MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

VII SEMESTER B.TECH. (COMPUTER SCIENCE & ENGINEERING)
END SEMESTER EXAMINATIONS, NOVEMBER 2017

SUBJECT: ELECTIVE – IV– COMPUTER VISION [CSE 4002]
REVISED CREDIT SYSTEM
(25/11/2017)

Time: 3 Hours   MAX. MARKS: 50

Instructions to Candidates:

❖ Missing data may be suitable assumed.

1A.	Describe the following feature descriptors with an example.
	    (i) Texture using *GLCM*
	    (ii) Local binary pattern
	    (iii) Colour descriptors
		3M

1B.	What is the importance of *correlation* operation? Mathematically show that *correlation* is equivalent to *sum of squared differences*.	2M
1C.	What makes corner a distinctive interest point? Explain the mathematics of Harris corner detection. Also interpret the Eigen values computed from Hessian matrix.	5M
2A.	For image alignment, it is required to establish correspondence between matched feature points. Describe a *line fitting* algorithm responsible for removing outliers among the matched points. Give an equation to calculate the number of trials required to find right set of inliers with a probability of 99.9%.	3M
2B.	Elucidate Histogram of oriented features (*HOG*) method for human detection.	2M
2C.	How does *SIFT* method achieve scale invariance? Provide the mathematical steps used for key point localization and orientation assignment to the detected interest points.	5M
3A.	Given few known 3D points *(X, Y, Z)* in world coordinate system and their corresponding 2D points *(x, y)* in image space. Determine camera matrix elements using pseudo inverse least square fit.	3M
3B.	Derive the equation to calculate depth information from two *stereo* images. Assume a simple model wherein cameras are placed next to each other separated by a distance T along x direction.	2M

3C	With a proper diagram explain *epipolar geometry*. Provide the steps to derive *fundamental matrix*.	**5M**
4A.	What is *optimal flow*? Derive the necessary equation required for motion analysis using optical flow.	**3M**
4B.	Derive the *Jacobian matrices* for Translation, Rigid and Affine displacement models.	**2M**
4C.	Derive the nine steps involved in estimation of parameters P required to find transformation between two patches between frames in tracking algorithm.	**5M**
5A.	Describe K-nearest neighbor algorithm for object classification.	**3M**
5B.	Explain *Bag of features* method.	**4M**
5C.	Draw a block diagram of a simple pipeline for object recognition. Name few challenges for the existing visual recognition algorithms.	**3M**

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