

$$I_0(\boldsymbol{x}), I_1(\boldsymbol{x}) : \Omega \subset \mathbb{R}^2 \rightarrow \mathbb{R}$$

$$\boldsymbol{u} = \begin{pmatrix} u(\boldsymbol{x}) \\ v(\boldsymbol{x}) \end{pmatrix} : \Omega \rightarrow \mathbb{R}^2$$

$$I_1(\boldsymbol{x} + \boldsymbol{u}(\boldsymbol{x})) = I_0(\boldsymbol{x})$$

$$E(\boldsymbol{u}) = D(\boldsymbol{u}) + \alpha \cdot R(\boldsymbol{u})$$

$$\int_{\Omega} p(\boldsymbol{u}) \; dx$$

$$p(\boldsymbol{u}) = (\; I_1(\boldsymbol{x} + \boldsymbol{u}(\boldsymbol{x})) - I_0(\boldsymbol{x}) \; )^2$$

$$p(\boldsymbol{u}) = ||\; \nabla I_1(\boldsymbol{x} + \boldsymbol{u}(\boldsymbol{x})) - \nabla I_0(\boldsymbol{x}) \; ||_2^2$$

$$p(\boldsymbol{u}) = ||\; \nabla u \; ||_2^2 + ||\; \nabla v \; ||_2^2$$

$$D(\boldsymbol{u}) = \int_{\Omega} \Psi_D(p_{brightness}(\boldsymbol{u})) + \gamma \cdot \Psi_D(p_{gradient}(\boldsymbol{u})) \; dx$$

$$p_{brightness}(\boldsymbol{u}) = (\; I_1(\boldsymbol{x} + \boldsymbol{u}(\boldsymbol{x})) - I_0(\boldsymbol{x}) \; )^2$$

$$p_{gradient}(\boldsymbol{u}) = ||\; \nabla I_1(\boldsymbol{x} + \boldsymbol{u}(\boldsymbol{x})) - \nabla I_0(\boldsymbol{x}) \; ||_2^2$$

$$\Psi_D(s^2) = 2\epsilon^2\sqrt{1+s^2/\epsilon^2}$$