Give Overall Feedback

Multiple Choice

For Questions 1-2, select the most likely computer vision challenge(s) being described. Q3 is a stand-alone question.

1 Your face detector finds only Caucasian (white-skinned) faces but not Chinese or Indian faces

Multiple Response (Answered)

- [ ] inter-class variation
- [ ] viewpoint variation
- [x] intra-class variation
- [ ] motion blur

Marks 1 / 1

Comment: Enter optional comments here

2 Your surveillance system has difficulty finding intruders once the sun sets.

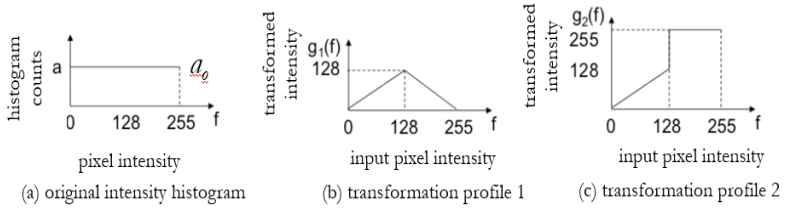
Multiple Response (Answered)

- [ ] motion blur
- [ ] occlusion
- [ ] viewpoint variation
- [x] illumination

Marks 1 / 1

Comment: Enter optional comments here

3 You are given a grey-scale image with the intensity histogram shown in Figure (a), as well as two transformation functions shown in Figures (b) and (c).



(a) original intensity histogram (b) transformation profile 1 (c) transformation profile 2

What is the transformed histogram count at intensity $x = 255$? In the options, $f_1(x), f_2(x)$ is used to denote the counts for the transformations g_1, g_2 respectively.

Multiple Choice (Answered)

- $f_1(x) = 0,\ f_2(x) = 2a_0$
- $f_1(x) = 2a_0,\ f_2(x) = a_0$
- [x] $f_1(x) = 0,\ f_2(x) = 127a_0$
- $f_1(x) = 127a_0,\ f_2(x) = 0$

Marks 1 / 1

Comment: Enter optional comments here

Numerical Response

Consider the following 4x4 image **P** with 3 bits per pixel i.e. pixel values take values in {0, 1, 2, … 7}:

1	3	1	2
2	6	1	3
1	2	3	2
3	1	4	1

4 Fill in the blanks

(Answered)

You perform histogram stretching to map the pixels p_{ij} to the full range of values to get an output image **X**. The elements x_{ij} can be expressed as $x_{ij} = a \cdot p_{ij} + b$, where coefficient b rounded to 1 decimal place is 1. {-1.4}

Enter the correct answer below.

1 -1.4

Marks 1 / 1

Comment

Enter optional comments here

5 Fill in the blanks

(Answered)

You perform histogram equalization on the above image. For pixel $p_{ij} = 3$, the remapped value is 1. {6}. Use rounding to obtain the quantized intensity.

Enter the correct answer below.

1 6

Marks 1 / 1

Comment

Enter optional comments here

6 Fill in the blanks

(Answered)

You are presented with the following 3x3 kernel

0	.25	0
.25	0	.25
0	.25	0

which you convolve with the input. If you zero-pad such that your output is the same size as the input, then the output at x_{11} is 1. {2}. (assume the indexing starts at 0,0 on the upper left corner).

Enter the correct answer below.

1 2

Marks 1 / 1

Comment Enter optional comments here

7 Fill in the blanks

(Answered)

You perform 3x3 median filtering on the above example. Then the element $p_{11} = 6$ changes to 1. {2}

Enter the correct answer below.

1 2

Marks 1 / 1

Comment Enter optional comments here

8 Fill in the blanks

(Answered)

You are presented with an RGB image where each colour channel has 4 intensity levels and the range of intensity for each channel is the same. You opt to convert the image into a greyscale image by weighting all three channels equally.

The maximum shades of grey in the resulting image is 1. {10}. The minimum number of bits required to encode this greyscale image is 2. {4}.

Enter the correct answer below.

1 10

2 4

Marks 2 / 2

Comment Enter optional comments here

Written Response

You are presented with the following two figures which have the same histogram. Suppose that each image is blurred using a 3x3 box kernel.

(a) (b)

9 Would the histograms of the blurred images still be equal? Why or why not?

Essay (Answered)

No. The second image has a lot more boundaries between the black and white pixels and when the kernel is placed to contain such boundaries the output pixel value is changed to some value in between the values corresponding to black and white. Hence, we would expect the outout image of the second image to have more counts for pixel values in between the values corresponding to black and white.

Marks / 1

Comment Enter optional comments here

10 You are presented an image $\mathbf{I}$ with values between 0-255 and a normalized kernel f with non-negative, non-zero weights, i.e. $\sum_{ij} f_{ij} = 1,\ 0 < f_{ij} < 1\ \forall i, j$. Assume that the size of your kernel is much smaller than the image.

Instead of applying the kernel to the image once, you apply the kernel repeatedly to the output, i.e.

$$\mathbf{X}_t = \begin{cases} \mathbf{X}_{t-1} * f, & 0 < t \leq T \\ \mathbf{I} * f, & t = 0 \end{cases}$$

where t is the iteration number and $\mathbf{X}_t$ is the output at iteration t.

Suppose now the number of iterations T becomes very large (you may also assume $T \to \infty$). Describe how $\mathbf{X}_T$ would look and explain or justify your solution. For this question, please consider $\mathbf{X}_t$ as a matrix of floating values, i.e. do not factor in the effects of rounding. For handling the borders, assume that (a) a reflection or a wrap-around operation is used.

(b) Would your answer differ if we were to use zero-padding to handle the borders? If so, describe the new output and explain or justify your answer.

Essay (Answered)

(a)XT would look like the if the original image is undergoing image matching with the histogram of the kernel

(b) If zero padding is used, the pixel values of the output image will all shrink towards zero as the kernel is normalized more and more zeros are assigned weights i.e. the non-zero values are having less and less weights.

Marks / 2

Comment Enter optional comments here