

MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent institution of MAHE, Manipal)

## II SEMESTER M.TECH. (INDUSTRIAL AUTOMATION AND ROBOTICS) END SEMESTER EXAMINATIONS, APRIL 2018

## SUBJECT: MACHINE VISION AND IMAGE PROCESSING [MTE 5136]

(25/04/2018)

Time: 3 Hours

MAX. MARKS: 50

## **Instructions to Candidates:**

- ✤ Answer ALL questions.
- ◆ Data not provided may be suitably assumed with justification.
- 1A A bottle manufacturing industry is using machine vision to pick –out the **8** unqualified tube-type bottles, which possibly have breaks and irregular shapes. A novel image processing measure is taken for extracting the boundary based on mathematical morphology. Image captured from the camera is degraded by a noise and it is shown in Fig.Q1A (i). Identify and describe the noise present in the image using its histogram and also explain the reason behind the occurrence of noise.

Image in Fig.Q1A(i) has been preprocessed for the noise removal and the image obtained is shown in Fig.Q1A(ii). The output image has been again preproceesd for binary morphological operation and the output is shown in Fig.Q1A(iii). Boundary extraction is performed in Fig.Q1A(iii) to obtain image shown in Fig.Q1A(iv). Analyze the images given below and determine the key stages of image processing for obtaining the image shown in Fig.Q1A(iv) from image shown in Fig.Q1A(i). Also validate your answer by explaining each key stage using mathematical expressions.



1B An aortic angiogram near the kidney area is shown in Fig.Q1B(i). Some image 2 enhancement technique has been performed on image shown in Fig.Q1B(i) to obtain image shown in Fig.Q1B(ii) such that the blood vessels and some part of kidney will be converted into white. Identify and explain the image enhancement technique performed.





- 2A Rail track failures may directly lead to train derailment which may cause 5 destruction and threaten people's lives. Detecting rail track defects in advance can improve the reliability of the railway transport systems. In order to detect the faults of the track surface, a vision based inspection technique is adopted. The team who were doing the inspection have selected a canny edge detection technique for image segmentation. Comment on their selection of canny edge detection technique over other edge detection techniques like sobel, Prewitt. Also explain the steps involved in the algorithm of canny edge detection.
- 2B Camera calibration is used in the applications such as machine vision to detect 5 and measure objects. They are also used in robotics, for navigation systems, and 3-D scene reconstruction. Camera calibration is the process of estimating intrinsic and/or extrinsic parameters. Explain intrinsic and extrinsic parameters of a camera.
- 3A Object classification is an important task in many computer vision applications, **6** including surveillance, automotive safety, and image retrieval. Digit classification has been performed using HOG features and a multiclass SVM classifier. Explain steps involved in the HoG feature extraction and also briefly describe SVM classifier.
- 3B Imagine there is crossing D and a car C is approaching the crossing. There is a 4 4km and a 2km sign board at point A and B as shown in the Fig.Q3B (i). However, when an image is captured from the satellite it looks as shown in Fig.Q3B (ii) which is the perspective projection of the roads. Consider point A' is at 4km sign and B' at the 2 km sign board, C' and D' are the points of the car and crossing in Fig. Q3A (ii). The coordinates of the pixels in the image are observed and the distance in pixels is given as A'D' =300 pixels, A'C' =275 pixels, B'C'=50 pixels. Using the data provided, calculate the distance of the car C from the crossing D in kilometers.

Also describe the technique used to calculate the distance.



4A Explain disparity map in stereovision. Also discuss an algorithm for solving the 5 [MTE 5136] Page 2 of 3 correspondence problem in stereo vision

- 4B Explain Kalman filtering for tracking the ball adaptively and robustly in a soccer 5 video.
- 5A FigQ5A(ii) is a blurred image of the image shown in Fig.Q5A(i). The image is passed through the direct inverse filter and the output image is shown in 2 Fig.Q5A (iii). Explain the reason behind poor result. Suggest a method to improve the performance of this inverse filter.



5B The degraded image in Fig.Q5A(ii) can be restored using Weiner filter also. **3** Describe wiener filtering operation.

| Compute Huffmann code for the following symbols |     |     |     |     |     |
|---|-----|-----|-----|-----|-----|
| Symbol  | Al  | A2  | A3  | A4  | A5  |
| Probability                                     | 0.1 | 0.1 | 0.4 | 0.2 | 0.2 |

Determine the average length of the encoded pixels which is encoded using Huffman and fixed length encoding. Comment on it using compression ratio

5C

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