Corner Detection

STEP1:
Compute partial derivatives $X = \partial I_x/\partial x, Y = \partial I_y/\partial y$ per pixel, I is image intensities

$$X = I \otimes (-1, 0, 1)$$
$$Y = I \otimes (-1, 0, 1)^T$$

STEP2:
Obtain a matrix M using X and Y from STEP1

$$M = \begin{bmatrix} A & C \\ C & B \end{bmatrix}$$

Where $A = X^2 \otimes w, B = Y^2 \otimes w, C = (XY) \otimes w$

w is the window function, in the paper, it uses Gaussian:

$$w_{u,v} = e^{-(u^2+v^2)}/2\sigma^2$$

STEP3:
Find Eigenvalues of Matrix M

$$\lambda(M) = \alpha, \beta$$

and define

$$Tr(M) = \alpha + \beta \quad \text{and} \quad Det(M) = \alpha\beta$$

Then, we can find the Corner/Edge Response Function

$$R = Det(M) - kTr(M)^2$$

STEP4:

For Figure5 in the paper, it uses α, β to classify corner/edge/flat region. It shows that α and β are both small in the flat region, both large in the corner region, and differ a lot in the edge region.
We can also use R in STEP4 to classify region. R is positive in the corner region, negative in the edge region, and small in the flat region. The threshold value for flat region is specified by |Tr|.

END