BRAINWARE UNIVERSITY

Term End Examination 2023-2024
Programme – M.Tech.(RA)-2023
Course Name – Image Processing and Robotic Vision
Course Code - PCC-MIRA202
(Semester II)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Define the camera model that assumes light travels in straight lines and forms an image on a plane.

a) Pinhole Camera Model
b) Thin Lens Camera Model
c) Pinhole Camera and Thin Lens Camera Model
d) Neither Pinhole Camera Nor Thin Lens Camera Model

(ii) Examine the factor that affects the field of view in a camera.

a) Focal Length
b) Aperture
c) Shutter Speed
d) Neither of Focal Length, Aperture, Shutter Speed

(iii) Enumerate the factors that affect the depth of field.

a) Distance between camera and subject
b) Shutter Speed
c) ISO
d) Neither of Distance between camera and subject, Shutter Speed, ISO

(iv) State the type of transformation that preserves the angles between the lines.

a) Orthogonal
b) Euclidean
c) Affine
d) Projective

(v) Describe the output of the Harris corner detector.

a) A scalar value
b) A binary image
c) A corner response image
d) A gradient image

(vi) Explain what the Harris corner detector computes.

a) The eigenvalues of the image gradient
b) The sum of the image gradients in a window

c) The difference of image gradients in a window
d) The corner response function

(vii) Relate which transform is used to analyze the frequency content of a signal or image.

a) Fourier transform
b) Karhunen-Loeve Transform
c) Discrete Cosine Transform
d) Singular Value Decomposition

(viii) Rewrite the full form of FFT.

a) Fast Fourier Transform
b) Fast Frequency Transform
c) Fourier Frequency Transform
d) Fourier Fast Transform

(ix) Estimate the shape of an object by analyzing the way that light interacts with its surface using which method of 3D reconstruction?

a) Photometric stereo
b) Shape from shading
c) Frankot Chellappa algorithm
d) 1D reconstruction

(x) Estimate the surface normals of an object based on the gradients in the image using which type of algorithm for shape from shading?

a) Propagation method
b) Optimization method
c) Frankot Chellappa algorithm
d) Nothing from Propagation method, Optimization method, Frankot Chellappa algorithm

(xi) Explain the benefits of using the cv bridge package in ROS.

a) Allows users to use OpenCV functions on ROS image messages
b) Allows users to use ROS functions on OpenCV image format
c) Allows users to launch OpenCV applications from ROS
d) Allows users to control cameras in ROS

(xii) Survey which technique is based on finding the minimum cut in a graph that models the image.

a) Graph-Cut
b) Mean-Shift
c) MRFs
d) No option is correct

(xiii) Organize the technique that uses a graphical model to represent the interactions between image pixels.

a) Graph-Cut
b) Mean-Shift
c) MRFs
d) Nothing fom Graph-Cut, Mean-Shift, MRFs

(xiv) Assess the truth about the Gaussian pyramid.

a) It is a band-pass filter
b) It consists of multiple copies of an image at different scales
c) It is a high-pass filter
d) It is used for image sharpening

(xv) Persuade the need for mapping sonar data in camera calibration.

a) To correct for lens distortion in sonar readings
b) To correct for perspective distortion in sonar readings
c) To convert sonar readings to visual data
d) To eliminate noise in sonar readings

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Define the field of view in a camera and explain how it impacts the composition of a photograph. (3)
3. Define histogram equalization and explain how it is used to improve the contrast of an image. (3)
4. Define image segmentation and differentiate it from object recognition. (3)

5. Explain the basic architecture of the Robotic Operating System (ROS) and how it facilitates communication between different hardware and software components. (3)
6. Explain what camera calibration is and why it is important for computer vision applications. (3)

OR

Describe how stereo imaging is used for depth perception in computer vision. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Address the common challenges in developing computer vision systems for autonomous vehicles and propose solutions to overcome them. (5)
8. Differentiate between 2D and 3D transforms and compare them in terms of computational complexity. (5)
9. Define multiscale image processing and describe how it is used for image analysis and recognition in computer vision. (5)
10. Define image registration and describe its use in medical imaging and other applications. (5)
11. Define a Gaussian filter and explain how it is used to smooth images. (5)
12. Define the DCT (Discrete Cosine Transform) and explain how it is used for image compression and analysis in computer vision. (5)

OR

Explain the use of histogram equalization for image enhancement and contrast enhancement in computer vision. (5)

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