CS/IT 441 Computer Vision

Mid-semester Examination

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Date: 07/09/2022 **Duration: 2 hours**

Note: Please scan and upload the answer-sheets on Google classroom for the course.

Useful values: $cos\ 60^\circ = 0.5;\ sin\ 60^\circ = 0.866$

1. **[5 Marks]** Compute SVD of the following matrix. Find the projection matrix associated with the strongest principal component.

$$\begin{bmatrix} -1 & 3 & 0 \\ 0 & -1 & 1 \end{bmatrix}$$

2. **[4 Marks]** Compute transformation of the following vector in both inhomogeneous and homogenous coordinate system.

$t_x = 4, t_y = 1.5,\ rotation\ with\ \theta = -60^\circ$

$$\begin{bmatrix} -3 \\ 7 \end{bmatrix}$$

3. [2+2+2+3 = 9 Marks]

a) Design a filter to compute the derivative in y-direction for 1D signal.

b) Which of the following cannot be used as a gradient filter and why?

A

-1	-1	0
-1	0	1
0	1	1

B

1	2	0
2	0	-2
0	-1	-1

C

2	1	0
1	0	-1
0	-1	-2

c) Write down thresholding and hysteresis thresholding for edge detection.

d) Explain the requirements for designing feature detector for matching. Why are corners used as features?

4. [4 + 4 + 4 = 12 Marks]

a). Draw and explain the Pinhole Camera model. Derive perspective projection equations for the same. Explain effects of pinhole size on image formation.

b). List down the issues with lenses and explain the causes for each.

c). What are the intrinsic parameters for camera calibration? Explain all the parameters and derive the calibration matrix K in homogeneous coordinate system.