# Naive Bayesian Classifier:

1. Observation of MLE vs BE values:

Here are some sample of MLE vs BE values:

PMLE8.735854635378867E-5 PBE6.666666666666667E-5

PMLE4.23352955406822E-4 PBE3.0476190476190474E-4

PMLE0.0018479692497916835 PBE0.0013142857142857142

PMLE6.0478993629546005E-5 PBE4.761904761904762E-5

PMLE1.0751821089697067E-4 PBE8.095238095238095E-5

PMLE1.2095798725909201E-4 PBE9.047619047619048E-5

PMLE2.755154154234874E-4 PBE2.0E-4

PMLE0.0 PBE5.546803931574627E-6

* One main observation we can make is that MLE have 0.0 values possible. It is one of the main factors that ruins the performance using MLE. BE does not have 0.0 values
* We observe that the probability values are very small and range between 10^-4 to 10^-6
* The small probabilities are because the data being distributed such that a document only has a small fraction of the total vocabulary of words
* The non-null MLE and BE values are somewhat similar

1. Performance of Training Data vs Testing Data:

* We observe that performance over training data(44%) was better than performance over testing data(37%)
* This occurs because of greater the model is fitted over the training data and adjusts its parameters for a best fit.
* We also observe most of the documents either get sorted in class 1 or the correct class.
* This is because it is easy to have argument Value for w1 greater than default max value (-99999999) but only to find a value greater than w1 depends on how well the model is trained
* To get more accuracy the model should be trained over more documents

1. Classification using MLE vs BE:

* Bayesian Estimate gives a higher accuracy than Max Likelihood estimate.
* This is because for a word that does not occur in any document of a given class the MLE value is 0. This makes the cumulative value of product of MLEs for every word also 0. This makes the final argument value as the prior value only and the document gets classified into whichever class has greatest prior.
* Bayesian Estimate has a value of 1/n+|Vocab| for such vales which disallows the wrong classification.