

$$\begin{aligned}
E(u, v) &= \sum_{(x, y) \in W} [I(x + u, y + v) - I(x, y)]^2 \\
&\simeq \sum_{(x, y) \in W} [I(x, y) + I_x u + I_y v - I(x, y)]^2 \\
&= \sum_{(x, y) \in W} [I_x u + I_y v]^2 \\
&= \sum_{(x, y) \in W} [I_x^2 u^2 + I_x I_y uv + I_y I_x uv + I_y^2 v^2]
\end{aligned}$$