Computer vision

Question bank for chapter 4

1. What is meant by a linear filter? Explain with an example as a convolution.
2. Roughly draw the 2D symeetric gaussian kernel and explain the advantages.
3. Derive from the estimate a partial derivative as a symmetric finite difference into a kernel.
4. What is meant by Shift Invariant Linear System?
5. Explain the effect of aliasing based on sampling.
6. With a neat diagram explain how a signal can be reconstructed using fourier transform.
7. What type of filter is represented in the following image and explain the same.

A close-up of a blurry image

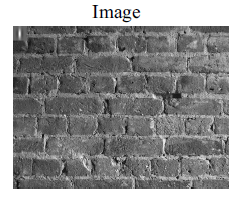
Description automatically generated

Question bank for chapter 5

1. Sugegst a method to remove additive stationary Gaussian noise.
2. Write the algorithm for Gradient-Based Edge Detection.
3. What is meant by Nonmaximum suppression and how it is used?
4. Explain how gradient orientation is used with an example.
5. Explain Harris corner detector.
6. Describe with a neat diagram, how to construct a SIFT feature/descriptor.
7. Write the algorithm for computing a SIFT Descriptor in a Patch Using Location, Orientation and Scale.
8. Differentiate LOG and HOG.

Question bank for chapter 6

1. What is a texton and draw suitable examples?
2. Explain how the filter responses for the oriented filters applied to an image is useful with a simple diagram.
3. Given the following image, roughly draw the rectified and summary as Filter-based texture representations.



1. Explain the two steps to building a pooled texture representation for a texture

in an image domain

1. Write the algorithm for Non-parametric Texture Synthesis.
2. What is meant by filling a hole in an image and where it is used.
3. Explain one method of filling the hole.
4. Prove or disprove whether Shape from Texture for Curved Surfaces is possible.

Question bank for chapter 7

1. Explain binocular problem with a neat diagram.
2. Explain the epipolar geometry with a neat diagram.
3. Derive the essential matrix equation.
4. Derive the fundamental matrix equation.
5. What are epipolar constraints? Express them in equations.
6. What is meant by image rectification in the context of stereopsis and mention the steps involved?
7. With a neat diagram, explain Vieth Mueller circle.
8. Explain the correlation methods find pixel-wise image correspondences.
9. Write the Marr–Poggio Multi-Scale Binocular Fusion Algorithm.
10. What is meant by ordering constraint in binocular fusion.
11. Write the Dynamic-Programming Algorithm for Establishing Stereo Correspondences Between Two Corresponding Scanlines.
12. Narrate the possibility of incorrect reconstruction using multiple cameras with a diagram.
13. Explain how binocular vision is used in robot navigation.

Question bank for chapter 8

1. Show that there is a rigid transformation ambiguity in SFM (structure from motion) problem.
2. Explain weak calibration in SFM.
3. Explain the 8 point algorithm.
4. Show that there is an affine transformation ambiguity in SFM (structure from motion) problem.
5. Explain Tomasi–Kanade Factorization Algorithm for Affine Shape from Motion.
6. What is meant by bundle adjustment and explain with an simple example.
7. Explain how to get the camera motion from affine fundamental matrix.

Problems:

1. Given the image as

A grid of numbers with black lines

Description automatically generated

Calculate GLCM with d = (1,0) and compute the contrast and dissimilarity.

1. Calculate GLCM with d = (1,1) and compute the contrast and any other parameter.
2. Calculate GLCM with d = (1,1) and compute any three parameters.
3. Given the image as above, generate any 5 Law’s 2 D masks and apply it on the image for computing the values.
4. Generate any 5 Law’s 2 D masks from 1D masks.
5. Given the fundamental matrix (3\*3) as the following

1 2 3

0 1 0

1 2 3

Check which of the following is/are epipole(s)?

(1 1 1),(0 1 0),(1 0 0),(0 1 1),(0 0 0)

1. Given the fundamental matrix (3\*3) as the following

-1 -2 3-

0 1 0

1 2 3

Check which of the following is/are epipole(s)?

(1 1 1),(0 1 0),(1 0 0),(0 -1 -1),(0 -1 0)

1. Given the two windows of size 3\*5 along the epipolar lines, compute the correlation.

10 20 30 12 22 32

5 5 5 7 7 7

0 10 0 2 12 2

5 5 5 7 7 7

10 20 30 12 22 32

1. Given the two windows of size 3\*5 along the epipolar lines, compute the correlation.

100 200 300 120 220 320

50 50 50 70 70 70

0 100 0 20 120 20

50 50 50 70 70 70

101 201 301 121 221 321

1. If the epipole is given as (10 -10 1), construct any 3 fundamental matrices.
2. If the epipole is given as (10 -10 1), construct a fundamental matrix.
3. If the epipole is given as (1 -1 10), construct any 3 fundamental matrices.
4. If the epipole is given as (10 -1 1), construct a fundamental matrix.

**<All the best and Godspeed>**