International Institute of Information Technology, Hyderabad

Spring 2024 CS7.505: Computer Vision

Quiz 1

31 January 2024

10:20 – 11:00 [40 minutes]

Roll number: _____

Name: _____

Instructions:

- The quiz is of 6 points. There are 7 questions, each of 1 point.
- Questions Q1-Q3 are compulsory.
- Among questions Q4-Q7, you can **attempt any 3**.
- Feel free to draw over the gray lines for answering questions.
- Please answer within the provided space, no extra sheets will be given. There is some extra space on the last page.

Q1. (compulsory) Explain with an example **why** parallel lines in the real world converge to a point on the image plane. Hint: You may assume the camera is at the world origin.

Q2. (compulsory) Provide and explain **three** different reasons due to which the bag of visual words representations may perform poorly at image retrieval.

Q3. (compulsory) How would you capture the perpendicular distance between a camera C placed at point P and a texture-less wall? Note, point P is not on the wall! You may assume access to multiple other cameras with the same *known* intrinsic properties. Think like computer vision students. Assume no access to length measuring devices/instruments, chessboards, any light sources, stickers, etc. Don't damage the wall.

Q4. Given the fundamental matrix, what does the epipolar constraint mean? Explain how this can be useful with an example.

Q5. How does a square camera sensor of 1.08cm x 1.08cm capture images or videos at a non-square resolution, such as HD 1920 x 1080? How is this codified in the camera intrinsics?

Q6. Under what assumptions can we rewrite the 3x4 projection matrix as 3x3? Provide an example where this assumption is reasonable in the real-world.

Q7. Mathematically, what differentiates an edge from a corner? Use the relationships between eigen vectors and eigen values of the following matrix:

$$H = \begin{bmatrix} I_x^2 & I_x I_y \\ I_x I_y & I_y^2 \end{bmatrix},$$

where I_x is the image gradient in the x-direction and I_y is the gradient in the y-direction.