IST736 Text Mining
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Shivangi Mundhra
SUID - 842548148

HW_2 MNB and SVM for Fake Review Detection

We created 4 models in all -

1. MNB model for sentiment analysis using count vectorizer
2. SVM model for sentiment analysis using count vectorizer
3. MNB model for authenticity analysis using Boolean vectorizer
4. SVM model for authenticity analysis using Boolean vectorizer

1. Describe best choices of vectorization and why.

Sentiment

For sentiment prediction, I used the unigram, non-Boolean CountVectorizer with minimum document frequency of 5. This seemed like an obvious choice given that Multinomial Naïve Bayes analysis uses frequency of words and count vectorizer will help us identify word frequency. The Support Vector Machine model should also work well with this vectorizer.

Authenticity

For authenticity prediction, I used the unigram, Boolean vectorizer with minimum document frequency of 5. I tried this because Professor had mentioned that Boolean vectorizer might give better results, especially, for smaller datasets. This data seemed small enough.

2. Describe top 10 features for each category in each task.

	MNB				SVM			
	Sentiment		Authenticity		Sentiment		Authenticity	
Rank	positive	negative	TRUE	FALSE	positive	negative	TRUE	FALSE
1	amazing	terrible	bar	want'	best	cold	chicken	want
2	best	asked	environment	cold	need	dishes	good	delicious
3	fresh	took	people	said	friendly	service	bar	cold
4	friendly	came	good	staff	nice	said	ask	high
5	great	said	life	delicious	delicious	went	came	meal
6	prices	minutes	time	worth	fresh	meal	amazing	worth
7	nice	bad	bad	waiters	great	asked	bad	said
8	need	wasn	nice	sauce	waiters	ny	overall	definitely
9	delicious	cold	waitress	meal	environment'	minutes	dish	dining
10	sauce	dine	ask	high	ask	restaurant	ordered	sauce

3. Describe each model's performance in accuracy, precision, recall and F-measure.

Sentiment – MNB

	precision	recall	f1-score	support
0	1.00	0.82	0.90	11
1	0.80	1.00	0.89	8
accuracy			0.89	19
macro avg	0.90	0.91	0.89	19
weighted avg	0.92	0.89	0.90	19

As we can see, the precision in predicting negative examples is 1 as the model predicted all negative ones correctly. The model mistakenly predicted 2 positive ones as negative which is why the precision for positive examples is 0.8 (8/10). As we can see the recall for negative words is 0.82 and for positive is 1. The f1-score for negative is 0.90 and for positive is 0.89. The model's overall accuracy is 89%.

Authenticity – MNB

	precision	recall	f1-score	support
0	0.50	0.70	0.58	10
1	0.40	0.22	0.29	9
accuracy			0.47	19
macro avg	0.45	0.46	0.43	19
weighted avg	0.45	0.47	0.44	19

As we can see, the precision in predicting true examples is 0.5 as the model predicted 50% of them correctly. The precision for predicting false examples is 0.4. the recall for true is 0.70 and for false is 0.22. f1-score for true is 0.58 and for positive is 0.29. The model's overall accuracy is 47%.

Sentiment – SVM

	precision	recall	f1-score	support
0	0.77	0.91	0.83	11
1	0.83	0.62	0.71	8
accuracy			0.79	19
macro avg	0.80	0.77	0.77	19
weighted avg	0.80	0.79	0.78	19

This model predicted the positive words with 77% precision as it predicted 10 correctly and 3 incorrectly. It predicted the negative words with accuracy of 83% as it predicted 5 correctly. Recall for positive words is 91% and negative words is 62%. The f1-score for positive is 0.83 and negative is 0.71. The model's overall accuracy is 79%.

Authenticity – SVM

The model's classification report is as below.

	precision	recall	f1-score	support
0	0.42	0.50	0.45	10
1	0.29	0.22	0.25	9
accuracy			0.37	19
macro avg	0.35	0.36	0.35	19
weighted avg	0.35	0.37	0.36	19

The model's overall accuracy is only 37%. It predicted false words with 42% precision and true words with 29% precision. The recall for false and true words is 50% and 22% respectively. The f1-score is 0.45 and 0.25 respectively. The overall accuracy for both sentiment and authenticity is higher in MNB models as compared to SVM models.

4. Describe each model's error analysis to identify areas for improvement

Sentiment – MNB

For error analysis, we print out the examples that were predicted as positive when they were negative and vice versa. From the confusion matrix, we see that we should have 0 positive examples that are predicted as negative and 2 negative examples that are predicted as positive.

Authenticity – MNB

For error analysis, we print out the examples that were predicted as true when they were false and vice versa. From the confusion matrix, we see that we should have 3 false examples that are predicted as true and 7 true examples that are predicted as false.

Sentiment – SVM

For error analysis, we print out the examples that were predicted as positive when they were negative and vice versa. From the confusion matrix, we see that we should have 3 positive examples that are predicted as negative and 1 negative example that are predicted as positive.

Authenticity – SVM

For error analysis, we print out the examples that were predicted as true when they were false and vice versa. From the confusion matrix, we see that we should have 5 false examples that are predicted as true and 7 true examples that are predicted as false.

5. Describe a comparison of the difficulty in sentiment classification vs. fake review classification

A reviews sentiment can be predicted relatively easily as compared to its authenticity. This is because we can more accurately classify words or tokens in positive and negative words. However, it seems illogical to classify tokens in true and false words. The same words that are used in a true review can be used in a fake review.