EE 637 Exam #2

April 22, Spring 1997

Name: _____

Instructions: One hour exam, with no books, notes or calculators.

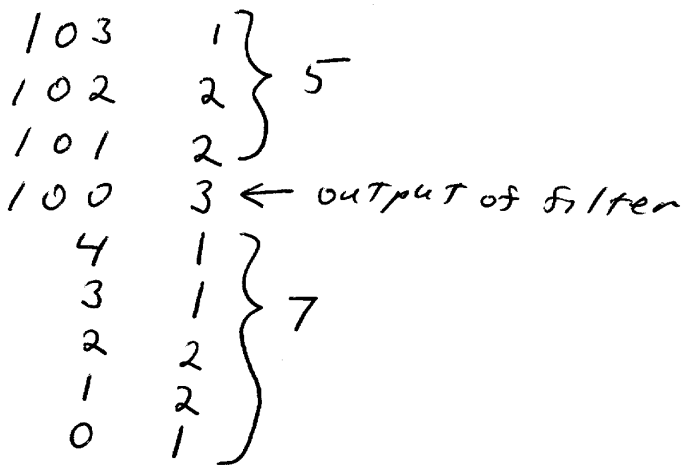
Problem 1.(11pt)

a) Consider the weighted median filter with the following weights.

1	2	1
2	3	2
1	2	1

Compute the filter output for input pixels:

0	1	4
2	100	102
3	101	103



Problem 2.(22pt)

Consider the index screen given by

10	9	8	7
11	1	2	6
12	3	4	5
13	14	15	16

a) Is this a cluster dot screen or dispersed dot screen? Why?

b) Compute the output halftone for an input image of 0.25 where the input image is in the range 0 to 1.

a) cluster, because dot that turn on are grouped together.

b) $t(m,n) = \frac{I(m,n)}{16} - 0.5$

$h(m,n) = 0.25 > t(m,n)$

$$h(m,n) = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

3)

a) $$\frac{d}{d\theta_j} E = \frac{d}{d\theta_j} \sum_{i=1}^{N} \rho(Y_i - \hat{Y}_i)$$

$$= \sum_{i=1}^{N} \rho'(Y_i - \hat{Y}_i)(-Z_{ij})$$

$$= \sum_{i=1}^{N} -\rho'(Y_i - Z_i\theta) Z_{ij}$$

b) $$\theta_j^{(k+1)} = \theta_j^{(k)} + \mu \sum_{i=1}^{N} \rho'(Y_i - Z_i\theta) Z_{ij}$$

$$\theta_i^{(k+1)} = \theta^{(k)} + \mu \sum_{i=1}^{N} \rho'(Y_i - Z_i\theta) Z_i^t$$

c) $$Y_1 - Z_1\theta^{(1)} = 0 - [0,1,2,3,4]\begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{bmatrix}$$

$$= -2$$

$$\theta^{(2)} = \theta^{(1)} + \frac{1}{10}\rho'(-2) Z_1^t$$

$$= \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{bmatrix} + \frac{1}{10}(-1)\begin{bmatrix} 0 \\ 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}$$

$$= \begin{bmatrix} 0 \\ -1/10 \\ 8/10 \\ -3/10 \\ -4/10 \end{bmatrix}$$

4)

a) P multiplies for each evaluation of $\|q_i - x\|^2$

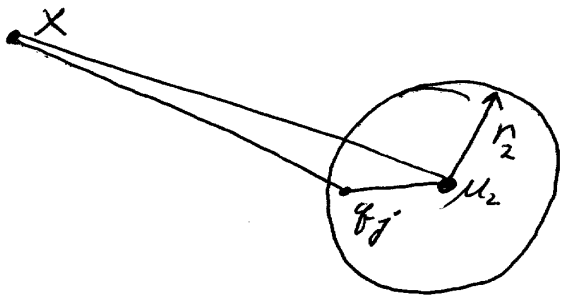
Must compute $\|q_i - x\|^2$ for $i = 1, \ldots, M$

$\Rightarrow PM$ multiplies

b) Let $j \in \{M_1+1, \ldots, M\}$ (second group)

Then by the triangle inequality

$$\|x - q_j\| + \|q_j - \mu_2\| \geq \|x - \mu_2\|$$



$$\Rightarrow \|x - q_j\| + r_2 \geq \|x - \mu_2\|$$

$$\Rightarrow \|x - q_j\| \geq \|x - \mu_2\| - r_2$$

$$\geq \|x - q_1\|$$

$\Rightarrow q_j$ cannot be the best codeword

$\Rightarrow$ best codeword cannot be from group 2.