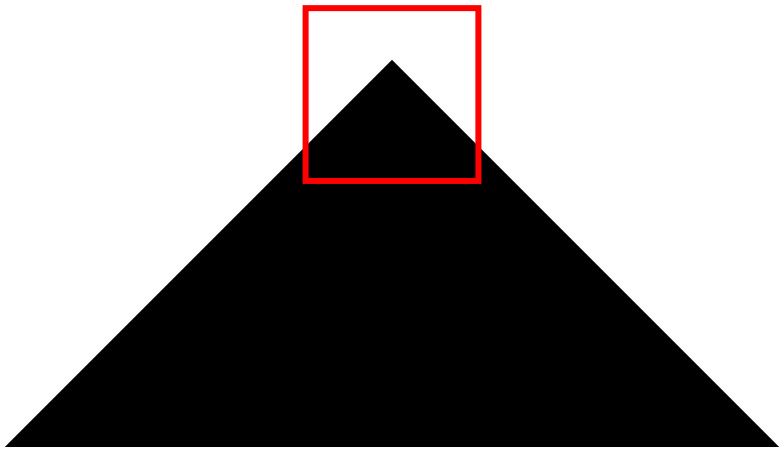
Harris Corner Detector

Examples



I

0	0	0	0	0	0	0
0	**0**	**0**	**1**	**0**	**0**	0
0	**0**	**0**	**1**	**0**	**0**	0
0	**0**	**1**	**1**	**1**	**0**	0
0	**0**	**1**	**1**	**1**	**0**	0
0	**1**	**1**	**1**	**1**	**1**	0
0	1	1	1	1	1	0

I_x

0	-1	0	1	0
0	-1	0	1	0
-1	-1	0	1	1
-1	-1	0	1	1
-1	0	0	0	1

I_y

0	0	-1	0	0
0	-1	0	-1	0
0	-1	0	-1	0
-1	0	0	0	-1
-1	0	0	0	-1

I_x^2

0	1	0	1	0
0	1	0	1	0
1	1	0	1	1
1	1	0	1	1
1	0	0	0	1

I_y^2

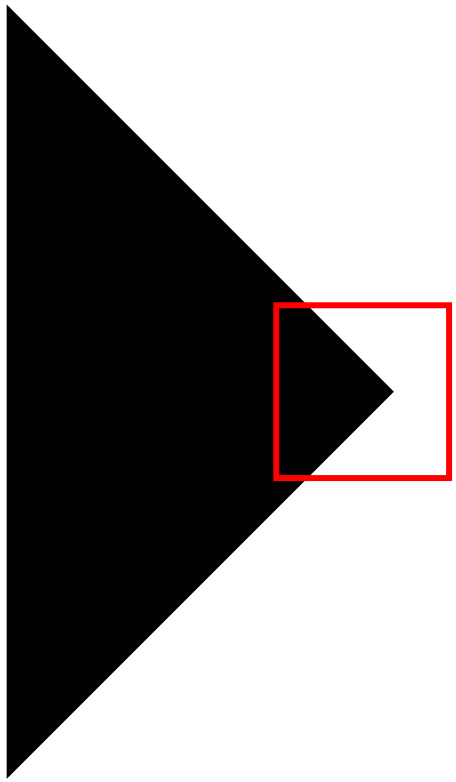
0	0	1	0	0
0	1	0	1	0
0	1	0	1	0
1	0	0	0	1
1	0	0	0	1

$I_x I_y$

0	0	0	0	0
0	1	0	-1	0
0	1	0	-1	0
1	0	0	0	-1
1	0	0	0	-1

$$M = \begin{bmatrix} \Sigma I_x^2 & \Sigma I_x I_y \\ \Sigma I_x I_y & \Sigma I_y^2 \end{bmatrix} = \begin{bmatrix} 14 & 0 \\ 0 & 9 \end{bmatrix}$$

$$\begin{aligned} R &= \det(M) - k * Tr(M)^2 \\ &= 14 * 9 - 0.05 * (14 + 9)^2 \\ &= 99.55 \end{aligned}$$



I

0	0	0	0	0	0	0
1	**1**	**0**	**0**	**0**	**0**	0
1	**1**	**1**	**1**	**0**	**0**	0
1	**1**	**1**	**1**	**1**	**1**	0
1	**1**	**1**	**1**	**0**	**0**	0
1	**1**	**0**	**0**	**0**	**0**	0
0	0	0	0	0	0	0

I_x

1	1	0	0	0
0	0	1	1	0
0	0	0	0	1
0	0	1	1	0
1	1	0	0	0

I_y

-1	-1	-1	0	0
0	-1	-1	-1	-1
0	0	0	0	0
0	1	1	1	1
1	1	1	0	0

I_x^2

1	1	0	0	0
0	0	1	1	0
0	0	0	0	1
0	0	1	1	0
1	1	0	0	0

I_y^2

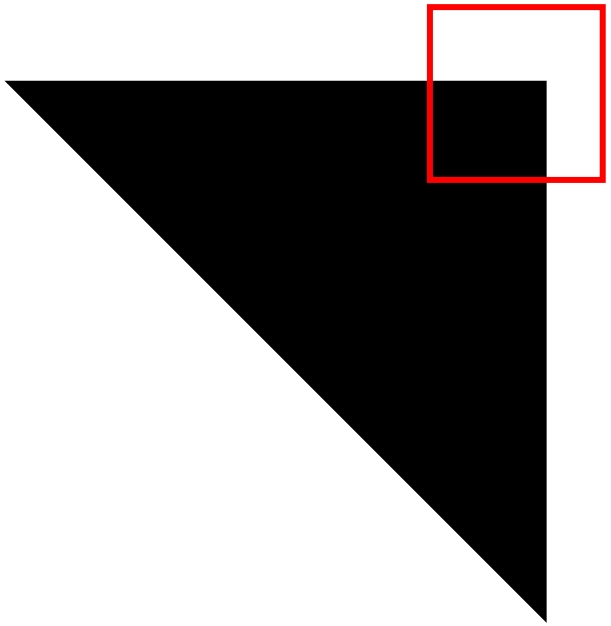
1	1	1	0	0
0	1	1	1	1
0	0	0	0	0
0	1	1	1	1
1	1	1	0	0

$I_x I_y$

-1	-1	0	0	0
0	0	-1	-1	0
0	0	0	0	0
0	0	1	1	0
1	1	0	0	0

$$M = \begin{bmatrix} \Sigma I_x^2 & \Sigma I_x I_y \\ \Sigma I_x I_y & \Sigma I_y^2 \end{bmatrix} = \begin{bmatrix} 9 & 0 \\ 0 & 14 \end{bmatrix}$$

$$\begin{aligned} R &= \det(M) - k * Tr(M)^2 \\ &= 9 * 14 - 0.05 * (9 + 14)^2 \\ &= 99.55 \end{aligned}$$



I

0	0	0	0	0	0	0
0	**0**	**0**	**0**	**0**	**0**	0
1	**1**	**1**	**1**	**1**	**0**	0
1	**1**	**1**	**1**	**1**	**0**	0
1	**1**	**1**	**1**	**1**	**0**	0
1	**1**	**1**	**1**	**1**	**0**	0
1	1	1	1	1	0	0

I_x

0	0	0	0	0
0	0	0	1	1
0	0	0	1	1
0	0	0	1	1
0	0	0	1	1

I_y

-1	-1	-1	-1	0
-1	-1	-1	-1	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

I_x^2

0	0	0	0	0
0	0	0	1	1
0	0	0	1	1
0	0	0	1	1
0	0	0	1	1

I_y^2

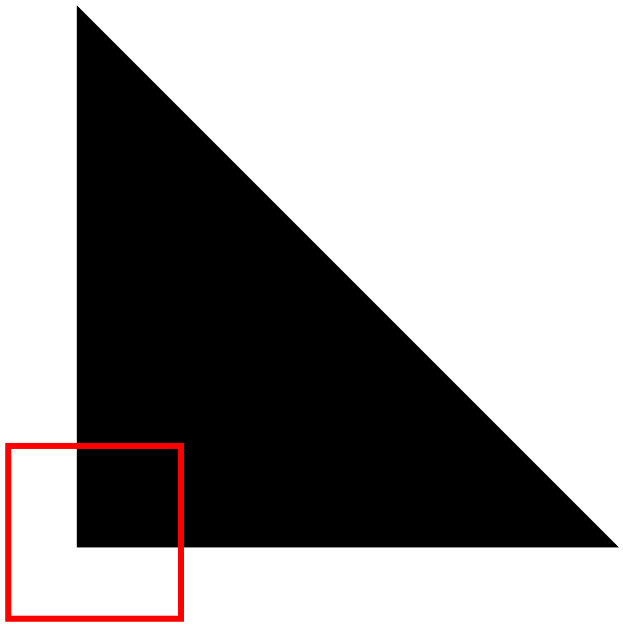
1	1	1	1	0
1	1	1	1	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

$I_x I_y$

0	0	0	0	0
0	0	0	-1	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

$$M = \begin{bmatrix} \Sigma I_x^2 & \Sigma I_x I_y \\ \Sigma I_x I_y & \Sigma I_y^2 \end{bmatrix} = \begin{bmatrix} 8 & -1 \\ -1 & 8 \end{bmatrix}$$

$$\begin{aligned} R &= \det(M) - k * Tr(M)^2 \\ &= 8 * 8 - 1 - 0.05 * (8 + 8)^2 \\ &= 50.2 \end{aligned}$$



I

0	0	1	1	1	1	1
0	**0**	**1**	**1**	**1**	**1**	1
0	**0**	**1**	**1**	**1**	**1**	1
0	**0**	**1**	**1**	**1**	**1**	1
0	**0**	**1**	**1**	**1**	**1**	1
0	**0**	**0**	**0**	**0**	**0**	0
0	0	0	0	0	0	0

I_x

-1	-1	0	0	0
-1	-1	0	0	0
-1	-1	0	0	0
-1	-1	0	0	0
0	0	0	0	0

I_y

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	1	1	1	1
0	1	1	1	1

I_x^2

1	1	0	0	0
1	1	0	0	0
1	1	0	0	0
1	1	0	0	0
0	0	0	0	0

I_y^2

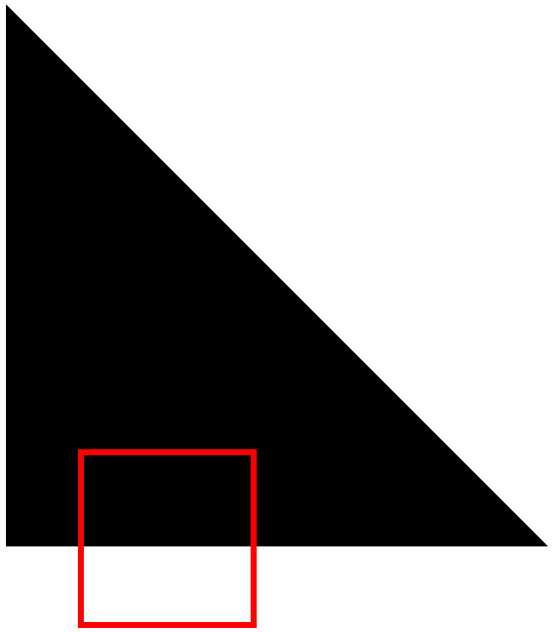
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	1	1	1	1
0	1	1	1	1

$I_x I_y$

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	-1	0	0	0
0	0	0	0	0

$$M = \begin{bmatrix} \Sigma I_x^2 & \Sigma I_x I_y \\ \Sigma I_x I_y & \Sigma I_y^2 \end{bmatrix} = \begin{bmatrix} 8 & -1 \\ -1 & 8 \end{bmatrix}$$

$$\begin{aligned} R &= \det(M) - k * Tr(M)^2 \\ &= 8 * 8 - 1 - 0.05 * (8 + 8)^2 \\ &= 50.2 \end{aligned}$$



I

1	1	1	1	1	1	1
1	**1**	**1**	**1**	**1**	**1**	1
1	**1**	**1**	**1**	**1**	**1**	1
0	**0**	**0**	**0**	**0**	**0**	0
0	**0**	**0**	**0**	**0**	**0**	0
0	**0**	**0**	**0**	**0**	**0**	0
0	0	0	0	0	0	0

I_x

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

I_y

0	0	0	0	0
1	1	1	1	1
1	1	1	1	1
0	0	0	0	0
0	0	0	0	0

I_x^2

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

I_y^2

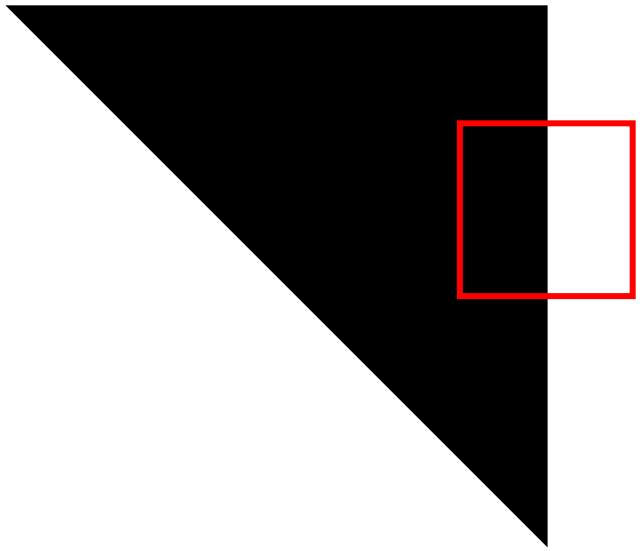
0	0	0	0	0
1	1	1	1	1
1	1	1	1	1
0	0	0	0	0
0	0	0	0	0

$I_x I_y$

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

$$M = \begin{bmatrix} \Sigma I_x^2 & \Sigma I_x I_y \\ \Sigma I_x I_y & \Sigma I_y^2 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 10 \end{bmatrix}$$

$$\begin{aligned} R &= \det(M) - k * Tr(M)^2 \\ &= 10 * 0 - 0.05 * (10 + 0)^2 \\ &= -5 \end{aligned}$$



I

1	1	1	0	0	0	0
1	**1**	**1**	**0**	**0**	**0**	0
1	**1**	**1**	**0**	**0**	**0**	0
1	**1**	**1**	**0**	**0**	**0**	0
1	**1**	**1**	**0**	**0**	**0**	0
1	**1**	**1**	**0**	**0**	**0**	0
1	1	1	0	0	0	0

I_x

0	1	1	0	0
0	1	1	0	0
0	1	1	0	0
0	1	1	0	0
0	1	1	0	0

I_y

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

I_x^2

0	1	1	0	0
0	1	1	0	0
0	1	1	0	0
0	1	1	0	0
0	1	1	0	0

I_y^2

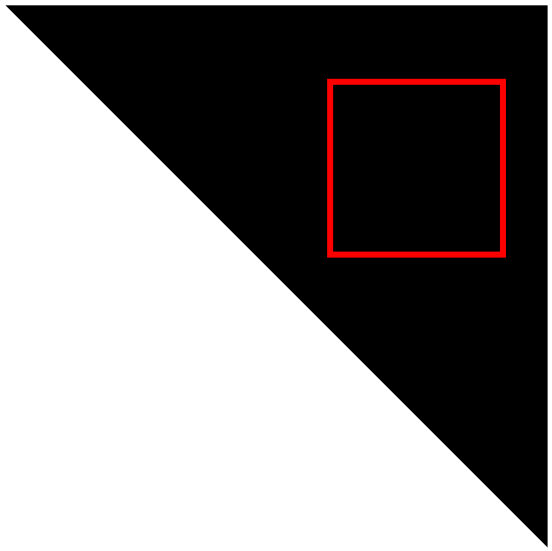
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

$I_x I_y$

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

$$M = \begin{bmatrix} \Sigma I_x^2 & \Sigma I_x I_y \\ \Sigma I_x I_y & \Sigma I_y^2 \end{bmatrix} = \begin{bmatrix} 10 & 0 \\ 0 & 0 \end{bmatrix}$$

$$\begin{aligned} R &= \det(M) - k * Tr(M)^2 \\ &= 10 * 0 - 0.05 * (10 + 0)^2 \\ &= -5 \end{aligned}$$



I

1	1	1	1	1	1	1
1	**1**	**1**	**1**	**1**	**1**	1
1	**1**	**1**	**1**	**1**	**1**	1
1	**1**	**1**	**1**	**1**	**1**	1
1	**1**	**1**	**1**	**1**	**1**	1
1	**1**	**1**	**1**	**1**	**1**	1
1	1	1	1	1	1	1

I_x

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

I_y

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

I_x^2

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

I_y^2

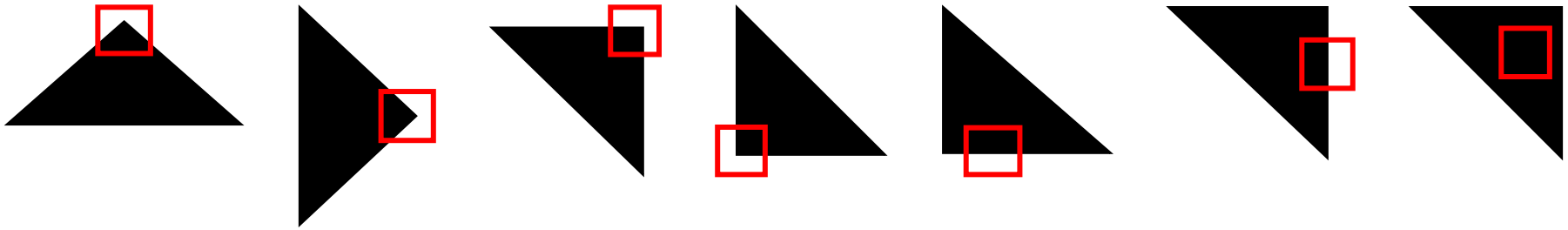
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

$I_x I_y$

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

$$M = \begin{bmatrix} \Sigma I_x^2 & \Sigma I_x I_y \\ \Sigma I_x I_y & \Sigma I_y^2 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$\begin{aligned} R &= \det(M) - k * Tr(M)^2 \\ &= 0 * 0 - 0.05 * (0 + 0)^2 \\ &= 0 \end{aligned}$$



99.55 99.55 50.2 50.2 -5 -5 0

Harris detector gives a high response at the corners.