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Course outline

About NPTEL

How does an NPTEL online course work?

Week 0

Week 1

Week 2

- Edge Detection
- From Edges to Blobs and Corners
- Scale Space, Image Pyramids and Filter Banks
- Feature Detectors : SIFT and Variants
- [Optional] Image Segmentation
- Other Feature Spaces
- [Optional] Human Visual System
- Lecture Slides
- Week 2 Feedback Form : Deep Learning for Computer Vision
- Practice: Week 2 : Assignment 2(Non-Graded)
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Problem Solving Session - July 2024

Week 2: Assignment 2

The due date for submitting this assignment has passed.

Due on 2024-08-07, 23:59 IST.

Assignment submitted on 2024-08-06, 00:25 IST

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

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

Partially Correct.
Score: 0.5
Accepted Answers:
$\begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}$
$\begin{bmatrix} -1 & -1 & 0 \\ -1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}$

2) Match the following: ***1 point***

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

- 1 → iii, 2 → iv, 3 → i, 4 → ii
- 1 → iii, 2 → i, 3 → ii, 4 → v
- 1 → iii, 2 → iv, 3 → v, 4 → ii
- 1 → iv, 2 → iii, 3 → i, 4 → ii

Yes, the answer is correct.
Score: 1
Accepted Answers:
1 → iii, 2 → iv, 3 → v, 4 → ii

3) Identify the correct sequence of steps in a Canny edge detection pipeline. Steps are listed below: ***1 point***

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

- 6 → 1 → 4 → 5 → 2
- 3 → 1 → 6 → 4 → 2
- 3 → 5 → 1 → 4 → 2
- 6 → 8 → 5 → 7 → 2

No, the answer is incorrect.
Score: 0
Accepted Answers:
3 → 1 → 6 → 4 → 2

4) In terms of computational efficiency, how does the separability of a 2D convolution kernel affect the filtering process? ***1 point***

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

Yes, the answer is correct.
Score: 1
Accepted Answers:
It allows the convolution to be performed as two 1D convolutions, which is faster

5) Which of the following operations is an example of linear filtering? ***1 point***

- Thresholding an image
- Histogram equalization
- Morphological dilation
- Applying a Gaussian blur

Yes, the answer is correct.
Score: 1
Accepted Answers:
Applying a Gaussian blur

6) What is the purpose of creating a scale space in SIFT? ***1 point***

- To remove noise from the image
- To detect features at different scales
- To enhance edge detection
- To compress the image

Yes, the answer is correct.
Score: 1
Accepted Answers:
To detect features at different scales

7) Choose the **correct** statements from among the following: ***1 point***

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.

- only 1
- 1 and 2
- only 2
- None of the above

Yes, the answer is correct.
Score: 1
Accepted Answers:
only 2

8) Which of the following statements is **false**? ***1 point***

- Real-world $\mathbf{RGB}$ images can be thought of as matrices in continuous space on $\mathbb{R}^3$, but the images we store on a computer are discrete.
- We can represent an $\mathbf{RGB}$ 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.
- The transformation $I\hat{(}x, y) = I(x, -y)$ flip the image I upside down.
- Denoising an image through the moving average filter is an example of global operation as opposed to point or local operations.

Yes, the answer is correct.
Score: 1
Accepted Answers:
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. ***1 point***
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:

- Both A and R are true, and R is the correct explanation of A.
- Both A and R are true, but R is not the correct explanation of A.
- A is true, but R is false.
- A is false, but R is true

Yes, the answer is correct.
Score: 1
Accepted Answers:
Both A and R are true, and R is the correct explanation of A.

10) Which property is SIFT designed to be invariant to? ***1 point***

- Only rotation
- Only scale
- Rotation and scale
- Scale, rotation, and illumination changes

Yes, the answer is correct.
Score: 1
Accepted Answers:
Scale, rotation, and illumination changes

11) What is the primary difference between blob detection and corner detection? ***1 point***

- Blob detection finds regions, while corner detection finds points
- Blob detection finds circles, while corner detection finds rectangle
- Corner detection works on color images, while blob detection only works on gray scale
- Blob detection requires machine learning, while corner detection doesn't

No, the answer is incorrect.
Score: 0
Accepted Answers:
Blob detection finds regions, while corner detection finds points

12) Given is a 3 × 3 image, ***1 point***

10	100	200
128	20	120
10	40	160

The central element after applying linear contrast stretching is:

- 54
- 25
- 13
- 18

No, the answer is incorrect.
Score: 0
Accepted Answers:
13