EE6222: Machine Vision

Tutorial

3.1 Give a single intensity transformation function for spreading the intensities of an image so that the lowest intensity is *C* and the highest is *L*-1.

3.5 What effect would "setting to zero half of lower-order bit planes" have on the histogram of an image?

3.6 Explain why the discrete histogram equalization in general does not yield a flat histogram.

3.19 Develop a procedure for computing the median of an n x n neighborhood. Propose an efficient technique for updating the median as the centre moves from one pixel to the next.

3.23 In an application, an averaging mask is applied followed by a Laplacian mask. Would the results be the same if the order of the operations was reversed?

5.1 The white bars in the test pattern shown are 7 pixels wide and 210 pixels high. The separation between bars is 17 pixels. What would this image look alike after application of (a) 3 x 3 arithmetic mean filter, (b) 5 x 5 arithmetic mean.

9.7 What is the limiting effect of repeatedly dilating an image? What is the smallest image from which you can start?

9.33 Prove the validity of the duality property of erosion and dilation for grey level images. You may use a flat structuring element b, $f^c(x,y)=-f(x,y)$ and $\hat{b} = b(-x,-y)$.

9.35 A grey-scale image is corrupted by non-overlapping noise spikes that can be modeled as small cylindrical artifacts of radii $R_{min} \le r \le R_{max}$ and amplitude $A_{min} \le a \le A_{max}$. Develop a morphological filtering approach for cleaning up the image.

10.2 A binary image contains straight lines oriented horizontally, vertically at 45^o and -45^o. Develop a set of 5 x 5 masks that can detect 1-pixel breaks in these lines.

10.11 Compass gradient operators of size 3 x 3 are designed to measure gradients of edges oriented in 8 directions: E, NE, N, NW, W, SW, S, SE. Develop these 8 operators using values such as 0, 1, 2, -1, -2.

10.14 Show that the average value of the LoG is zero.

10.15 Does zero-crossing method for finding edge location always result in closed contours? Explain.

10.16 Derive an expression for LoG by using this substitution: $r^2=x^2+y^2$. Compare the resulting expression with the one given in the lecture slides and explain if they're different.

10.22 Develop a general procedure for obtaining the normal (i.e. polar coordinate) representation of a line from its slope-intersect for $y=ax+b$.

10.23 Show that Hough mapping of a point is sinusoidal in general. What is the Hough mapping for the pixel at origin (0,0)?

11.1 Show that redefining the starting point of a chain code so that the resulting sequence of numbers forms an integer of minimum magnitude makes the code independent of the initial starting point on the boundary.

11.16 Propose a set of descriptors capable of differentiating between the shapes of the characters 0, 1, 8, 6 and Z.

12.5 Show that the following two expressions perform the same function in terms of pattern classification:

$$D_j(\mathbf{x}) = \|\mathbf{x} - \mathbf{m}_j\| \qquad j = 1,2,\ldots,M$$

$$d_j(\mathbf{x}) = \mathbf{x}^T \mathbf{m}_j - \frac{1}{2}\mathbf{m}_j^T \mathbf{m}_j$$

12.8 The following pattern classes have Gaussian density functions: Class-1: { $(-1,0)^T$, $(0,-1)^T$, $(1,0)^T$, $(0,1)^T$} & Class-2: { $(-4,0)^T$, $(0,-4)^T$, $(4,0)^T$, $(0,4)^T$ }. Assume that P(Class-1)=P(Class-2)=0.25. Obtain the equation of the Bayes decision boundary.

Additionally, you can try past exam questions!