MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Media Arts and Sciences Section

Course 4.902: Pattern Recognition and Analysis — Assigned: 4/1/93

Problem Set No. 7 — Due: 4/8/93

READING: Therrien, Chapters 8 and 9;
Moody and Darken paper;
Lippmann paper

This problem set consists of seven problems. Remember that you are *not* allowed to look at old problem sets, but collaboration is allowed and encouraged.

Problem 1: (10 points)

Let $\tilde{p}_y$ be the Parzen estimate for a density function p_y and let the kernel γ satisfy

$$\int_{-\infty}^{\infty} \gamma(\mathbf{z}) d\mathbf{z} = 1 \qquad \text{and} \qquad \int_{-\infty}^{\infty} \mathbf{z}\gamma(\mathbf{z}) d\mathbf{z} = 0.$$

Derive the simplest possible expression for the estimated mean vector,

$$\tilde{\mathbf{m}} = \int_{-\infty}^{\infty} \mathbf{y}\tilde{p}_y(\mathbf{y}) d\mathbf{y}.$$

Problem 2: (15 points)

Therrien, Problem 8.4.

Problem 3: (15 points)

Therrien, Problem 8.5.

Problem 4: (10 points)

Therrien, Problem 9.1.

Problem 5: (15 points)

Therrien, Problem 9.6.

Problem 6: (15 points)

Which neural network structure(s) can implement a Gaussian classifier? Under what conditions? Please limit your answer to 1/2 page.

Problem 7: (20 points)

What is the relationship between the network of locally-tuned processing units (radial basis functions) of Moody and Darken to the non-parametric methods we have discussed? Please limit your answer to 1/2 page.