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Machine Learning 446

Winter 2014

Homework 3

**2.2 Naïve Bayes Classifier**

To run my code: run the NiaveBayesClassifier.java file with a parameter given.

The code works as follows: first it learns on the training set. To do this, it calculates the percentage of spam emails out of the whole training set. This is totalCount.pSpam. Also, out of all the words in the emails, it makes a wordMap<String, WordCount>. WordCount calculates the probability of a given word in spam and non spam email. This is used for probability (word | spam) and p(word|not spam). For example:

P(word | spam) = 

For the testing set: a new example email is spam if the probability that it is spam is greater than the probability that it is ham. The probability that it is spam is calculated by the prior probability of spam (totalCount.pSpam) multiplied by the product of (for each of the email’s words) p(word|spam). If a word occurs more than once, each occurrence is factored in.

The accuracy is the number of emails that the classifier correctly predicts if they are spam or not.

I obtained an accuracy of 90.2%

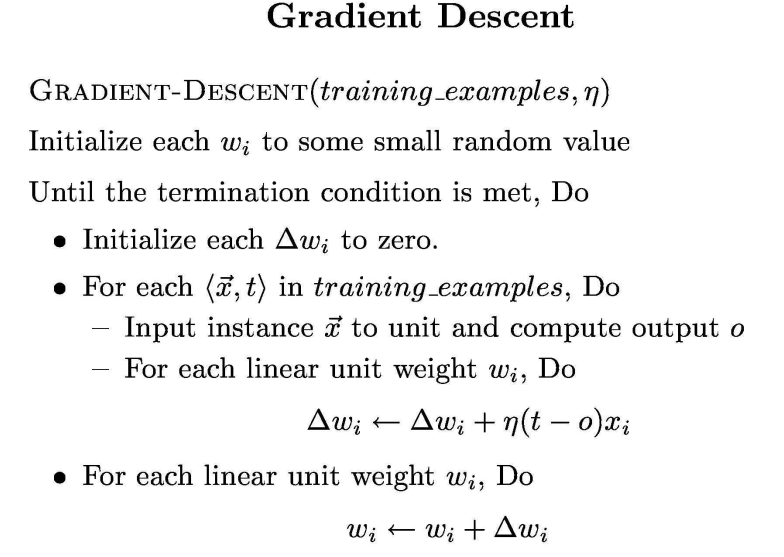
2.3 I implemented the smoothing parameter, as described above it is the alpha value. The most effective was when alpha equal to 10, however this was based on the test data, so this may well be a case of over fitting to the test data. It would be better if I split the test data up to also include a verification set, and then tested to find the optimal parameter.

|  |  |
| --- | --- |
| Parameter | Accuracy on Given Test Data |
| .5 | .902 |
| 1.0 | .902 |
| 10.0 | .904 |
| 100.0 | .904 |
| 500.0 | .881 |

**Problem 2: Textbook problems re: Neural Networks**

**MITCHELL, 4.5**

The gradient descent algorithm should be implemented as in the course lecture slides on Nueral Networks, slide 15, however a different formula for ∆wi should be used.



∆wi should be equal to –ŋ () as before, but a different value should be used for.

 should be derived as follows

 = 

 =  where  is the o given in problem 4.5, see next page

= 

 = 

 = 

 refers to the equation given in the problem:

This can be rewritten as 

Thus, the derivative of this with respect to weight i, for any  is 

Since only the i terms remain after taking the derivative with repsect to weight i.

This is used in my work on the previous page.

**MITCHELL, 4.10**

This can be implemented by multiplying each weight by the constant (1-2γŋ) upon each iteration.