

HW#3

ICS485

Group #11

	Work distribution
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Part A

Q1. Can you figure out how many test points there are from each class?

Class#1 = 17 test samples

Class#2 = 16 test samples

Class#3 = 12 test samples

Q2. In the function `density_plot`, the code for plotting the Gaussian density focuses on the region within 3 standard deviations of the mean. Do you see where this happens? Why do you think we make this choice?

Because in statistics(empirical rule) 99.73% of the samples are around the mean within 3 standard deviation

Q3. Here's something for you to figure out: for which feature (0-3) does the distribution of (training set) values for species-2 have the *smallest* standard deviation? what is the value?

Feature#3 with 0.281 standard deviation.

1. For which feature (0-3) do the densities for classes 0 and 2 *overlap* the most?

Feature_1(petal_width)

2. For which feature (0-3) is class 2 the most spread out relative to the other two classes?

Feature_3(sepal_width)

3. For which feature (0-3) do the three classes seem the most *separated* (this is somewhat subjective at present)?

It could be feature#2(sepal_length) or feature#3(sepal_width)

How well can we predict the class (0, 1, 2) based just on one feature?

Error rate for each features in the test set

Features	Error rate
0	12/45 = 26.67%
1	20/45 = 44.44%

2	$3/45 = 6.67\%$
3	$2/45 = 4.44\%$

Which two features have the lowest training error? List them in order (best first).

- Feature#2 = 3.81% training error
- Feature#3 = 3.81% training error

Which two features have the lowest test error? List them in order (best first).

- Feature#3 = 4.44% testing error
- Feature#2 = 6.67% testing error

Part B

1. What is the smallest achievable test error?

2.22% test error

2. Which pair of features achieves this minimum test error?

- feature#0 'petal_length'

- feature#2 'sepal_length'

Parc C

Exercise 1. How many errors are made on the test set when using the single feature 'petal_length'?

26.67% test error

Exercise 2. How many errors when using 'petal_length' and 'petal_width'?

22.22% test error

Exercise 3. How many errors when using all the 4 features?

4.44% test error

Part D

Exercise 1: What happens if you do not regularize the covariance matrices?

I can't compute sigma inverse because it is a singular matrix.

Exercise 2: What happens if you set the value of c too high, for instance to one billion? Do you understand why this happens?

The main diagonal in the covariance matrix will be very large so the inverse of that matrix will be very small(near to zero) and the determinant will be very larger therefore we will have underfitting.

Exercise 3: What value of c did you end up using? How many errors did your model make on the validation set?

$C = 2000$

581 errors out of 12000

With 95.16% accuracy

Exercise 4: How many errors did your model make on the test set?

439 errors out of 10000

With 95.61% accuracy