BRAINWARE UNIVERSITY

Term End Examination 2023
Programme – M.Tech.-RA-2022
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) Identify the property of a lens that determines how much light it can gather.

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

(ii) Define the distance between the nearest and farthest objects in an image that appear acceptably sharp.

a) Depth of Focus
b) Field of Depth
c) Depth of Field
d) Neither of Depth of Focus, Field of Depth, Depth of Field

(iii) Use a clustering algorithm for image segmentation by doing what?

a) Graph-Cut
b) Mean-Shift
c) MRFs
d) All options are wrong

(iv) State a drawback of the Hough Transform that is NOT true.

a) Computationally intensive
b) Affected by noise and outliers
c) Only detects straight lines
d) Cannot detect curves

(v) Test the term for determining the 3D location of a point in space by finding its projection onto two or more images.

a) Triangulation
b) Rectification
c) Stereo matching
d) Disparity mapping

(vi) 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

(vii) Subdivide which technique is a non-parametric algorithm that iteratively shifts a window to the mean of the points in the window.

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

(viii) Evaluate the truth about PCA.

a) It is used for clustering
b) It is used for dimensionality reduction
c) It is a supervised learning algorithm
d) It is only used for classification

(ix) Compare a linear multiscale image processing technique as an example.

a) Laplacian pyramid
b) Wavelet transform
c) Non-local means
d) K-means clustering

(x) Classify, which type of projection is commonly used in technical and engineering drawings

a) Orthographic projection
b) Parallel projection
c) Perspective projection
d) Oblique projection

(xi) Show the type of filter used to sharpen an image.

a) High-pass filter
b) Low-pass filter
c) Band-pass filter
d) Notch filter

(xii) Give examples of a step in the HOG algorithm.

a) Compute the gradient magnitude and orientation
b) Perform Gaussian smoothing
c) Perform edge detection
d) Compute the Laplacian of the image

(xiii) Locate the ROS package that contains the ROS camera driver base class.

a) camera_info_manager
b) image_transport
c) camera_calibration
d) usb_cam

(xiv) 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

(xv) Solve a partial differential equation to estimate the surface normals of an object as part of 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

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Differentiate and explain how pinhole and thin lens model for cameras affect resulting image. (3)
3. Define homogeneous coordinates and explain their usage in image processing and computer vision. (3)
4. Estimate depth from stereo images using binocular stereopsis techniques. (3)
5. Describe principal component analysis (PCA) and its use for dimensionality reduction in image processing. (3)
6. Describe how face detection works and speculate on the algorithms used for this task. (3)

OR

Differentiate between pedestrian detection and face detection and reorganize how they are approached differently. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Perform basic image processing tasks using OpenCV, including filtering, thresholding, and edge detection. (5)
8. Define eigenfaces and describe how they are used in face recognition. (5)
9. Compare and contrast low-pass and high-pass filters, and explain their use in image processing. (5)
10. Define landmarks in computer vision and explain how they are used for object recognition and tracking. (5)
11. Explain the use of the Laplacian of Gaussian (LOG) filter for feature extraction in computer vision. (5)
12. Address the common challenges in developing computer vision systems for autonomous vehicles and propose solutions to overcome them. (5)

OR

Use machine learning algorithms such as neural networks and support vector machines to improve the performance of computer vision systems and explain how they work. (5)

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