**Nptel Online Certification Course**
**Indian Institute of Technology Kharagpur**
**Computer Vision**
**Assignment - Week 1**

**Number of questions: 10** **Total marks: 10x2=20**

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**QUESTION 1:** **Type: MCQ**

Consider the Direct Linear Transform (DLT) algorithm for a point correspondence $x_i' \leftrightarrow x_i$ which involves the following equation using homogeneous coordinate representation of points $x_i'$ and $x_i$ in the transformed and original 2-D projective space where H is a projective transformation.

$x' \sim Hx$

Choose the correct option from the following:

a) Vectors $x'$ and $Hx$ may have similar magnitude but different direction.

b) Vectors $x'$ and $Hx$ may not be equal. They have similar direction but different magnitude.

c) Vectors $x'$ and $Hx$ may be equal. They have similar direction and magnitude.

d) Cross product of $x'$ and $Hx$ is a zero vector.

**Correct Answer:** b), c), d)

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**FOR QUESTIONS 2 AND 3**

Consider a 3-bit grey scale image with dimension 256 $\times$ 32.

**QUESTION 2:** **Type: Comprehensive**

What will be the range of values in its X-axis?

a) 0 to 255

b) 1 to 256

c) 0 to 15

d) 0 to 7

**Correct Answer:** d)

**Detailed Solution:**

For a 3-bit image, there are $2^3$ intensities. The intensities start from 0. So, range is 0 to 7.

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**QUESTION 3:** **Type: Comprehensive**

What will be the minimum and maximum range of values in its Y-axis?

a) 32 and 512

b) 1024 and 8192

c) 0 and 16

d) 32 and 128

**Correct Answer:** b)

**Detailed Solution:**

There are total $256 \times 32 = 8192$ pixels. If all pixels have same color, then maximum height of histogram will be 8192. If all colors are uniformly distributed, then maximum height of histogram will be $\frac{\#\ pixels}{\#\ colors} = 1024$

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**QUESTION 4:** **Type: MCQ**

An image taken using a camera can be enhanced different techniques. Suppose, a software is developed which can detect if an image has been enhanced or not with 95% accuracy. A survey is done and it is found that 80% of all images are enhanced. If the software predicts that an image is enhanced, what is the probability that the image is actually enhanced.

a) 0.95

b) 0.987

c) 0.2

d) 0.77

**Correct Answer:** b)

**Detailed Solution:**

Let A be the event that an image is actually enhanced. Let B be the event that an image is predicted as enhanced by the software.

$P(A) = 0.8$

$P(\overline{A}) = 0.2$

$P(B|A) = 0.95$

$P(B) = P(A) \times P(B|A) + P(\overline{A}) \times P(\overline{B|A}) = 0.8 \times 0.95 + 0.2 \times 0.05 = 0.77$

$P(A|B) = \frac{P(B|A) \times P(A)}{P(B)} = \frac{0.95 \times 0.8}{0.77} = 0.987$

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**QUESTION 5:** **Type: MCQ**

Consider two images $I_1$ and $I_2$ with dimensions $16 \times 2$ and $4 \times 16$ respectively. $I_1$ consists of 16 background pixels and $I_2$ consists of 4 background pixels. Rest pixels are foreground pixels. Suppose, a pixel is selected at random and is found to be background pixel. What is the probability that the selected pixel is from image $I_2$?

a) 0.125

b) 0.2

c) 0.6

d) 0.33

**Correct Answer:** b)

**Detailed Solution:**

# of background pixels = $16 + 4 = 20$

# of pixels in image $I_1 = 16 \times 2 = 32$

# of pixels in image $I_2 = 4 \times 16 = 64$

Let A be the event that a selected pixel is from image $I_2$.

Let B be the event that a selected pixel is background pixel.

$P(A) = \frac{64}{64 + 32}$

$P(B) = \frac{20}{64 + 32}$

$P(B|A) = \frac{4}{64}$

$P(A|B) = \frac{P(B|A) \times P(A)}{P(B)} = \frac{\frac{4}{64} \times \frac{64}{64 + 32}}{\frac{20}{64 + 32}} = 0.2$

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**QUESTION 6:** **Type: MCQ**

Consider the following 3-bit grey scale image

| | | | |
|---|---|---|---|
| 0 | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 |
| 0 | 1 | 2 | 5 |
| 4 | 1 | 5 | 6 |

What of the following can be the value when vertical Prewitt operator and horizontal Prewitt operator are applied on the orange colored pixel?

a) 0 and 2

b) 0 and 10

c) 8 and $-2$

d) 2 and 10

**Correct Answer:** c)

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**QUESTION 7:** **Type: MCQ**

Consider the following 3-bit grey scale image

| | | | |
|---|---|---|---|
| 0 | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 |
| 0 | 1 | 2 | 5 |
| 4 | 1 | 5 | 6 |

What of the following can be the value when vertical Snobel operator and horizontal Snobel operator are applied on the orange colored pixel?

a) 0 and 2

b) 7 and 9

c) $-5$ and 5

d) 5 and 5

**Correct Answer:** b)

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**QUESTION 8:** **Type: MCQ**

Consider the following 3-bit grey scale image

| | | | |
|---|---|---|---|
| 3 | 1 | 2 | 3 |
| 1 | 7 | 6 | 4 |
| 2 | 1 | 7 | 5 |
| 0 | 1 | 5 | 6 |

When contrast enhancement using histogram equalization is used, to which intensity is the intensity 5 mapped to?

a) 6

b) 5

c) 4

d) 3

**Correct Answer:** b)

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**QUESTION 9:** **Type: MCQ**

Consider the following 3-bit grey scale image

| | | | |
|---|---|---|---|
| 3 | 1 | 2 | 3 |
| 1 | 7 | 6 | 4 |
| 2 | 1 | 7 | 5 |
| 0 | 1 | 5 | 6 |

When contrast enhancement using histogram equalization is used, to which intensity is the intensity 3 mapped to?

a) 6

b) 5

c) 4

d) 3

**Correct Answer:** c)

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**QUESTION 10:** **Type:MSQ**

A continuous time signal is given by $x(t) = e^{-2t}u(t)$, its fourier transform $X(j\omega)$ is given by

a) $1/(2 + j\omega)$

b) $1/(3 + j\omega)$

c) $1/(1 + j\omega)$

d) $1/(4 + j\omega)$

**Correct Answer:** a)

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