

CS/IT 441 Computer Vision

Mid-semester Examination Dr. Gitam Shikkenawis

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.

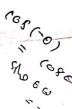
$$\begin{bmatrix} -1 & 3 & 0 \\ 0 & -1 & 1 \end{bmatrix}$$

2. [4 Marks] Compute transformation of the following vector in both inhomogeneous and homogeneous 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?

	Α		,
1-1	-1	0	
()-1	0	> 1	,
· 0	1	_ 1	

	Soban	В	
٢	/ 1	2	0
	2	0	-2
	0	-1	-1

		С		
	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.