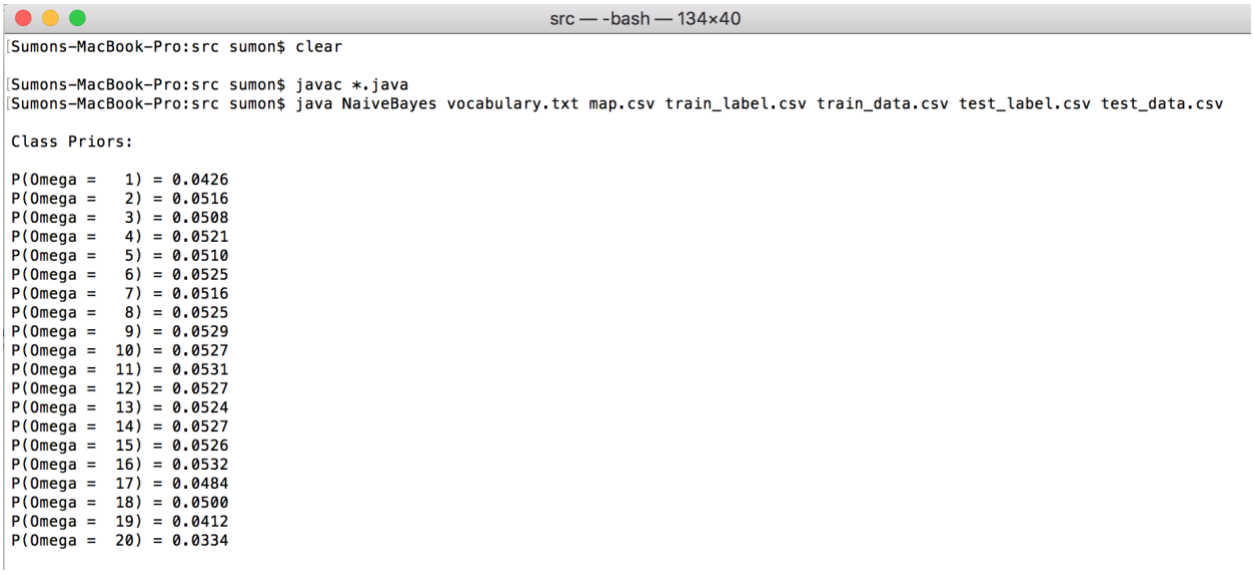
Class Priors:



In our result P_{BE} is always greater than P_{MLE}. Because when we calculate P_{MLE}, only one word with zero occurrence can make the whole posterior to zero. Therefore, often it can not provide the correct result. In case of P_{BE} , we counter this by adding 1 with the number of occurrences.

Performance on Training Data:

In our result, we the overall accuracy on training data is more than accuracy on the test data. For training data it is about 94% and in case of test data is about 78%.

First, we use Bayesian Estimator to measure the performance. Later we also used Maximum Likelihood to measure. The performance using BE on training data is shown below:

src — -bash — 134×40

```
Overall Accuracy for Training Data = 0.9411

Class Accuracy for Training Data:

Group  1 = 0.9667
Group  2 = 0.9191
Group  3 = 0.8794
Group  4 = 0.9302
Group  5 = 0.9409
Group  6 = 0.9493
Group  7 = 0.7749
Group  8 = 0.9662
Group  9 = 0.9631
Group 10 = 0.9714
Group 11 = 0.9783
Group 12 = 0.9798
Group 13 = 0.9239
Group 14 = 0.9764
Group 15 = 0.9781
Group 16 = 0.9833
Group 17 = 0.9853
Group 18 = 0.9681
Group 19 = 0.9698
Group 20 = 0.7606
```

src — -bash — 134×44

```
Confusion Matrix for Training Data:

  464     0     0     0     0     0     0     0     0     0     1     0     0     0     0    11     0     1     1     2
    1   534     6    15     1     9     2     0     1     0     0     2     1     1     2     4     0     0     2     0
    1    10   503    23     1    20     2     0     0     0     0     7     1     1     0     2     0     0     1     0
    0    10     4   546     4     4     6     2     0     0     0     0     3     0     1     2     0     2     2     1
    2     5     2     7   541     3     1     0     2     0     0     2     1     2     2     3     0     1     1     0
    0    11     8     1     2   562     0     0     1     1     0     2     0     1     1     0     1     0     1     0
    2     3     2    34     6     2   451    17     1     3     3    16    15     5     4     5     5     1     7     0
    1     0     0     3     1     2     3   572     1     1     0     1     0     0     0     1     1     1     3     1
    0     1     0     1     1     0     4     1   574     0     0     0     0     2     0     2     6     1     3     0
    0     3     0     1     0     1     1     3     0   577     4     0     0     1     0     1     2     0     0     0
    1     0     1     2     0     1     0     2     0     0   585     1     0     0     0     1     0     2     2     0
    0     2     0     0     0     0     0     0     0     0     0   582     0     1     0     0     3     1     5     0
    1     4     0    15     5     0     3     2     0     0     1     5   546     2     2     1     2     0     2     0
    0     1     0     0     0     1     0     1     0     0     0     1     2   580     0     5     2     0     1     0
    2     2     0     1     0     1     0     1     0     0     0     1     0     2   580     1     0     0     2     0
    0     0     0     2     0     1     0     0     0     0     1     0     0     0     0   589     1     3     2     0
    0     0     0     0     0     0     0     1     0     0     0     0     0     0     0     2   537     2     3     0
    1     1     0     0     0     0     0     0     0     1     1     1     0     2     0     6     0   546     5     0
    2     2     0     0     0     0     0     0     0     1     0     3     0     1     0     1     2     2   450     0
   25     0     0     0     0     0     0     0     2     0     0     0     0     0     1    39    15     4     4   286
```

Performance using BE on test data is shown below:

src — -bash — 134×44

```
Overall Accuracy for Test Data = 0.7811

Class Accuracy for Test Data:

Group  1 = 0.7390
Group  2 = 0.7609
Group  3 = 0.5294
Group  4 = 0.7781
Group  5 = 0.7128
Group  6 = 0.7846
Group  7 = 0.5916
Group  8 = 0.9013
Group  9 = 0.8892
Group 10 = 0.8690
Group 11 = 0.9549
Group 12 = 0.9139
Group 13 = 0.6590
Group 14 = 0.8244
Group 15 = 0.8546
Group 16 = 0.9472
Group 17 = 0.8929
Group 18 = 0.8644
Group 19 = 0.5935
Group 20 = 0.3546
```

src — -bash — 134×44

```
Confusion Matrix for Test Data:

  235     0     0     0     0     1     0     0     0     0     1     1     1     2     3    45     3    10     7     9
    3   296     6    12     7    22     1     3     2     0     0    17     4     4     7     4     0     0     1     0
    3    33   207    58    11    31     0     2     2     2     1    17     1     4     4     5     0     0     9     1
    0     8    15   305    21     2     4     6     0     0     1     6    23     0     1     0     0     0     0     0
    0     8    10    37   273     3     4     4     1     1     0     6    17     8     2     0     3     0     6     0
    0    42     7    10     2   306     1     0     2     1     0    10     0     0     3     2     1     1     2     0
    0     8     4    50    20     1   226    33     5     0     1     3    11     2     3     4     2     3     6     0
    1     1     0     2     0     1     5   356     4     2     0     1     4     0     2     1     4     2     9     0
    0     1     0     0     0     0     0    26   353     2     0     1     1     1     0     1     4     2     5     0
    4     1     0     1     1     2     3     3     1   345    17     2     2     0     0     3     1     2     9     0
    2     0     0     0     0     0     1     1     0     4   381     1     0     2     1     2     0     1     3     0
    0     4     1     1     2     1     1     0     0     0     0   361     3     2     0     2     8     0     8     1
    2    18     0    27     8     3     1    10     2     0     0    46   259     6     3     6     0     2     0     0
   10     7     1     3     0     0     0     4     0     1     0     1     3   324     3    17     3     6    10     0
    3     7     0     0     0     2     0     0     1     0     1     4     4     4   335     5     1     2    22     1
    7     2     1     0     1     2     0     0     0     0     0     1     0     1     0   377     2     2     1     1
    1     0     0     0     1     0     1     2     1     1     1     3     0     1     2     3   325     2    16     4
   12     1     0     0     0     0     0     2     1     1     1     4     0     0     0     8     3   325    18     0
    6     1     0     0     0     1     0     1     0     0     0     3     0     3     7     3    95     5   184     1
   47     3     0     0     0     0     0     0     1     0     0     1     0     3     5    70    19     5     8    89
```

When we use MLE the performance dropped significantly. The overall accuracy it gives is only 12%. The reason is that for a given class only one word with zero count can make the whole posterior to zero. The performance when we use MLE is given by:

src — -bash — 134×44

```
Overall Accuracy for Test Data using MLE = 0.1233

Class Accuracy for Test Data using MLE:

Group  1 = 0.6667
Group  2 = 0.0308
Group  3 = 0.0307
Group  4 = 0.0536
Group  5 = 0.1567
Group  6 = 0.1564
Group  7 = 0.1728
Group  8 = 0.0228
Group  9 = 0.0907
Group 10 = 0.0277
Group 11 = 0.2506
Group 12 = 0.1089
Group 13 = 0.1196
Group 14 = 0.0509
Group 15 = 0.1429
Group 16 = 0.0729
Group 17 = 0.0522
Group 18 = 0.0532
Group 19 = 0.0710
Group 20 = 0.2749
```

src — -bash — 134×44

```
Confusion Matrix for Test Data using MLE:

  212    2    7    3    1    2    1    1    2    3    1    4    0    1    2   11    3    3    3   56

  246   12   15   10    8   17   11    5    2    5    4    7    9    6    9    7    3   10    2    1

  245    0   12   10   27   12   13    8    7    2    4    5    5   12   10    7    4    1    3    4

  214    0    1   21   45    9   23   10    9    6    2    6   16    8    6    5    3    3    4    1

  223    0    0    0   60    7    7   12    8    7    4    4   13    8   11    3    6    0    4    6

  247    0    1    1    0   61   12    8    5    5    9    6    8    6    7    2    1    6    3    2

  183    0    0    2    2    0   66   21   16   14   10    5   14    8   11    9    3    8    7    3

  269    1    0    0    0    0    0    9   37   19    3    1    6    9   14    3    6    6    6    6

  244    0    0    0    0    0    0    0   36   30   15    5    8   10    8    7   13   12    6    3

  272    0    0    0    0    0    0    1    0   11   53    5    4    8    5    8    7    8   13    2

  252    0    0    0    0    0    0    0    0    0  100    6    3   10    4    5    2   10    3    4

  234    1    0    0    2    0    0    0    0    1    0   43   18   12    7    4   23   10   17   23

  264    2    1    0    4    1    3    4    1    1    1    1   47   13   23   11    5    2    2    7

  320    0    0    0    0    0    1    1    0    0    1    0    0   20    6    9   10    9    9    7

  276    0    0    0    0    0    0    0    0    0    0    0    1    0   56   19    4   12   17    7

  255    1    1    1    0    0    1    0    0    0    0    0    0    1    0   29    4    8    2   95

  257    0    0    0    0    0    0    0    0    0    0    1    0    0    0    0   19   11   27   49

  299    0    0    0    0    0    0    0    0    0    0    0    0    0    1    1    1   20   23   31

  219    0    0    0    0    0    0    0    0    0    1    0    0    0    1    0    1    2   22   64

  169    1    1    0    0    0    1    0    0    0    0    0    0    0    1    6    1    0    2   69
```