Image Analysis SSY095 2009-08-26

1a)

$$p(r) \begin{cases} 2ar & 0 \le r \le 1/2 \\ -2ar + 2a & 1/2 \le r \le 1 \end{cases}$$

$$s = T(r) = \int_0^r p(w)dw$$

$$T(r) = ar^2 \qquad 0 \le r \le \frac{1}{2}$$

$$T(r) = -ar^2 + 2ar - \frac{a}{2} \qquad 1/2 \le r \le 1$$

1b) Quantization is digitization of continous values of the image function. Binarization is a conversion of the grayscale image to two levels, black and white (levels 0 and 1).

1c) median = 51

2a) See the textbook, page 217-218.

2b) (1) $y = -x\,cos(30°)/\,sin(30°) + 30/\,sin(30°)$
(2) $x = 30$

3a) ASM is an extension of ACM. It relies on a statistical description of the points belonging to the objects to be modeled.

3b) See Lab 3 – texture classification.

3c) See textbook, page 258. Main advantage: avoids estimation of of the probability density function (of the gray levels).

4) First, we need to define a cost function suitable for the horizon detection. As the horizon is an edge, we need to filter the input image by e.g. some edge detection filter and then use the output of that filter as a part of the cost function. We may also add some smoothess term that penalizes the vertical direction. See also Lab 2.

Then we may proceed with the Dynamic Programming. The numerical solution will depend on the filter used for the edge detection.

5) 1-a 2-e 3-j 4-i 5-h

6a) $U(3,3) = 128/75 \qquad V(3,3) = 0.$ See Exercise MA-1.
6b) A larger value λ results in a smoother velocity field.
6c) If every point of brightness pattern moves independently, then the velocities will be not recovered.