CSE 152: Computer Vision
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Quiz 2
1(a) For image I, are $I_x$ and $I_y$ small or large at points A, B, C and D?
Corners

2(a) Is this second moment matrix likely to represent a corner? Why?

\[ C = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \]

2(b) Is this second moment matrix likely to represent a corner? Why?

\[ C = \begin{bmatrix} 100 & 10 \\ 10 & 1 \end{bmatrix} \]

2(c) Is this second moment matrix likely to represent a corner? Why?

\[ C = \begin{bmatrix} 10 & 0.1 \\ 0.1 & 10 \end{bmatrix} \]
SIFT

3(a) What are invariances encoded by the SIFT feature?

3(b) You obtained 10 true positives, 5 false positives and 5 false negatives at a particular SIFT matching threshold. How would you change the threshold to:
   (i) Increase true positives?
   (ii) Decrease false positives?
   (iii) Decrease false negatives?
Answers

1(a) A: Large $I_x$, Large $I_y$
    B: Small $I_x$, Small $I_y$
    C: Small $I_x$, Large $I_y$
    D: Large $I_x$, Small $I_y$

2(a) Corner: Eigenvalues are the diagonal entries, both 1 (large and comparable)
    2(b) Not corner: Rank 1 matrix, one eigenvalue is 0 (it is an edge)
    2(c) Corner: Nearly diagonal, eigenvalues close to 10 (large and comparable)

3(a) Geometric: Scale, translation, rotation
    Photometric: Illumination, camera response

3(b) SIFT uses Euclidean distance between descriptors for matching.
    Descriptors with distance below a threshold are deemed matches.
      (i) Higher threshold allows more matches, increasing true positives.
      (ii) Lower threshold allows fewer matches, decreasing false positives.
      (iii) Higher threshold is less stringent, decreasing false negatives.