(2)

Harris Corner Detection :-

It is a method to find corners and infer features of an image.

Here we consider a small window of size 5×5 image patch in the picture. The idea is to identify unique pixel windows that are measured by shifting each window by a small amount of change that occurs in corresponding pixel values.

We define the change function $E(u,v)$ as the sum of all the sum squared differences where $u, v = (x, y)$ coordinates of every pixel in our 5×5 window

I = Intensity value of the pixel.

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

Summation matrix are M

$$E(u,v) \approx [u\ v]\left(\sum \begin{bmatrix} I_x^2 & I_xI_y \\ I_xI_y & I_y^2 \end{bmatrix}\right)\begin{bmatrix} u \\ v \end{bmatrix}$$

$$M = \sum w(x,y)\left(\begin{bmatrix} I_x^2 & I_xI_y \\ I_xI_y & I_y^2 \end{bmatrix}\right)$$

$$E(u,v) \approx [u\ v]\, M \begin{bmatrix} u \\ v \end{bmatrix}$$

Let The corresponding eigen value of M be λ_1, λ_2 these eigen values decide whether the region is corner, edge or flat.

Conv when λ_1, λ_2 are small the region is flat.

ans when $\lambda_1 >> \lambda_2$ the region is an edge.

ans when λ_1 & λ_2 are large & $\lambda_1 \approx \lambda_2$ the region is a corner.

In my work space i have considered an image path having the following values

141	142	143	143	143
140	140	141	142	151
140	140	141	141	159
150	143	135	129	139
154	149	144	140	143

After Calculating the eigen values

$\lambda_1 = 20.21$ $\lambda_2 = 3.14$ $\lambda_3 = 0.2$ $\lambda_4 = 2.13$

As we notice in case 3

$\lambda_1 \cong \lambda_3$ then the region will be detected as corner.

Combinations of these Eigen values results in location of the corner.

Approximately the corners can be found at