

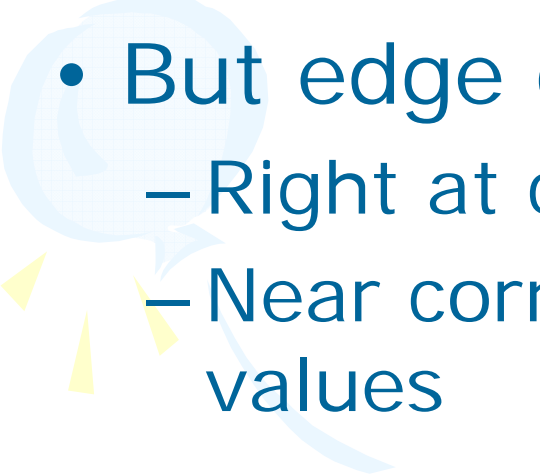
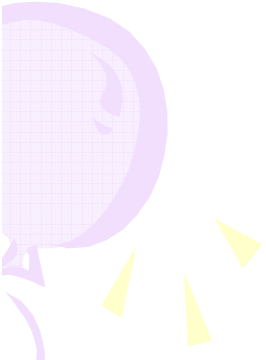


Other Non-Linear Filters

Slides from Cornelia Fermüller and Marc Pollefeys


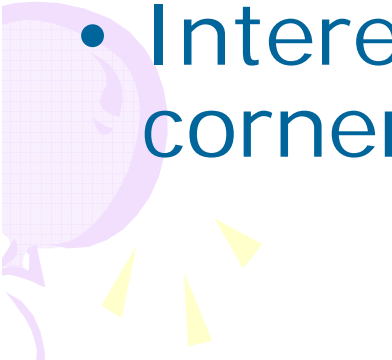


Corner Detection (Non-linear filter)

- Corners have more edges than lines
 - Should be easier
 - But edge detectors fail – why?
 - Right at corner, gradient is ill-defined
 - Near corner, gradient has two different values
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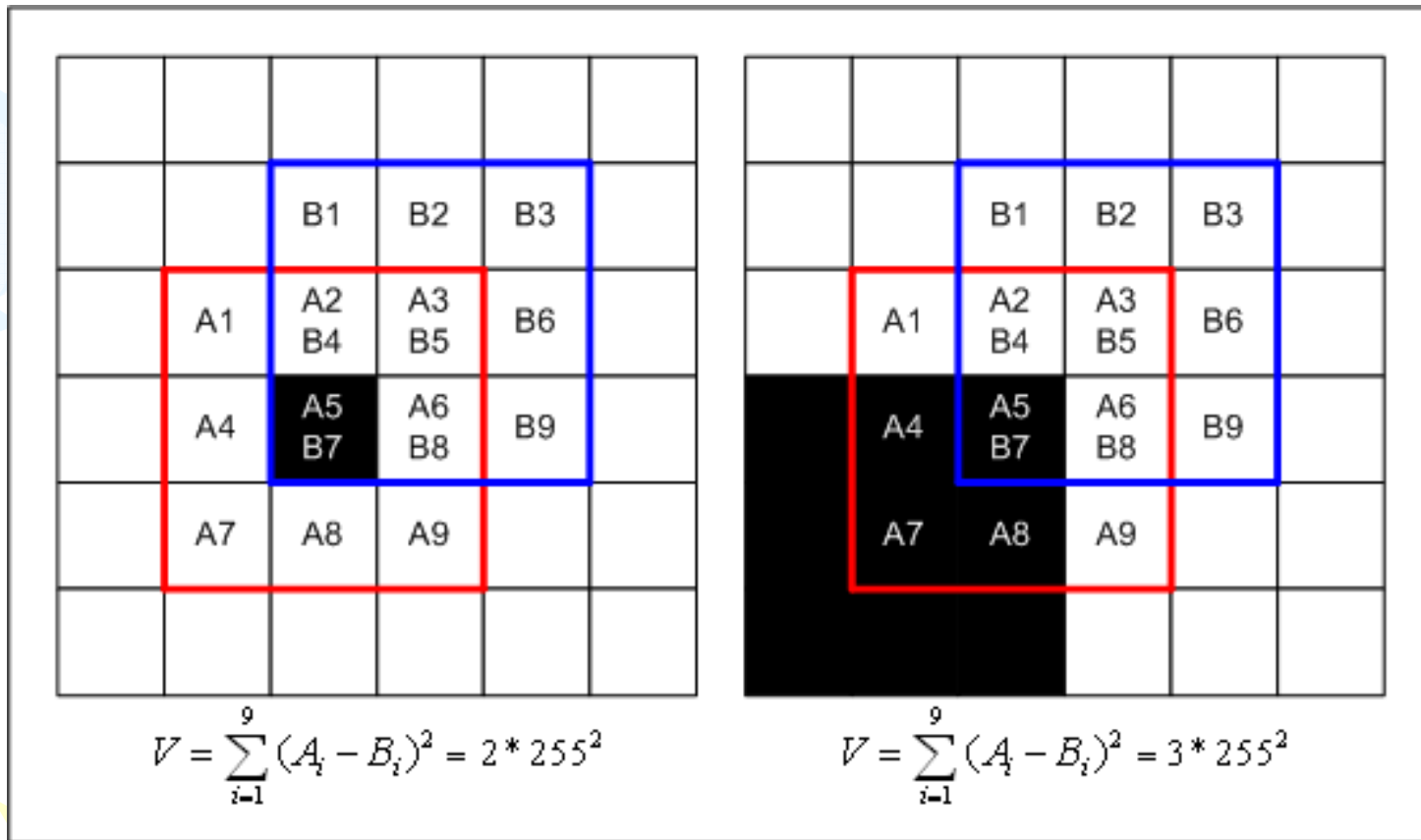


Moravec Operator

- Self-similarity
 - How similar are neighboring patches largely overlapping to me?
 - Most regions - Very similar
 - Edges - Not similar in one direction (perpendicular to edge)
 - Corners – not similar in any direction
 - Interest point detection – not only corners
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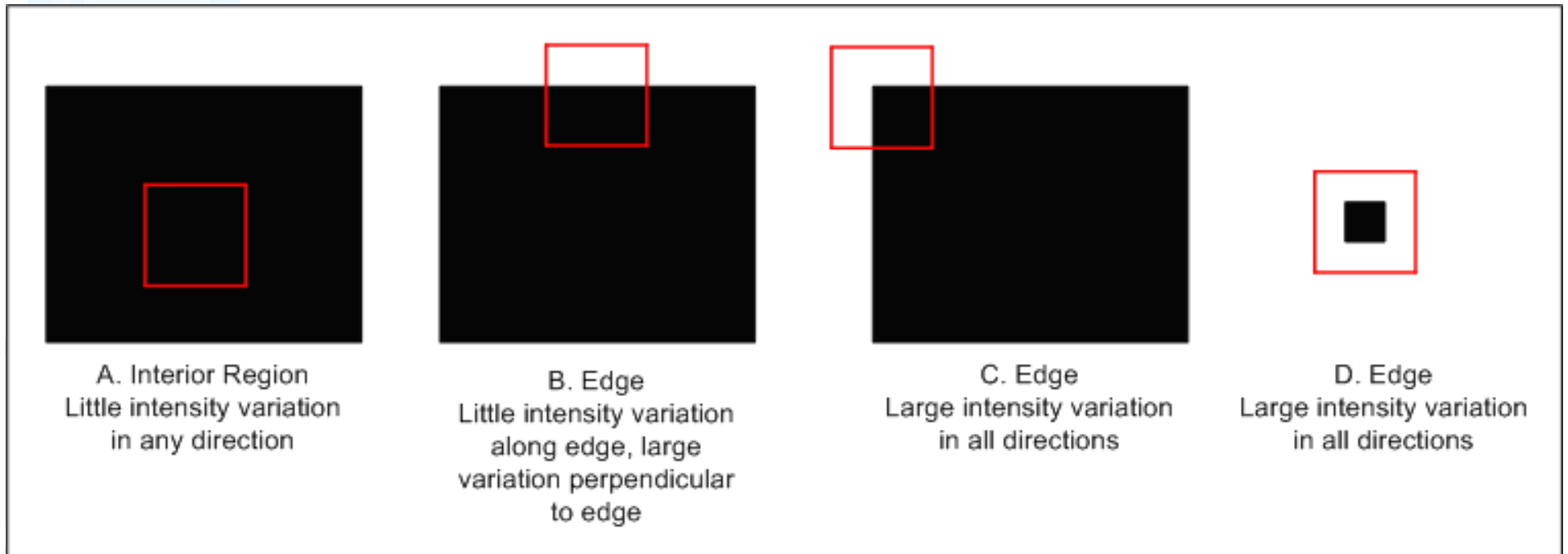
Measuring self-similarity

- SSD = Sum of squared differences
- Corner is local maxima



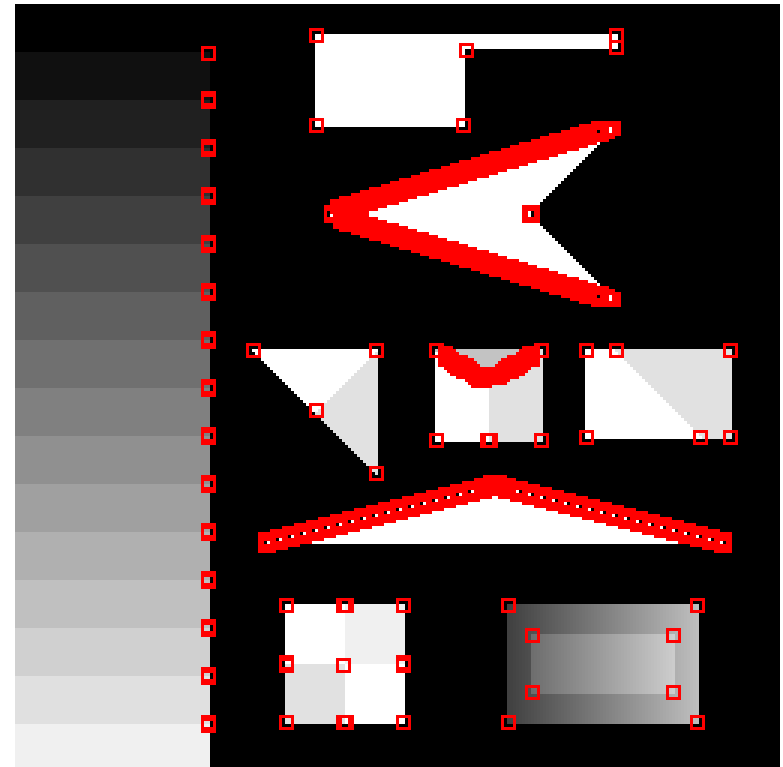
Limitations

- Sensitive to noise
 - Responds for isolated pixel
- Larger patches for robustness



Limitations

- Responds also to diagonal edges



Limitations

- Anisotropic (Not rotationally invariant)



Original Image



Image Rotated 30°

Harris & Stephens/Plessey Corner Detector

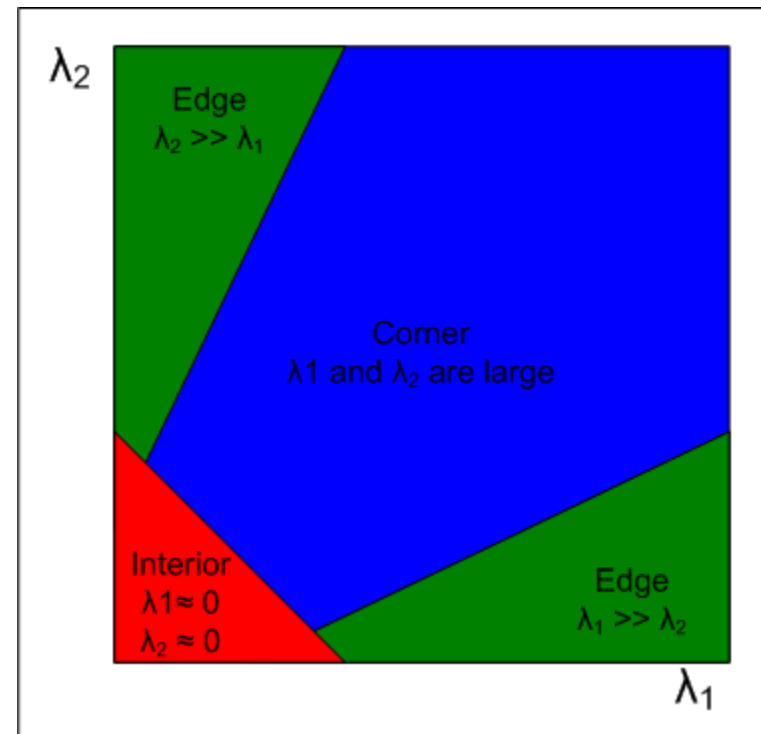
- Consider the differential of the corner score with respect to direction
- Describes the geometry of the image surface near the point (u, v)

$$A = \sum_u \sum_v w(u, v) \begin{bmatrix} I_x^2 & I_x I_y \\ I_x I_y & I_y^2 \end{bmatrix} = \begin{bmatrix} \langle I_x^2 \rangle & \langle I_x I_y \rangle \\ \langle I_x I_y \rangle & \langle I_y^2 \rangle \end{bmatrix},$$

Hessian Matrix
(Second derivatives of
multi-variate function)

How to find the corner?

- The eigenvalues are proportional to the principal curvatures
- If both small, no edge/corner
- If one big and one small, edge
- If both big, then corner



Rotationally Invariant

- If w is Gaussian, then this is isotropic

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