Overview Computer Vision Exercises SS 2014

July 4, 2014

1 Exercise 1

- Image Storage, PGM/PNM format
- Differences JPG/PNG (just pros/cons, not how they are created)

2 Exercise 2

- Pixel spacing
- Perspective Projection, effect on objects closer and further away from camera
- Effect of different illumination conditions on images
- Explanation why the intensity in the image center is brighter than in the outer regions, using the equation of irradiance.

3 Exercise 3

- Gaussian Filter (equation, linear shift-invariance)
- Separability and cascading for speed-up of Gaussian Filtering
- Complexity of convolution, normal convolution compared to separable kernel and use of cascading
- Proof for cascading with a Gaussian 1-D kernel
- Boundary conditions

4 Exercise 4

- Canny Edge detection (Properties, + all individual steps)

5 Exercise 5

- Feature Detection (invariance vs covariance, properties of ideal features)
- Idea of the Harris Corner Detector (structure tensor (simplified eq. from slides), what do the eigenvalues tell us)
- Additional step for Corner Detection in the Kanade-Tomasi Corner Detector

6 Exercise 6

- Gabor Filters (idea what they are/used for, equation, what are the components)

7 Exercise 7a

- Hough Transform for lines

8 Exercise 7b

- Hough Transform theory
  - Discretization of parameter space (m,t) and (ρ, θ)
  - Accuracy depending on discretization
  - Hough Transform bias
- Hough Transform for circles (known and unknown radius)

9 Exercise 8

- Active contours: classical snake problem (description of equation components, equation itself unnecessary)
- Optimization: dependence on initialization, influence of different force terms (general idea)
- Active contours without edges (Chan): general idea

10 Exercise 9

- Simple Stereo Vision setup, including proper terms and properties
- Depth estimation equation
- Main sources of error in depth estimation: z-range, correspondence problem (examples when these might happen)
- Popular similarity measures for point matching (how does it generally work, where do the measures come in)

11 Exercise 10

- Calibration: what is it, why is it necessary, general procedure
- Intrinsic and extrinsic parameters
- Possible calibration patterns
- Projection of world point to image plane (equation, components)
- Epipolar constraint, essential matrix, fundamental matrix (rank, how many points to solve, how)
- Calibration of TOF/Kinect: additional depth calibration needed

12 Exercise 11

- will not be part of examination