# Handout 02 Local Interest Point Detectors

1. Basic Concepts

(1) Hierarchy of geometric transformations: Euclidean transform, similarity transform, affine transform, and projective transform.

(2) Basic idea for the Harris corner detector: Shifting a window in any direction should give a large change in intensity; cornerness of a local window can be characterized by the eigen-values (λ_1, λ_2) of the auto-correlation matrix M: if both λ_1 and λ_2 are very large, the examined position is highly likely to be a corner point; if one of them is large while the other is small, the examined position is highly likely to be an edge point; if both of them are very small, the examined position actually locations on a flat region. Cornerness measure is $R=\det\mathbf{M}-k(\mathrm{trace}\mathbf{M})^2$.
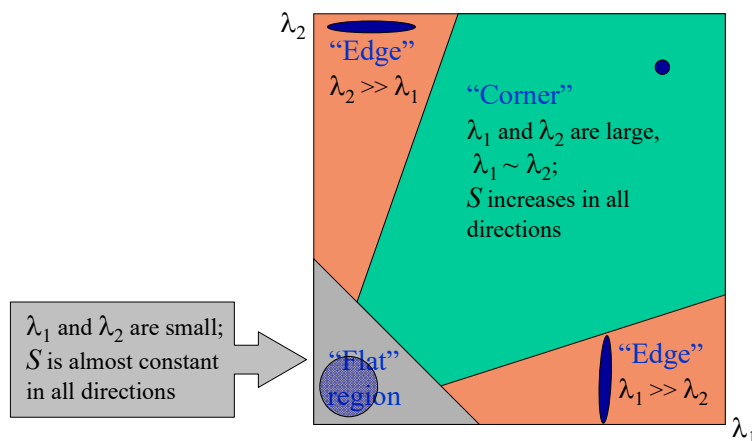
(3) Harris corner detection is rotation invariant; but not scale invariant.

(4) A scale selection function should have the following property: it can find the characteristic region size that is covariant with the image scaling. Laplacian of Gaussian (LOG) is such a function.

(5) To find scale-invariant interest points, we can find the extrema points in the scale-spatial space defined by LoG.

(6) In implementation, difference of Gaussian (DoG) is vastly used to approximate LoG.

2. Matlab Programming

(1) Study the demo program "HarrisCornerDetector". Get an image and test the corner detection result.

(2) Get two images, taken from the same scene but with scale transformations. Detect the scale invariant points on the two images. You can use the center of the circle to indicate the spatial position of the point and use the radius of the circle to indicate the characteristic scale of the point, just like the following example.