bmatrix}$$

$$\mathbf{A} \mathbf{u} = \mathbf{f}_t$$

Lucas & Kanade

$$\mathbf{A} \mathbf{u} = \mathbf{f}_t$$

$$\mathbf{A}^T \mathbf{A} \mathbf{u} = \mathbf{A}^T \mathbf{f}_t$$

$$\mathbf{u} = (\mathbf{A}^T \mathbf{A})^{-1} \mathbf{A}^T \mathbf{f}_t$$



$$\min \sum_{i=-2}^2 \sum_{j=-2}^2 (f_{xi} u + f_{yj} v + f_{ti})^2$$