SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

RAMAPURAM CAMPUS

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

ACADEMIC YEAR (2022-2023)

CONTINUOUS LEARNING ASSESSMENT- I

ANSWER KEY

Sub Code/Name	**: 18CSE390T COMPUTER VISION**	**Set: EVEN**
Class	**: III Year / V Sem / B.Tech (AIML)**	
Date	**: 16-09-2022**	
Max Marks	**: 25**	**Duration : 60 mins**

PART A (5x1= 5)

ANSWER ALL THE QUESTIONS

Q.No.	Question	Marks	CO	BL	PI
1.	A translation is applied to an object by____________. a) Enlarging the Object b) **Repositioning it along with straight line path** c) Repositioning it along with circular path d) Shrinking the Object	1	1	1	1.2.2
2.	The two-dimensional translation equation in the matrix form is ____________. **a) P'=P+T** b) P'=P-T c) P'=P*T d) P'=p	1	1	1	1.2.1
3.	The rotation axis that is perpendicular to the xy plane and passes through the pivot point is known as ____________. **a) Rotation** b) Translation c) Scaling d) Shearing	1	1	1	1.6.1
4.	In controllable interaction users can change the attributes of the ____________. **A) Images** B) Widgets C) Videos D) Audios	1	1	2	2.5.1
5.	If the direction of the projection is normal then it is called as ____________. **A) Orthographic parallel projection** B) Oblique parallel projection C) Perspective Projection D) Ortho-Oblique Projection	1	1	2	2.6.1

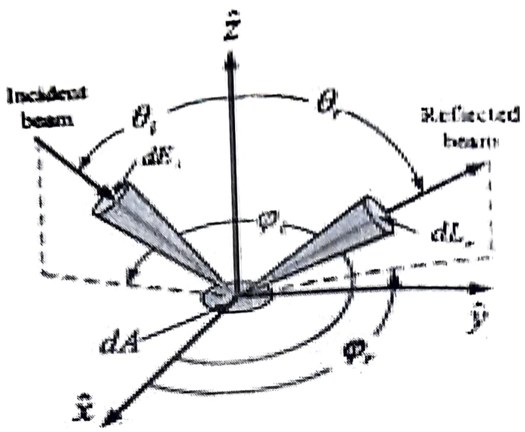
PART-B (2x4= 8)

ANSWER ALL THE QUESTIONS

<table>
<tr><th>Q.No.</th><th>Question</th><th>Marks</th><th>CO</th><th>BL</th><th>PI</th></tr>
<tr><td>6.</td><td>

Define BRDF.What is Helmholtz reciprocity?

The bidirectional reflectance distribution function (BRDF;) is a function of four real variables that defines how light is reflected at an opaque surface



The Helmholtz reciprocity principle describes how a ray of light and its reverse ray encounter matched optical adventures, such as reflections, refractions, and absorptions in a passive medium, or at an interface. It does not apply to moving, non-linear, or magnetic media.

fr(θi , θr, |φr − φi |; λ) or fr(ˆvi , ˆvr, ˆn; λ),

as the quantities θi , θr, and φr − φi can be computed from the directions ˆvi , ˆvr, and ˆn.

</td><td>4</td><td>1</td><td>3</td><td>3.6.2</td></tr>
<tr><td>7.</td><td>

Differentiate between Discrete Fourier Transform and Fast Fourier Transform.

FFT	DFT
FFT is abbreviated as Fast Fourier Transform.	DFT stands for Discrete Fourier Transform.
FFT is a much faster version of the DFT algorithm.	DFT is the discrete version of the Fourier Transform.
Various fast DFT computation techniques are collectively known as the FFT algorithm.	It is the algorithm that transforms the time domain signals to the frequency domain components.
It's an implementation of the DFT.	It establishes a relationship between the time domain and the frequency domain representation
Applications include integer and polynomial multiplication, filtering algorithms, computing isotopic distributions, calculating Fourier series coefficients, etc.	Applications of DFT include solving partial differential applications, detection of targets from radar echoes, correlation analysis, computing polynomial multiplication, spectral analysis, etc.

</td><td>4</td><td>1</td><td>3</td><td>3.6.4</td></tr>
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DFT	FFT
The DFT stands for Discrete Fourier Transform.	The FFT stands for Fast Fourier Transform.
The DFT is only applicable for discrete and finite-length signals. Discrete time-domain signals are transformed into discrete frequency domain signals using DFT.	It is an implementation of DFT.
$X(k) = \sum_{n=0}^{N-1} x(n) e^{-\frac{j2\pi kn}{N}}$	FFT mainly works with computational algorithms for the fast execution of DFT.
The time complexity required for a DFT to perform is equal to the order of N^2 or $o(N^2)$.	The time complexity reduces in the case of FFT and becomes equal to $o(N\log N)$.
The DFT has less speed than the FFT.	It is the faster version of DFT.
Some applications of the DFT are spectral analysis, solution of partial differential equations, correlation analysis, etc.	Filtering algorithms, multiplication of integer and polynomials, etc. are some applications of the FFT.

PART-C (1x12= 12)
ANSWER ALL THE QUESTIONS

Q.No.	Question	Marks	CO	BL	PI
8.a	Illustrate briefly about Orthography and Para-perspective in 2D and 3D geometric primitives.	12	1	2	2.6.4

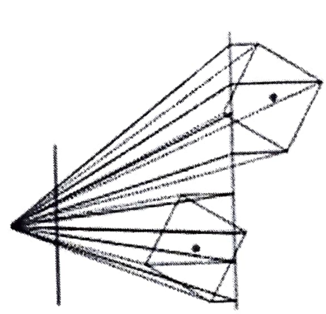
ORTHOGRAPHIC PROJECTION

An orthographic projection simply drops the z component of the three-dimensional coordi[1]nate p to obtain the 2D point x. (In this section, we use p to denote 3D points and x to denote 2D points.) This can be written as

$$\mathbf{x} = [\mathbf{I}_{2\times 2}|\mathbf{0}]\,\mathbf{p}.$$

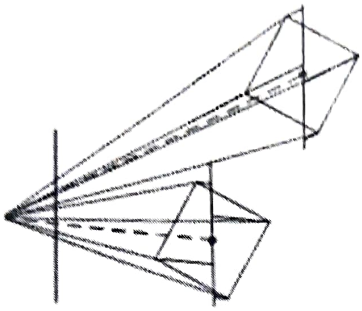
If we are using homogeneous (projective) coordinates, we can write

$$\tilde{\mathbf{x}} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \tilde{\mathbf{p}}.$$



A closely related projection model is para-perspective (Aloimonos 1990; Poelman and Kanade 1997). In this model, object points are again first projected onto a local reference parallel to the image plane. However, rather than being projected orthogonally to this plane, they are projected parallel to the line of sight to the object center (Figure 2.7d). This is followed by the usual projection onto the final image plane, which again amounts to a scaling.

PARA-PERSPECTIVE



Para-perspective provides a more accurate projection model than scaled orthography, without incurring the added complexity of per-pixel perspective division, which invalidates traditional factorization methods (Poelman and Kanade 1997). Perspective The most commonly used projection in computer graphics and computer vision is true 3D perspective. Here, points are projected onto the image plane by dividing them by their z component. Using inhomogeneous coordinates, this can be written as

$$\bar{\mathbf{x}} = \mathcal{P}_z(\mathbf{p}) = \begin{bmatrix} x/z \\ y/z \\ 1 \end{bmatrix}.$$

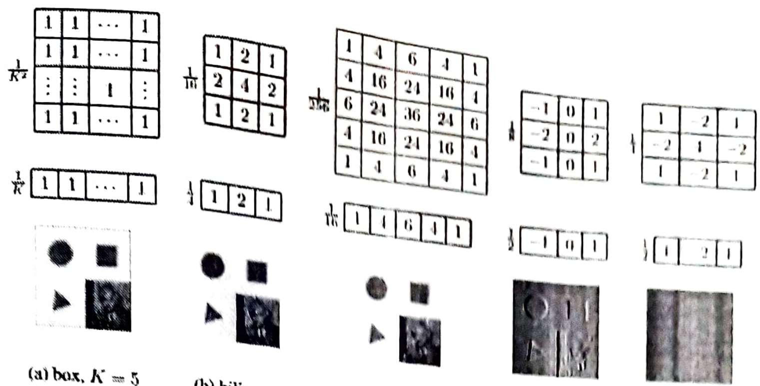
In homogeneous coordinates, the projection has a simple linear form,

$$\tilde{\mathbf{x}} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \bar{\mathbf{p}}.$$

[or]

8.b	Explain the following Linear Filtering techniques, ❖ Separable filtering ❖ Band-pass and steerable filters **SEPARABLE FILTERING** The process of performing a convolution requires K2 (multiply-add) operations per pixel, where K is the size (width or height) of the convolution kernel, e.g., the box filter in Figure 3.14a. In many cases, this operation can be significantly sped up by first performing a one-dimensional horizontal convolution followed by a one-dimensional vertical convolution, which requires a total of 2K	12	1	1	1.6.1

operations per pixel. A convolution kernel for which this is possible is said to be separable

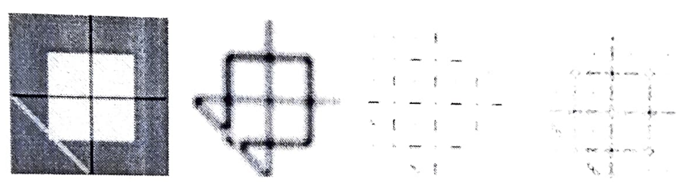


(a) box, $K = 5$ (b) bilinear (c) "Gaussian" (d) Sobel (e) corner

BAND-PASS AND STEERABLE FILTERS

The Sobel and corner operators are simple examples of band-pass and oriented filters. More sophisticated kernels can be created by first smoothing the image with a (unit area) Gaussian filter,

$$G(x, y; \sigma) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}},$$



(a) (b) (c) (d)

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