**Lab 1 Report**

# Introduction

The program is a sentiment training and predicting program, based on 2000 doc- uments data (1000 for positive, 1000 for negative) and using 1600 documents to get training and 400 documents to get testing. N-Gram model has been applied in the program, more specifically, in the program, Uni-gram, Bi-gram, Tri-gram have been achieved. To run the program with different kinds of N-Gram model, by typing in the optional parameters following the execution command, i.e.

*python l a b 1 . py r e v i e w p o la r i t y −t [ o p t i o n ]*

The option could be unigram,bigram,trigram. Missing the optional parameter, all the approach would be adopted.

# Implementation

* Training the data adopted the binary perceptron approach.
* The max number of iteration was set to 10. Before each iteration, the row of training data would be random, but in order to make the results to be reproducible I set the seed for random function permutation and update the seed by using the number of iteration.
* The graphs of the multiple passing over the training data will show when the program are running.
* After all iteration, the weight would be taken the average for all document.
* The most positively-weighted feature would be selected and printed in the console.

# Evaluation

When the program is running, all the process would be recorded including the cost, the size of the feature and the error. The error, here, means the difference between the prediction label and the training data label. First of all, the cost of three approaches are totally different, showing as the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type** | **Extracting feature** | **Building matrix** | **Training** | **Number of features** |
| Uni-gram | 0.54s | 12.70s | 15.12s | 39588 |
| Bi-gram | 1.76s | 174.02s | 192.41s | 497761 |
| Tri-gram | 4.66s | 306.87s | 941.20s | 820398 |

Obviously, Uni-gram is the most time saving, comparing with other two approaches, because it has the smallest number of feature that could save time on building matrix and training. The number of feature increase sharply form Uni-gram to Tri-gram because of has low probability of the same phrase or word group occurring in the all documents.

Secondly, applying the evaluation mentioned on the class on the results, we could get the comparison of precision and recall among the three results, and it is showing as the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type** | **TruePositive** | **TrueNegative** | **Precision** | **Recall** |
| Uni-gram | 169 | 169 | 0.84 | 0.84 |
| Bi-gram | 170 | 153 | 0.85 | 0.78 |
| Tri-gram | 151 | 150 | 0.76 | 0.75 |

Three kinds of approaches have similar precision and recall, only Tri-gram per- formed poorly. I think the reason might be that the scale of training data is not large enough. Many phrases in the training data might occur only one time. So, in this case, only Uni-gram preforms well.

Thirdly, the top 10 positively-weighted features would be printed when run the program, showing in the table below. Most of the results are appropriate.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Uni-Gram** | | **Bi-Gram** | | **Tri-Gram** | |
| **Positive** | **Negative** | **Positive** | **Negative** | **Positive** | **Negative** |
| great | bad | the best | the worst | of the best | of the worst |
| jackie | worst | star wars | supposed to | to take the | could have been |
| quite | why | is very | have been | boogie nights is | mission to mars |
| seen | only | more than | should have | my best friend's | the first movie |
| most | nothing | starship troopers | the only | a good job | supposed to be |
| also | plot | is also | but the | the devil's advocate | have been a |
| best | any | the world | and then | american history x | the only thing |
| fun | script | he is | a bad | the life of | a bad movie |
| see | boring | that will | to show | but it does | is supposed to |
| will | unfortunately | in their | the filmmakers | of the series | the king and |

However, if we want use these words to predict another new domain, it would be ok, but the results would be poor, because some of the high weight terms have the special meaning for the present domain and it cannot be applied on other domains. The better features for new domain, I think, would be the common words that do not involve the character of the domain.