Homework 5 Austin Frownfelter

# Problem 1

## (D)

The training and test misclassification errors were 0.2988 and 0.2722, respectively.

|  |  |  |
| --- | --- | --- |
| Predict\Target (Train) | 1 | 0 |
| 1 | 118 | 42 |
| 0 | 82 | 297 |

|  |  |  |
| --- | --- | --- |
| Predict\Target (Test) | 1 | 0 |
| 1 | 46 | 27 |
| 0 | 22 | 134 |

Sensitivity (test): 0.6765

Specificity (test): 0.8323

## (E)

For the schedule, the gradient would converge after 30,000 epochs. For a schedule, it converged after only ~200 epochs. The initial starting weights of all 1’s and weights of all 0’s converged in the same time. Even starting weights of 100’s and -100’s converged in the same time. In all cases, the convergence point was with a test misclassification error of 0.2722 and training error of 0.2988.

# Problem 2

Note: I will preface this section by saying I did not do the Naïve Bayes classification properly (as will be explained in Problem 3). I understand the concept of Naïve Bayes classification, but did not understand these implementation details.

## 2.1

### (B)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Class 0 | Exp | Normal | Normal | Normal | Exp | Normal | Exp | Exp |
| Class 1 | Exp | Normal | Normal | Normal | Normal | Normal | Exp | Normal |

## 2.2

### (B)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Normal |  |  |  |  |  |  | Exp |  |  |
| 0 | Mu | Sigma | Muci lower | Muci upper | sci lower | sci upper | 0 | Muhat | Muci lower | Muci Upper |
| 2 | 109.98 | 26.1412 | 107.6831 | 112.2769 | 24.6152 | 27.8705 | 1 | 3.298 | 3.027 | 3.6073 |
| 3 | 68.184 | 18.0631 | 66.5969 | 69.7711 | 17.0086 | 19.258 | 5 | 68.792 | 63.1391 | 75.2436 |
| 4 | 19.664 | 14.8899 | 18.3557 | 20.9723 | 14.0207 | 15.8749 | 7 | 0.4297 | 0.3944 | 0.47 |
| 6 | 30.3042 | 7.6899 | 29.6285 | 30.9799 | 7.2409 | 8.1986 | 8 | 31.19 | 28.627 | 34.1151 |
| 1 |  |  |  |  |  |  | 1 |  |  |  |
| 2 | 141.2575 | 31.9396 | 137.4161 | 145.0988 | 29.4451 | 34.8995 | 1 | 4.8657 | 4.3319 | 5.5051 |
| 3 | 70.8246 | 21.4918 | 68.2398 | 73.4094 | 19.8133 | 23.4835 | 5 | 100.3358 | 89.3289 | 113.5215 |
| 4 | 22.1642 | 17.6797 | 20.0379 | 24.2905 | 16.2989 | 19.3181 | 7 | 0.5505 | 0.4901 | 0.6228 |
| 6 | 35.1425 | 7.263 | 34.269 | 36.016 | 6.6957 | 7.936 | 8 | 37.0672 | 33.0009 | 41.9384 |

## 2.3

### (A)

The Training and Testing misclassification errors were 0.5356 and 0.6241, respectively.

The confusion matrices were as follows (Train|Test):

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Predict\Target | 1 | 0 |  | 1 | 0 |
| 1 | 168 | 156 |  | 59 | 79 |
| 0 | 32 | 183 |  | 9 | 82 |

### (B)

Misclassification and confusion matrices are in 2.3(a). The Sensitivity and Specificity for the test set was 0.8676 and 0.5093, respectively.

### (C)

Since I (presumably) implemented the Naïve Bayes classifier incorrectly, the Logistic regression model performed better. I was able to get a misclassification error of 0.2988 and 0.2722 for Training and Testing, respectively, as opposed to the abysmal 0.5356 and 0.6241 from my Naïve Bayes.

# Problem 3

## (C)

## C:\Users\frown\AppData\Local\Microsoft\Windows\INetCache\Content.Word\ROC_log.pngC:\Users\frown\AppData\Local\Microsoft\Windows\INetCache\Content.Word\ROC_NB.PNG

The AUCs were 0.8518 and 0.4450 for Logistic and Naïve Bayes, respectively. Since I (presumably) implemented NB incorrectly, the ROC curve is worse than random guessing. Just by looking at the graphs, you can see the Logistic ROC is better by far. The AUC’s show this as well, with Logistic having 0.8518, miles ahead of the 0.4450 for NB. In this case, the Logistic model is better, though this may not necessarily be the actual case if NB is implemented properly.