$$E(u,v) = \sum_{(x,y) \in W} [I(x+u, y+v) - I(x,y)]^2$$

$$\simeq \sum_{(x,y) \in W} [I(x,y) + I_x u + I_y v - I(x,y)]^2$$

$$= \sum_{(x,y) \in W} [I_x u + I_y v]^2$$

$$= \sum_{(x,y) \in W} [I_x^2 u^2 + I_x I_y uv + I_y I_x uv + I_y^2 v^2]$$