HW3

CS4720 Machine Learning

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Question 1:

Suppose we have two normal distributions with the same covariances but different means. In terms of their prior probabilities, state the condition that the Bayes decision boundary not pass between the two means.

In the case of two distributions with equal covariences, different means, and different prior probabilities, the discriminant function would be:

gi(**x**) = -1/2(**x** – **u**)tΣ-1(**x** – **u**) + ln P(wi).

To find the decision boundary, you must set g1(**x**) = g2(**x**). This expands out to:

(**x** – **u**1)tΣ-1(**x** – **u**1) + ln P(w1) = (**x** – **u**2)tΣ-1(**x** – **u**2) + ln P(w2).

Here, you can see that in terms of the prior probabilities, the situation where the decision boundary doesn’t pass between the two means is only when one of the prior probabilities is significantly smaller than the other. The priors, in this case, are the only variable that determines the location of the decision boundary. If the two priors were equal, the boundary would lie in the exact middle of the means.

Question 2:

See python program.