PR HW #1

* **Problem 2.2 page 47**


**2.2**In a two-class one-dimensional problem the pdf’s are the Gaussians *N(0,***a2)**and
,V(1. ***c 2 )***for the two classes, respectively. Show that the threshold ***xu*** minimizing
the average **risk** is equal to


where *h* **11** = A22 = 0 has been assumed

* **Problem 2.5 page 47**

Consider a two (equiprobable) class one-dimensional problem with samples dis**trihuted according to the** Rayleigh **pdf in each class, that is,**

Compute the decision boundary point ***g ( x )*** = 0

* **Problem 2.7 page 48**

**2.7** In a three-class two-dimensional problem the feature vectors in each class are
normally distributed with covariance matrix


The mean vectors foreachclass are [O. 1,O.1IT, **[2.1,** 1.9IT, [- **1.5,** 2.OlT. Assuming
that the classes are equiprobable, (a) classify the feature vector [1.6, 1S I T according
to the Bayes minimum error probability classifier; (b) draw the curves of equal
Mahalanobis distance from [2.1, 1.9IT

* **Problem 2.12 page 49**

**2.12** Consider a two-class two-dimensional classification task, where the feature vectors
in each of the classes *w1*,LLV, are distributed according to


with


Assume that ***P ( w 1 )*** = *P(w2)*and design a Bayesian classifier
(a)that minimizes the error probability
(h) that minimizes the average risk with loss matrix


Using a pseudorandom number generator, produce **100** feature vectors from each
class. according to the preceding pdf's. Use the classifiers designed to classify **the**generated vectors. What is the percentage error for eachcase?Repeat the experiments
for ***pz*** = [ I O . ***3.OIT.***

* **Problem 2.10 page 49**

**2.10** Show that in the case in which the feature vectors follow Gaussian pdf's, the
likelihood ratio test in **(2.19)**

is equivalent to


where is the Mahalanobis distance between ***pi*** and **x** with respect to
the norm.

* **Problem 2.11 page 49**

**2.11** If **C I**= **C2** = E, show that the criterion of the previous problem becomes



Where



**Problem 2.17 Page 50 (first question only)**

**2.17** In a heads **or**tails coin-tossing experiment the probability of occurrence of a head **( I )
is *q*** and that of a tail (0)**is 1**-4. Let **x;** ,***i*** = **1,2,** . . .,***N,***be the resulting experimental
outcomes, ***xi*** E {0,**1)** .Show that the ML estimate of *q* is
 ***Hint:*** The likelihood function is


Then show that the ML results from the solution of the equation



* **Problem 2.19 page 51**

Show that if the likelihood function is Gaussian with unknowns the mean ***p*** as well
as the covariance matrix C, then the ML estimates are given by



* **Problem 2.24 page 52**

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| Show that for the lognormal distribution |

the ML estimate is given by


To be continued …