COL774 Assignment 2

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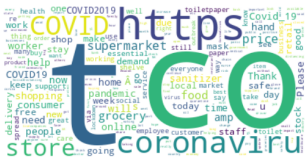
1 Naive Bayes

(a) Naive Bayes was implemented using Multinoulli model.

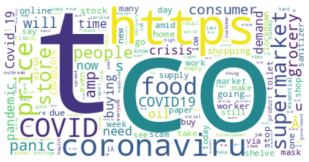
i.
- Accuracy in training set = 85.05%
- Accuracy in validation set = 67.05%

ii. Word clouds for each class:



Positive

Neutral



Negative

(b) For random guessing, accuracy obtained was 32.13 %, which is close to expected value of 33.33%. For always predicting positive, the accuracy is 43.85%, which would just simply show the percentage of positive tweets in the test data.

The Part a) of Naive Bayes gives 109% improvement over random guessing, and gives 52.91% gain over always predicting positive.

(c)
- The confusion matrices for training set are as follows:

NaiveBayes

	AP	ANu	AN
PP	15711	2158	1078
PNu	177	3574	171
PN	714	1364	12917

Random

	AP	ANu	AN
PP	5582	2381	4702
PNu	5464	2372	4727
PN	5556	2343	4737

All Positive

	AP	ANu	AN
PP	16602	7096	14166
PNu	0	0	0
PN	0	0	0

- The confusion matrices for validation set are as follows:

NaiveBayes

	AP	ANu	AN
PP	1197	338	305
PNu	21	101	17
PN	226	178	910

Random

	AP	ANu	AN
PP	471	200	410
PNu	514	213	417
PN	459	204	405

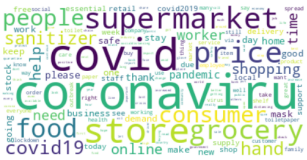
All Positive

	AP	ANu	AN
PP	1444	617	1232
PNu	0	0	0
PN	0	0	0

We can show that the Naive Bayes classifier has much higher accuracy than random guessing or constant classification.

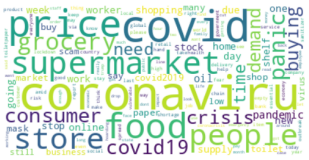
(d) The following transformations were done in order:

- Convert HTML references to unicode, i.e. convert "&" to &, "<" to < etc.
- convert to lowercase.
- remove non-ascii characters.
- remove links and @tags.
- Tokenize to extract only alphanumeric and ' values.
- remove stopwords.
- Lemmatize.



Positive

Neutral



Negative

The output accuracy produced was:

- Naive Bayes prediction accuracy with stemming = 69.85%
- Naive Bayes prediction accuracy with lemmatizing = 70.91%

Observations:

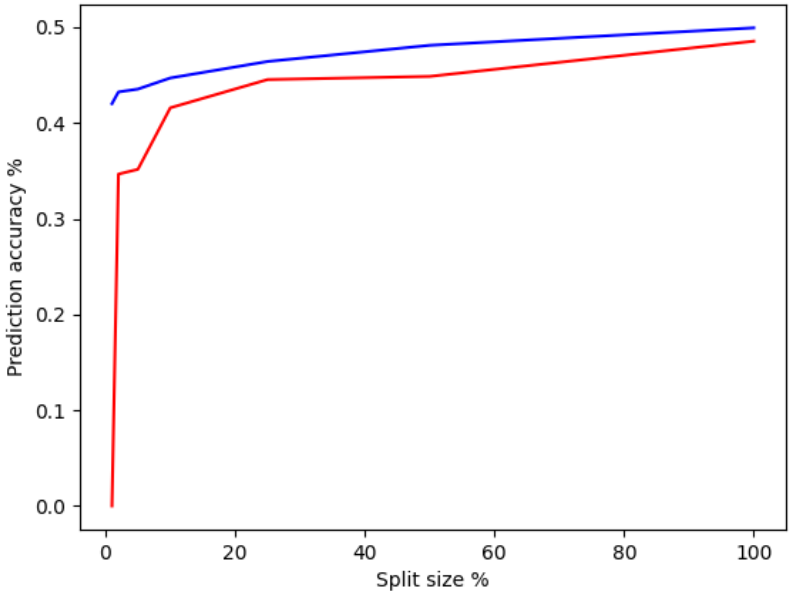
- Accuracy increased because after cleaning there is lesser noise in the data.
- Lemmatizing seems to have better accuracy and performance over stemming.

(e) Bigrams has not been implemented:

(f) Using Domain adaptation the following results were obtained:

- For size 1
- combined with corona tweets:
- Accuracy:0.43240556660039764
- Without corona tweets
- Accuracy:0.3465871438038436
- For size 2
- combined with corona tweets:
- Accuracy:0.43538767395626243
- Without corona tweets
- Accuracy:0.35155732273028495
- For size 5
- combined with corona tweets:
- Accuracy:0.4469847581179589
- Without corona tweets
- Accuracy:0.41583830351225975
- For size 10
- combined with corona tweets:
- Accuracy:0.46421471172962225
- Without corona tweets
- Accuracy:0.44532803180914515
- For size 25
- combined with corona tweets:
- Accuracy:0.48111332007952284
- Without corona tweets
- Accuracy:0.4486414844267727
- For size 50
- combined with corona tweets:
- Accuracy:0.4993373094764745
- Without corona tweets
- Accuracy:0.4854208084824387

i. The obtained graph is as follows:


0.5
0.4
0.3
0.2
0.1
0.0
Prediction accuracy %
0
20
40
60
80
100
Split size %

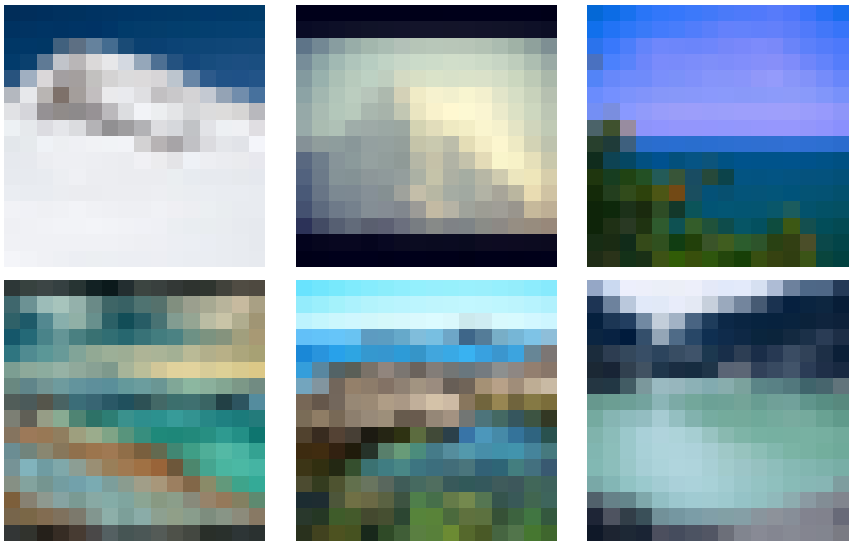
2 Binary SVM

(a) i. For linear kernel, datasets 3 and 4,

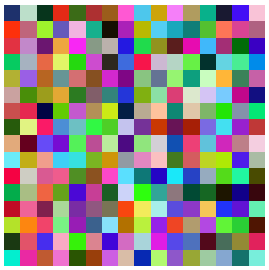
- No of support vectors: 3066 out of 4760
- % of support vectors wrt training examples: 64.41%

ii. The test accuracy we obtain is 71.00%

iii. The top 6 support vectors are:



The weight image obtained is:

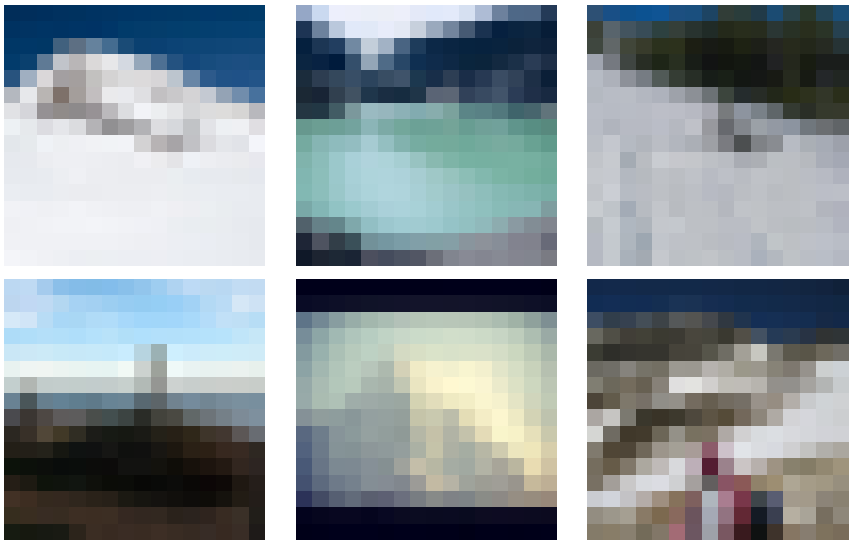


(b) i. For gaussian kernel, datasets 3 and 4,

- No of support vectors: 3682 out of 4760
- % of support vectors wrt training examples: 77.35%
- No of common support vectors between linear and gaussian: 2895

ii. The test accuracy we obtain is 76.25%

iii. The top 6 support vectors are:



iv. We can observer that gaussian kernel can get slightly more accuracy than linear kernel.

(c) i. Number of Support Vectors obtained, using sklearn's SVC:

- Linear Kernel: 2942, and 2942 SVs in common with CVXOPT version.
- Gaussian Kernel: 3393, and 3393 SVs in common with CVXOPT version.
- between both linear and gaussian there are 2722 common SVs.

ii. Comparison of weight and bias in linear kernel:

- CVXOPT: b = -0.7401936386523351
- sklearn_svm: b = -0.80421845
- norm(w_cv - w_skl) = 0.01106776175233239

iii. Validation set accuracy is as follows:

- Linear Kernel: sklearn_svm obtains 71.50% accuracy over CVXOPT's 71.00% accuracy
- Gaussian Kernel: sklearn_svm obtains 76.75% accuracy over CVXOPT's 76.25% accuracy

iv. The training times are given below:

Scikit RBF	3.99s
Scikit linear	6.96s
CVXOPT RBF	51.67s
CVXOPT linear	61.28s