Machine Vision: Homework 2

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1 Problem 1

$$\because \mathbf{I}(x,y)' = a\mathbf{I}(x,y) + b$$

$$\therefore \mathbf{I}_x(x,y)' = a\mathbf{I}_x(x,y) \text{ and } \mathbf{I}_y(x,y)' = a\mathbf{I}_y(x,y)$$

Given:

$$S(\mathbf{I}(W)) = \sum_{x,y\in W} \begin{bmatrix} \mathbf{I}_x(x,y)^2 & \mathbf{I}_x(x,y)\mathbf{I}_y(x,y) \\ \mathbf{I}_x(x,y)\mathbf{I}_y(x,y) & \mathbf{I}_y(x,y)^2 \end{bmatrix}$$

and:

$$S(\mathbf{I}'(W)) = \sum_{x,y\in W} \begin{bmatrix} \mathbf{I}_x(x,y)'^2 & \mathbf{I}_x(x,y)'\mathbf{I}_y(x,y)' \\ \mathbf{I}_x(x,y)'\mathbf{I}_y(x,y)' & \mathbf{I}_y(x,y)'^2 \end{bmatrix} = \sum_{x,y\in W} \begin{bmatrix} a^2\mathbf{I}_x(x,y)^2 & a^2\mathbf{I}_x(x,y)\mathbf{I}_y(x,y) \\ a^2\mathbf{I}_x(x,y)\mathbf{I}_y(x,y) & a^2\mathbf{I}_y(x,y)^2 \end{bmatrix}$$

We have:

$$S(\mathbf{I}'(W)) = a^2 S(\mathbf{I}(W))$$

Therefore:

$$response(\mathbf{I})' = a^2 response(\mathbf{I})$$

There is nothing to do with b. The conclusion is this new corner detector is invariant to b, but not invariant to a.