Exam-like Questions

1.1 Bilateral Filter equations

1.2 Show that the gaussian kernel is separable

1.3 Define integral image recursively

1.4 Show that convolution is commutative

1.5 Show that convolution distributes over addition

1.6 How can we approximate a 2D kernel with two 1D kernels

1.7 Histogram equalization proof

2.1 Derive the formula for computing the Laplacian of a Gaussian

2.2 Give the formula for normalized cross correlation

2.3 Explain the Nyquist theorem

2.4 How can we blend images through a Laplacian pyramid

3.1 Write the Hough algorithm for lines

3.2 How can we extend this to parabolas

3.3 Explain the mean shift algorithm

4.1 Explain k-means

4.2 Give advantages & disadvantages bet. mean shift & k-means

4.3 Explain Agglomerative clustering

4.4 Explain Spectral Clustering

4.5 Derive the generalized eigenvalue problem for spectral clustering

4.6 Give the Min. Norm. Cut formula

5.1. Give the energy equation for snakes

5.2 Give the continuous formulation

5.3 How can we solve this with gradient Descent

5.4 How are level sets used for contours

5.5 How can we derive a level set function from a contour

5.6. Define how we represent a contour using Geodesic active contours

5.7. How can we solve geodesic active contours using gradient descent

6.1 Give the general submodularity constraint

(6.2) Given this graph draw the min cut

6.3 Give the potential function of MRFs

6.4 Give the MAP solution for MRFs

6.5 Give the edge cost function for multi-label graphs

6.6 How can we re-parametrize a binary graph to allow general pairwise costs

6.7 How can we re-parametrize a multi-label graph

(6.8) Show that this function is/is not submodular

7.1 Give the general formulation of the E-step

7.2 Give the general formulation of the E-step

7.3 Give the definition of a mixture of gaussians

7.4 Give the E-step for MoG

7.5 Give the likelihood function for the M-step of MoG

7.6 Give the solutions for the M-step for MoGs

7.7 Derive the solution for the mixing coefficients

7.8 Derive the solution for the mean of the MoG

7.9 Give the mean shift tracking algorithm

8.1 Give the eq. for the Bayesian filtering framework

8.2 Give the Kalman filtering equations

8.3 Give the assumptions of the Kalman filter

8.4 Give the eq. for the Unscented filter

8.4 Give the eq. for the Extended Kalman filter

8.5 Give the steps of the particle filter

8.6 How do we resample in the particle filter

8.7 How can we learn the model parameters

8.8 Give the solutions to the model parameters in the M-step

8.9 Give the eq. of the fixed interval smoother

8.10 Give the eq. of the fixed lag smoother

9.1 Define a shape template model and its likelihood

9.2 What is the advantage of statistical shape models

9.3 How can we learn the parameters of a statistical shape model

9.4 Define a subspace shape model

9.5 Given the bases and mean, how can we get the latent coefficients for a new set of observed points

9.6 How can we fit a subspace shape model with PPCA

9.7 How can we again, given the parameters of PPCA, fit this to a new set of points

10.1 Explain the Harris Corner Detector and give all eq.

10.2 Give the corner response function

10.3 Describe the steps of creating a SIFT descriptor and derive the dimensionality of it

10.4 How can we get scale-invariant interest points

11.1 Explain the steps of RANSAC

11.2 Derive the formula defining the # of samples we have to take with RANSAC until we hit a good sample with prob. p

11.3 Given points from two planes, give the linear system to solve for the homography

12.1 Give the brightness constancy constraint

12.2 Give the gradient constancy constraint

12.3 Give the spatial coherence constraint

12.4 Explain the aperture problem

12.5 Explain the steps of Lucas-Kanade

12.6. Explain the Horn-Schunck assumptions and energy function

12.7. How do we solve the occlusion problem in Horn-Schunck

12.8 How do we solve the motion discontinuity problem in Horn-Schunc

12.9 How do we solve the large displacement problem in Horn-Schunck

12.10 How do we solve the illumination change problem in Horn-Schunc

13.1 How do we project a point

13.2 Give the lens formula

13.3 How can we adjust the depth of field

13.4 Give the pin-hole camera model

13.5 Describe the components in epipolar geometry

13.6 Give the polynomial distortion model

13.7 Give the Rocktaw distortion model

13.8 Given the homography between two image planes and the calibration, how can we retrieve the rotation and translatio

13.9 How can we perform distortion calibration

14.1 Derive the depth from disparity equations

14.2 Define visual and photo hull

14.3 Describe the steps of stereo image rectification

14.4 Describe volumetric stereo

14.5 Describe the carved visual hull algorithm

15.1 Describe bundle adjustment

15.2 Describe the primary structure in solving BA with LM

15.3 Describe the problem of non-rigid sfm

15.4 Describe the steps of affine sfm

15.5 Describe sequential sfm

15.6 Describe the steps of linear shape model

15.7 Describe the duality bet. linear shape and traj. models

16.1 Describe euler angles

16.2 Describe axis angles

16.3 Describe quaternions

16.4 What is gimbal lock

16.5 Conversion: axis -> matrix

16.6 Conversion: matrix -> axis