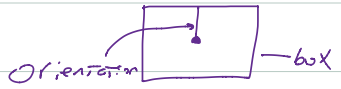
Features

Point, edge, region ....

1. locality (small regions)
2. stability ie don't change with view point, lighting, ect.
3. robust. likely to occour in many viewpoints
4. distinctive e.g. use for indexing.

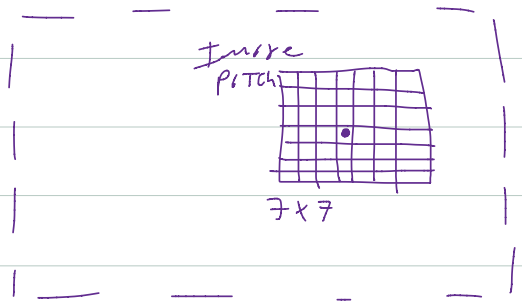
— Point features.



SIFT, SURF

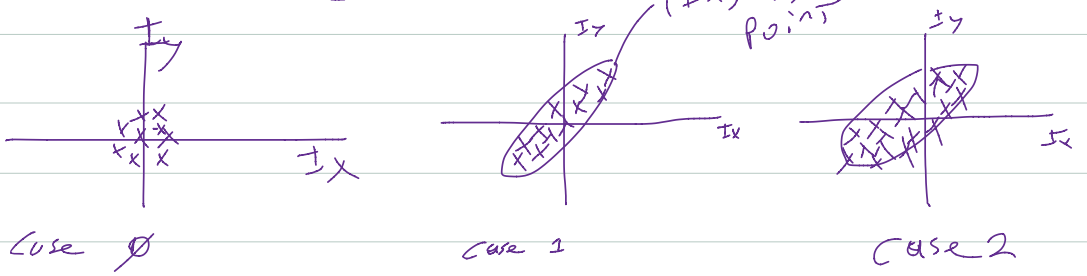
"Corners" (Harris)

Take small patch, eg. 7×7



$$I_x \leftarrow \frac{\partial}{\partial x}(G \otimes I)$$

$$I_y \leftarrow \frac{\partial}{\partial y}(G \otimes I)$$



$$C = \begin{bmatrix} \sum I_x^2 & \sum I_x^2 \\ \sum I_x I_y & \sum I_y^2 \end{bmatrix} = \sum_{\substack{\text{pixels} \\ \in N}} \begin{pmatrix} I_x \\ I_y \end{pmatrix} \begin{pmatrix} I_x & I_y \end{pmatrix}$$

Sum over pixels in patch

Outer product matrix

CS 370 Emergency

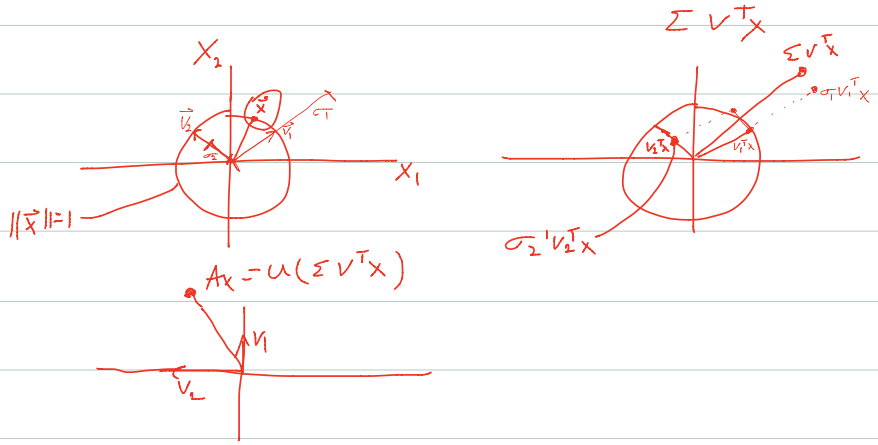
For any matrix

$$A \leftrightarrow U \Sigma V^T$$

$$\begin{bmatrix} \vec{u}_1 & \vec{u}_2 \\ \downarrow & \downarrow \end{bmatrix} \begin{bmatrix} \sigma_1 & 0 \\ 0 & \sigma_2 \end{bmatrix} \begin{bmatrix} V_1^T \rightarrow \\ V_2^T \rightarrow \end{bmatrix}$$

svd in MATLAB.

orthonormal basis



$$A \leftarrow \frac{V \Sigma V^T}{(V \Lambda V^T)}$$

no rotations

only direction

eigen decomposition

Shi & Malik "Good features to track"