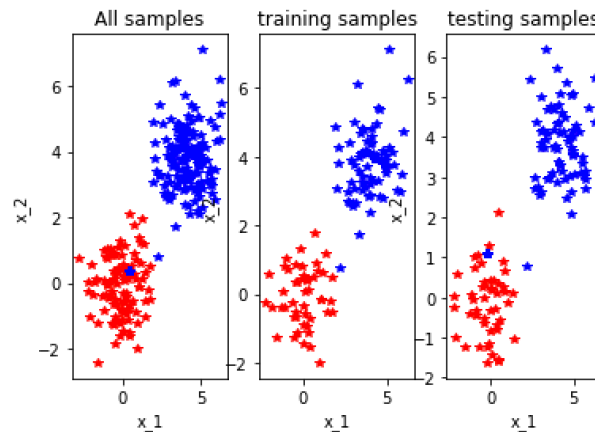


Kosuke Takahashi
 Liu
 CS596
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Homework Assignment 3 Write-up

Problem I. Logistic Regression



Using Gradient Descent:

Gradient Descent:

	precision	recall	f1-score	support
0.0	1.00	0.60	0.75	48
1.0	0.79	1.00	0.88	72
accuracy			0.84	120
macro avg	0.90	0.80	0.82	120
weighted avg	0.87	0.84	0.83	120

Gradient Descent Average Error: 0.4483333333333333 (0.4973233913215379)

Using sklearn:

sklearn:

	precision	recall	f1-score	support
0.0	1.00	1.00	1.00	48
1.0	1.00	1.00	1.00	72
accuracy			1.00	120
macro avg	1.00	1.00	1.00	120
weighted avg	1.00	1.00	1.00	120

sklearn Average Error: 0.48 (0.49959983987187184)

For placeholder #2, when using the sklearn method or the GD method there was a performance difference. The sklearn method processed extremely faster while the GD method took longer.

I used the following line in python to create these numerical results:

```
from sklearn.metrics import classification_report
```

Problem II. Confusion Matrix

The algorithm had 7 correct predictions where the Predicted class matched the True class in a data set of 20 tests.

$$\text{Accuracy} = (\# \text{ of correct predictions} / \# \text{ of predictions}) * 100$$

$$\text{accuracy} = (7/20) * 100 = 35\%$$

The precision of this animal class trained classifier was 35%. Looking at the results of the graph we can see:

Predicted Class	True Class		
	Cats	Dogs	Monkeys
Cats	1	3	2
Dogs	3	3	2
Monkeys	1	2	3

Cat recall: $\text{True_Positive} / \text{True_Positive} + \text{False_Negative} = 1/5 = 20\%$
 Cat precision: $\text{True_Positive} / \text{True_Positive} + \text{True_Negative} = 1/6 = 16.67\%$
 Dog recall = $3/8 = 37.5\%$
 Dog precision = $3/8 = 37.5\%$
 Monkey recall = $3/7 = 42.86\%$
 Monkey precision = $3/6 = 50\%$

Problem III. Comparative Studies

Using Gradient Descent:

Gradient Descent Confusion Matrix

```
[[29 19]
 [ 0 72]]
```

Using sklearn:

sklearn Confusion Matrix

```
[[48  0]
 [ 0 72]]
```