# Deep Learning for Computer Vision

Jul-Oct 2024

NPTEL and IIT-Hyderabad

Quiz 2

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Deep Learning for Computer Vision
Max Marks: 12
Quiz 2

1. Which of the following are examples of a high-pass filter? (Select all possible correct options)

   (a) $\begin{bmatrix} -2 & -2 & -2 \\ -2 & -2 & -2 \\ -2 & -2 & -2 \end{bmatrix}$

   (b) $\begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}$

   (c) $\begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 2 \\ 1 & 2 & 1 \end{bmatrix}$

   (d) $\begin{bmatrix} -1 & -1 & 0 \\ -1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}$

2. Match the following:

| | |
|---|---|
| 1) Gaussian filter | i) Edges found when gradient is low |
| 2) Sobel filter | ii) Edges found at zero crossing |
| 3) First derivative of Gaussian | iii) Edge smoothing |
| 4) Second derivative of Gaussian | iv) Edge detection |
| | v) Edges found when gradient is high |

   (a) 1 → iii, 2 → iv, 3 → i, 4 → ii

   (b) 1 → iii, 2 → i, 3 → ii, 4 → v

   (c) 1 → iii, 2 → iv, 3 → v, 4 → ii

   (d) 1 → iv, 2 → iii, 3 → i, 4 → ii

3. Identify the correct sequence of steps in a Canny edge detection pipeline. Steps are listed below:

    1. Compute gradient magnitude and direction
    2. Connect individual components
    3. Smoothen the image
    4. Threshold into strong, weak, or no edge
    5. Gaussian Filter and Hysteresis
    6. Non-maximum suppression
    7. Apply derivative to get edges

    (a) $6 \to 1 \to 4 \to 5 \to 2$
    (b) $3 \to 1 \to 6 \to 4 \to 2$
    (c) $3 \to 5 \to 1 \to 4 \to 2$
    (d) $6 \to 8 \to 5 \to 7 \to 2$

4. In terms of computational efficiency, how does the separability of a 2D convolution kernel affect the filtering process?

    (a) It has no effect on efficiency
    (b) It allows the convolution to be performed as two 1D convolutions, which is faster
    (c) It requires more memory but fewer computations
    (d) None of the above

5. Which of the following operations is an example of linear filtering?

    (a) Thresholding an image
    (b) Histogram equalization
    (c) Morphological dilation
    (d) Applying a Gaussian blur

6. What is the purpose of creating a scale space in SIFT?

   (a) To remove noise from the image

   (b) To detect features at different scales

   (c) To enhance edge detection

   (d) To compress the image

7. Choose the **correct** statements from among the following:

   1. For any low-pass or high-pass filter, the sum of the filter coefficients always adds up to 1.

   2. Brightness enhancement by image addition is a point operation.

   3. $k(a * b) = (ka) * (kb)$, where $a$ is the image, $b$ is the filter, $k$ is a scalar and $*$ is the convolution operator.

   (a) only 1

   (b) 1 and 2

   (c) only 2

   (d) None of the above

8. Which of the following statements is **false**?

   (a) Real-world **RGB** images can be thought of as matrices in continuous space on $\mathbb{R}^3$, but the images we store on a computer are discrete.

   (b) We can represent an **RGB** image as a function of the form. $f : \mathbb{R}^3 \to \mathbb{R}$ where $\mathbb{R}^3$ represents image coordinates (channel, height, width) and $\mathbb{R}$ represents intensity.

   (c) The transformation $\hat{I}(x, y) = I(x, -y)$ flip the image $I$ upside down.

   (d) Denoising an image through the moving average filter is an example of global operation as opposed to point or local operations.

9. Assertion (A): Gabor filters are particularly effective for texture analysis in image processing.
   Reason (R): Gabor filters can be tuned to respond to specific frequencies and orientations in an image. Choose the correct answer from the options below:
   (a) Both A and R are true, and R is the correct explanation of A.
   (b) Both A and R are true, but R is not the correct explanation of A.
   (c) A is true, but R is false.
   (d) A is false, but R is true.
10. Which property is SIFT designed to be invariant to?
   (a) Only rotation
   (b) Only scale
   (c) Rotation and scale
   (d) Scale, rotation, and illumination changes
11. What is the primary difference between blob detection and corner detection?
   (a) Blob detection finds regions, while corner detection finds points
   (b) Blob detection finds circles, while corner detection finds rectangle
   (c) Corner detection works on color images, while blob detection only works on gray scale
   (d) Blob detection requires machine learning, while corner detection doesn't

12. Given is a $3 \times 3$ image,

| | | |
|---|---|---|
| 10 | 100 | 200 |
| 128 | 20 | 120 |
| 10 | 40 | 160 |

The central element after applying linear contrast stretching is:

(a) 54

(b) 25

(c) 13

(d) 18

# Answer Key for Exam A

1. Which of the following are examples of a high-pass filter? (Select all possible correct options)

   (a) $\begin{bmatrix} -2 & -2 & -2 \\ -2 & -2 & -2 \\ -2 & -2 & -2 \end{bmatrix}$

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