GRADIENT MATRIX

$$\underset{\sim}{N} = \begin{bmatrix} \sum_w I_x^2 & \sum_w I_x I_y \\ \sum_w I_x I_y & \sum_w I_y^2 \end{bmatrix}$$

GRAYSCALE IMAGE

$$\underset{\sim}{N}_{COLOR} \begin{bmatrix} \sum_w (I_{x_1}^2 + I_{x_2}^2 + I_{x_3}^2) & \sum_w (I_{x_1} I_{y_1} + I_{x_2} I_{y_2} + I_{x_3} I_{y_3}) \\ \sum_w (I_{x_1} I_{y_1} + I_{x_2} I_{y_2} + I_{x_3} I_{y_3}) & \sum_w (I_{x_1}^2 + I_{x_2}^2 + I_{x_3}^2) \end{bmatrix}$$

EACH ELEMENT OF THE MATRIX IS A SUM OVER A (SQUARE) WINDOW CENTERED AT THE PIXEL.

MINOR EIGENVALUE OF GRADIENT MATRIX

SHI-TOMASI

$$\underline{\underline{N}} = \begin{bmatrix} \sum_w I_x^2 & \sum_w I_x I_y \\ \sum_w I_x I_y & \sum_w I_y^2 \end{bmatrix}$$

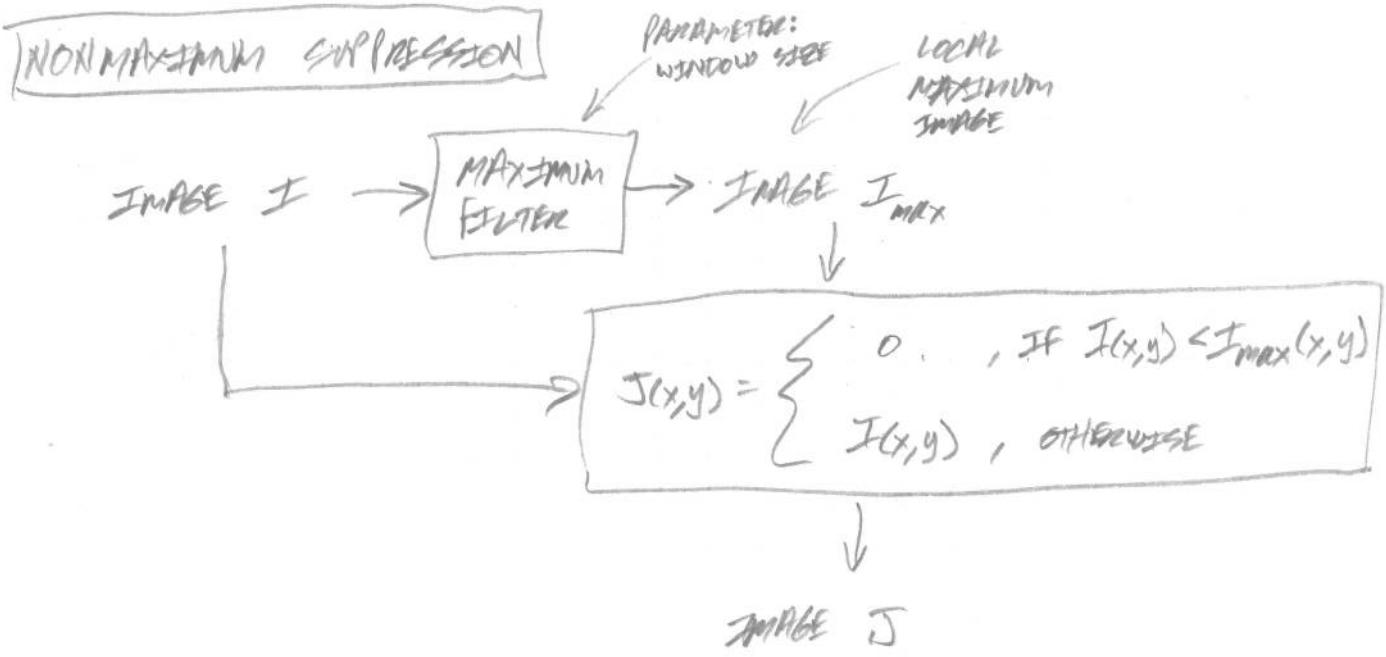
2×2 GRADIENT MATRIX

$$\lambda_{MIN} = \frac{Tr(\underline{\underline{N}}) - \sqrt{Tr(\underline{\underline{N}})^2 - 4\det(\underline{\underline{N}})}}{2}$$

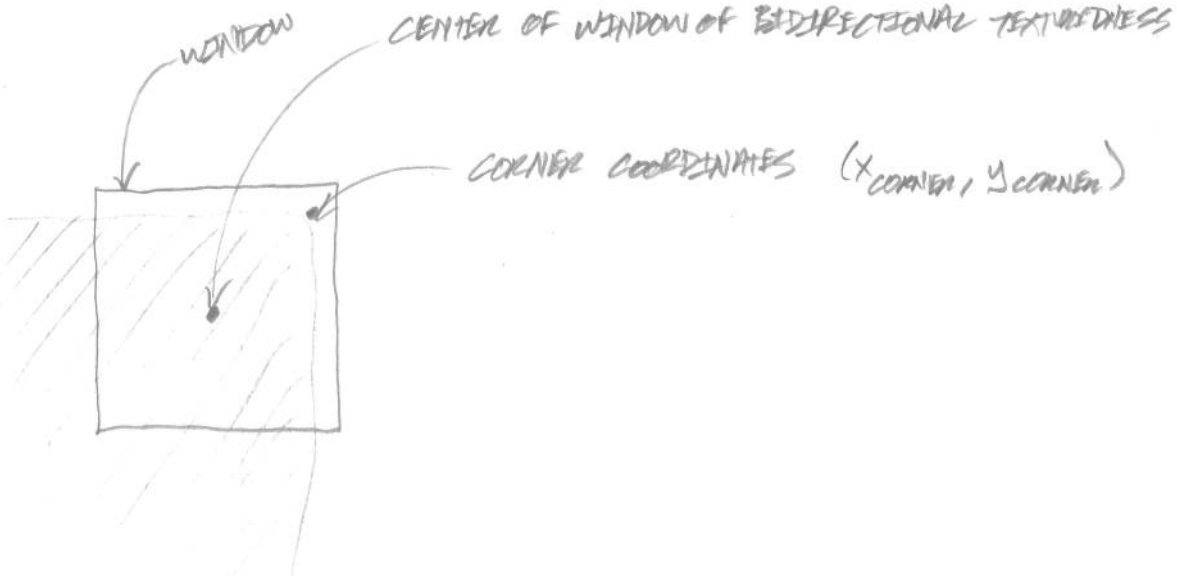
BIDIRECTIONAL TEXTUREDNESS (E.G., A CORNER)

NOTE: AVERAGING INSTEAD OF SUMMING ALLOWS FOR THE SAME MINOR EIGENVALUE THRESHOLD REGARDLESS OF WINDOW SIZE.

NONMAXIMUM SUPPRESSION



FIND COORDINATES OF PIXEL IN IMAGE J WITH NON-ZERO VALUES



FÖRSTNER, CORNER POINT

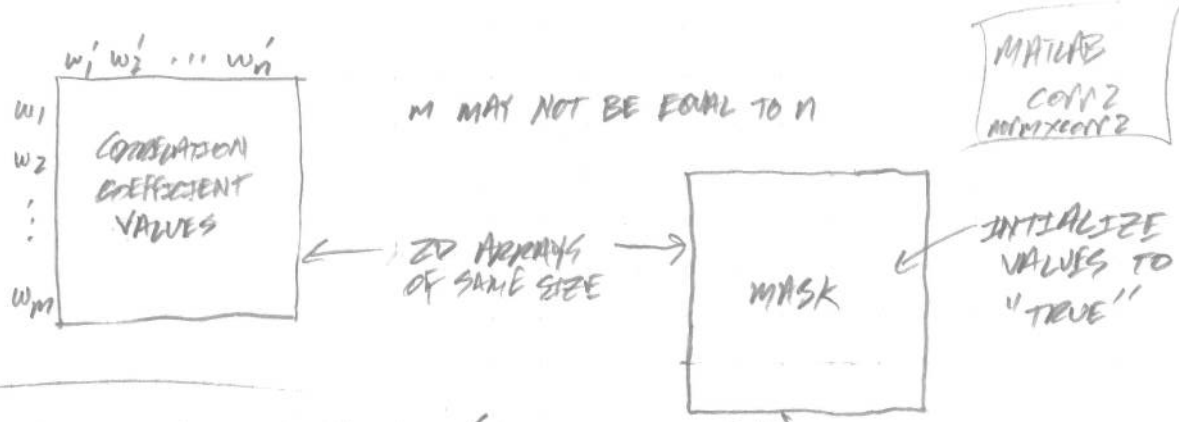
$$\begin{bmatrix} \sum_w I_x^2 & \sum_w I_x I_y \\ \sum_w I_x I_y & \sum_w I_y^2 \end{bmatrix} \begin{bmatrix} x_{\text{corner}} \\ y_{\text{corner}} \end{bmatrix} = \begin{bmatrix} \sum_w (x I_x^2 + y I_x I_y) \\ \sum_w (x I_x I_y + y I_y^2) \end{bmatrix}$$

$$\underline{\underline{A}}\,\underline{x} = \underline{b} \quad \text{SOLVE FOR } \underline{x}$$

FEATURE MATCHING

CALCULATE CORRELATION COEFFICIENT BETWEEN A GIVEN WINDOW IN IMAGE 1 AND ALL WINDOWS IN IMAGE 2. (WINDOWS ABOUT CORNER POINTS)

CORRELATION COEFFICIENT VALUE IS $[-1, 1]$ (GREATER IS BETTER)



ONE-TO-ONE MATCHING (NOT ONE-TO-MANY)

FIND INDICES OF ELEMENT WITH MAXIMUM VALUE IN MASKED CORRELATION COEFFICIENT ARRAY

IF SIMILARITY THRESHOLD < MAXIMUM VALUE, THEN

1. STORE BEST MATCH VALUE
2. TEMPORARILY, SET THE VALUE IN THE CORRELATION COEFFICIENT ARRAY TO -1
3. FIND NEXT BEST MATCH VALUE AS (MAX(NEXT BEST MATCH VALUE IN SAME ROW, NEXT BEST MATCH VALUE IN SAME COLUMN)
5. IF (1 - BEST MATCH VALUE) < (1 - NEXT BEST MATCH VALUE) * DISTANCE RATIO THRESHOLD
   STORE FEATURE MATCH
   ELSE
   MATCH IS NOT UNIQUE ENOUGH
6. SET ROW AND COLUMN MASK ARRAY TO FALSE

@ REPEAT UNTIL SIMILARITY THRESHOLD ≥ MAXIMUM VALUE

4. SET THE VALUE OF THE BEST MATCH BACK TO ITS ORIGINAL VALUE

OPTIONAL: PROXIMITY WINDOW

$[-1, 1] \mapsto [0, 2]$

CORRELATION COEFFICIENT VALUE → "DISTANCE"