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SEVENTH SEMESTER

Roll No.:........................
B.TECH (ECE)

END-SEMESTER EXAMINATION (SUPPLEMENTARY) FEBRUARY-2019

EC-409 Computer Vision

Time: 3:00 Hours **Max. Marks: 50**

Note: *Q1 is compulsory.
**Answer any 08 questions out of remaining 10 questions i.e. Q2 to Q11.
***Assume suitable missing data, if any.

1. **Answer all the following Compulsory questions:**

[a] Explain the projection matrix. [3]
[b] Define the epipole, epipolar plane and epipoloar line. [3]
[c] Explain the camera matrices. [2]
[d] Determine the skew-symmetric matrix from any two 3x1 vectors. [2]

2. The first and second cameras are specified by camera projection matrices, P and P'. The ray formed by two points, x (scene co-ordinate) and X (image co-ordinate) corresponding to first camera, $Px = X$ is projected onto second image plane at second camera centre, $P'C'$ and epipole, $P'C$, forming the epipolar line, $l' = FX$, by joining these two points, where F is a Fundamental matrix. Considering the above, derive the expression of F. [5]

3. Perform the histogram equalization for the following distribution of gray levels in the image: [5]

Gray levels	0	1	2	3	4	5	6	7
No of pixels	790	1023	850	656	329	245	122	81

4. Explain the Harris corner detector and derive the conditions for which edges and corners are located in the image. [5]

5. Scale Invariant Feature Transform (SIFT) is an algorithm used to detect and describe the local features in the images. Explain the main stages of computation of local features. [5]

6. Explain the optical-flow detection method for the solution of over-determined system of equations of local image flow vectors. [5]

7. An equation of the line in 3D space is given by $\frac{x-x_1}{l} = \frac{y-y_1}{m} = \frac{z-z_1}{n} = \lambda$: Project this 3D line into two image planes whose centers of projections are situated at $(0,0,0)$ and (x_d, y_d, z_d). Let the focal lengths of both the cameras are 'f_1' and 'f_2'. Obtain the equations of lines L_1 and L_2 in both the image planes. [5]

8. Consider the problem of image blurring in camera caused by the accelerated motion along x and y direction. The image in camera is at rest at $t = 0$ and undergoes the accelerated motion, $x_0(t) = \frac{at}{T}$ and $y_0(t) = \frac{bt}{T}$ along x- and y-direction for a time T where a and b are constants. Consider the exposure time of camera as T. Find out the blurring function. Shutter opening and closing time of camera are negligible. [5]

9. Explain the operation of particle filter relating the prediction and measurements of states. [5]

10. Explain the wavelet series expansions along with the determination of scaling and detail co-efficients. [5]

11. Find the equivalent filter, $H(u,v)$ that implements the spatial operation performed by the Laplacian mask in the frequency domain. [5]

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