32.19.Amazon_food_review_RF

July 1, 2018

1 Amazon food review dataset apply RF to predict polarity review

Data set from https://www.kaggle.com/snap/amazon-fine-food-reviews

2 Objective

Here try BOW,TFIDF,avg W2V, avg TFIDFW2V and different hyperparameter RF(no of base learner) # Import data and libraries

```
In [25]: import sqlite3
         import pandas as pd
         import numpy as np
         import nltk
         import string
         import matplotlib.pyplot as plt
         import seaborn as sns
         from sklearn.feature_extraction.text import TfidfTransformer
         from sklearn.feature_extraction.text import TfidfVectorizer
         from sklearn.feature_extraction.text import CountVectorizer
         from sklearn.metrics import confusion_matrix
         from sklearn import metrics
         from sklearn.metrics import roc_curve, auc
         from nltk.stem.porter import PorterStemmer
         con = sqlite3.connect('database.sqlite')
         #get only +ve and -ve review
         raw_data = pd.read_sql_query("""SELECT * FROM Reviews WHERE Score != 3""", con)
```

3 Data preprocessing

```
In [26]: filtered_data=raw_data
         # Score>3 a positive rating, and score<3 a negative rating.
         def partition(x):
             if x < 3:
                 return 'negative'
             return 'positive'
```

```
#changing reviews with score less than 3 to be positive and vice-versa
actualScore = filtered_data['Score']
positiveNegative = actualScore.map(partition)
filtered_data['Score'] = positiveNegative
#filtered_data.sample(5)
filtered_data['Score'].value_counts()
#Sorting data according to ProductId in ascending order
sorted_data=filtered_data.sort_values('ProductId', axis=0, ascending=True, inplace=Fa
#Deduplication of entries for same profilename,userid, time, text and take first elem
sorted_data=sorted_data.drop_duplicates(subset={"UserId","ProfileName","Time","Text"}
```

In [27]:
```
#take only 2500 + 2500 data
from sklearn.cross_validation import train_test_split,KFold
_ , clean_data = train_test_split(sorted_data, test_size = 40000, random_state=0,strat
clean_data['Score'].value_counts()
```

Out[27]:
```
positive    33727
negative     6273
Name: Score, dtype: int64
```

In [28]:
```
# Clean html tag and punctuation
import re
import string
from nltk.corpus import stopwords
from nltk.stem import PorterStemmer
from nltk.stem.wordnet import WordNetLemmatizer

stop = set(stopwords.words('english')) #set of stopwords
sno = nltk.stem.SnowballStemmer('english') #initialising the snowball stemmer
#substitute html tag and punctuation
def cleanhtml(sentence): #function to clean the word of any html-tags
    cleanr = re.compile('<.*?>')
    cleantext = re.sub(cleanr, ' ', sentence)
    return cleantext
def cleanpunc(sentence): #function to clean the word of any punctuation or special ch
    cleaned = re.sub(r'[?|!|\'|"|#]',r'',sentence)
    cleaned = re.sub(r'[.|,|)|(|\|/]',r' ',cleaned)
    return  cleaned
#print(sno.stem('tasty'))

i=0
str1=' '
final_string=[]
all_positive_words=[] # store words from +ve reviews here
all_negative_words=[] # store words from -ve reviews here.
s=''
#Create new catagory as Cleanedtext after removing htmltag and punctuation and upperc
for sent in clean_data['Text'].values:
```

```
            filtered_sentence=[]
            #print(sent);
            sent=cleanhtml(sent) # remove HTMl tags
            for w in sent.split():
                for cleaned_words in cleanpunc(w).split():
                    if((cleaned_words.isalpha()) & (len(cleaned_words)>2)):
                        if(cleaned_words.lower() not in stop):
                            s=(sno.stem(cleaned_words.lower())).encode('utf8')
                            filtered_sentence.append(s)
                            if (clean_data['Score'].values)[i] == 'positive':
                                all_positive_words.append(s) #list of all words used to descr
                            if(clean_data['Score'].values)[i] == 'negative':
                                all_negative_words.append(s) #list of all words used to descr
                        else:
                            continue
                    else:
                        continue
            str1 = b" ".join(filtered_sentence) #final string of cleaned words

            final_string.append(str1)
            i+=1

        clean_data['CleanedText']=final_string
        clean_data.shape
        #Sort data on timestamp
        clean_data=clean_data.sort_values(by=['Time'],ascending=False)
        clean_data.sample(2)
```

Out[28]:

	Id	ProductId	UserId	ProfileName	\
242151	262623	B003UGZOC0	A1I4M2EYH36A5V	Shannon Joyce	
320453	346891	B003CZG0SG	A1BEHDHARZDIMR	Tammie Sokoloff "Nashira"	

	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time	\
242151	3	3	positive	1322352000	
320453	2	2	positive	1295222400	

	Summary	\
242151	High Quality from Hill's	
320453	THE BEST!!!	

	Text	\
242151	We live in Santiago, Chile and the pickings we...	
320453	This stuff is great, tastes just like sugar an...	

	CleanedText
242151	b'live santiago chile pick slim far qualiti co...
320453	b'stuff great tast like sugar measur like suga...

4 Split train and test data

```
In [29]: x=clean_data['CleanedText'].values
         y = clean_data['Score']
         n=x.shape[0]
         n1=int(n*.3)
         X_test_raw = x[0:n1]
         X_train_raw= x[n1:n+1]
         y_test=y[0:n1]
         y_train=y[n1:n+1]
         print('size of X_train, X_test, y_train , y_test ',X_train_raw.shape, X_test_raw.shape
         print("positive and negative review in train and test\n",y_train.value_counts(),"\n",y
```

```
size of X_train, X_test, y_train , y_test  (28000,) (12000,) (28000,) (12000,)
positive and negative review in train and test
 positive    23774
negative     4226
Name: Score, dtype: int64
 positive    9953
negative    2047
Name: Score, dtype: int64
```

5 Build Random Forest

6 BOW

7 plot accuracy with k value

```
In [19]: #now convert CleanedText to TDM
         count_vect = CountVectorizer() #in scikit-learn
         X_train = count_vect.fit_transform(X_train_raw)

         #use the same vectors to convert test data
         X_test=count_vect.transform(X_test_raw)
         print(X_train.get_shape(),X_test.get_shape())

         #print(final_counts[0,:])# this is stored like dict format only non zero values. spars
         #x = pd.DataFrame(final_counts.toarray())#this is stored like dataframe format all 0
         # sparse matrix in csr format works faster compare to dense format
         #print(x.shape,x.loc[0])# sparse matrix in csr format works faster compare to dense f
         #print(x.shape,x.loc[0])

         # Use RF
         from sklearn.tree import DecisionTreeClassifier
         from sklearn.ensemble import GradientBoostingClassifier,RandomForestClassifier
         #RandomForestClassifier(n_estimators=10)
```

```
from sklearn.grid_search import GridSearchCV

#GradientBoostingClassifier(learning_rate=0.1, n_estimators=100, max_depth=3, random_

n_estimators=[10,50,100]

tuned_parameters=dict(n_estimators=n_estimators)

#Using GridSearchCV
model = GridSearchCV(RandomForestClassifier(), tuned_parameters, cv=5)
model.fit(X_train, y_train)


print('Best parameters \n',model.best_estimator_)
#print('Model test score', model.score(X_test, y_test))

optimumn_estimators=model.best_estimator_.n_estimators

#build model with optimum parameter
model = RandomForestClassifier(n_estimators=optimumn_estimators)
model.fit(X_train, y_train)

#Store scores
pred=model.predict(X_test)
mat=pd.crosstab(y_test, pred, rownames=['Actual'], colnames=['Predicted'], margins=Tru
tp=mat.iloc[1,1] ;tn=mat.iloc[0,0] ;fp=mat.iloc[0,1];fn=mat.iloc[1,0];precision=tp/(tp
recall=tp/(tp+fn);fscoretest=2*precision*recall/(precision+recall)

pred=model.predict(X_train)
mat=pd.crosstab(y_train, pred, rownames=['Actual'], colnames=['Predicted'], margins=Tr
print(mat);tp=mat.iloc[1,1] ;tn=mat.iloc[0,0];fp=mat.iloc[0,1] ;fn=mat.iloc[1,0] ;prec
recall=tp/(tp+fn);fscoretrain=2*precision*recall/(precision+recall)


aa=pd.DataFrame({'type':['BOW RF'],'depth':['na'],'estimator':[optimumn_estimators], '
                 'learningrate':['na'],'accuracy_train':[model.score(X_train,y_train)
                'fscore_train':[fscoretrain],'accuracy_test':[model.score(X_test,y_te
```

```
(28000, 20761) (12000, 20761)
Best parameters
 RandomForestClassifier(bootstrap=True, class_weight=None, criterion='gini',
            max_depth=None, max_features='auto', max_leaf_nodes=None,
            min_impurity_decrease=0.0, min_impurity_split=None,
            min_samples_leaf=1, min_samples_split=2,
            min_weight_fraction_leaf=0.0, n_estimators=50, n_jobs=1,
            oob_score=False, random_state=None, verbose=0,
            warm_start=False)
Predicted  negative  positive    All
```

```
Actual
negative       4225         1   4226
positive          0     23774  23774
All            4225     23775  28000
```

8 TFIDF

```
In [20]: tf_idf_vect = TfidfVectorizer()
         final_counts = tf_idf_vect.fit_transform(X_train_raw)
         #use the same vectors to convert test data
         X_test=count_vect.transform(X_test_raw)

         print(X_train.get_shape(),X_test.get_shape())
         #Use scale of train and apply to test
         from sklearn.preprocessing import StandardScaler
         scaler = StandardScaler(with_mean=False).fit(X_train)
         #X_train = scaler.transform(X_train)
         #X_test  = scaler.transform(X_test)
         print('size of X_train, X_test, y_train , y_test ',X_train.shape, X_test.shape,y_trai


         # Use RF
         from sklearn.tree import DecisionTreeClassifier
         from sklearn.ensemble import GradientBoostingClassifier,RandomForestClassifier
         #RandomForestClassifier(n_estimators=10)
         from sklearn.grid_search import GridSearchCV

         #GradientBoostingClassifier(learning_rate=0.1, n_estimators=100, max_depth=3, random_

         n_estimators=[10,50,100]

         tuned_parameters=dict(n_estimators=n_estimators)

         #Using GridSearchCV
         model = GridSearchCV(RandomForestClassifier(), tuned_parameters, cv=5)
         model.fit(X_train, y_train)


         print('Best parameters \n',model.best_estimator_)
         #print('Model test score', model.score(X_test, y_test))

         optimumn_estimators=model.best_estimator_.n_estimators

         #build model with optimum parameter
         model = RandomForestClassifier(n_estimators=optimumn_estimators)
         model.fit(X_train, y_train)
```

```
        #Store scores
        pred=model.predict(X_test)
        mat=pd.crosstab(y_test, pred, rownames=['Actual'], colnames=['Predicted'], margins=Tru
        tp=mat.iloc[1,1] ;tn=mat.iloc[0,0] ;fp=mat.iloc[0,1];fn=mat.iloc[1,0];precision=tp/(tp
        recall=tp/(tp+fn);fscoretest=2*precision*recall/(precision+recall)

        pred=model.predict(X_train)
        mat=pd.crosstab(y_train, pred, rownames=['Actual'], colnames=['Predicted'], margins=Tr
        print(mat);tp=mat.iloc[1,1] ;tn=mat.iloc[0,0];fp=mat.iloc[0,1] ;fn=mat.iloc[1,0] ;prec
        recall=tp/(tp+fn);fscoretrain=2*precision*recall/(precision+recall)


        bb=pd.DataFrame({'type':['TFIDF RF'],'depth':['na'],'estimator':[optimumn_estimators]
                         'learningrate':['na'],'accuracy_train':[model.score(X_train,y_train)
                        'fscore_train':[fscoretrain],'accuracy_test':[model.score(X_test,y_te
        aa=aa.append(bb)
```

```
(28000, 20761) (12000, 20761)
size of X_train, X_test, y_train , y_test  (28000, 20761) (12000, 20761) (28000,) (12000,)
Best parameters
 RandomForestClassifier(bootstrap=True, class_weight=None, criterion='gini',
            max_depth=None, max_features='auto', max_leaf_nodes=None,
            min_impurity_decrease=0.0, min_impurity_split=None,
            min_samples_leaf=1, min_samples_split=2,
            min_weight_fraction_leaf=0.0, n_estimators=50, n_jobs=1,
            oob_score=False, random_state=None, verbose=0,
            warm_start=False)
Predicted  negative  positive    All
Actual
negative       4222         4   4226
positive          0     23774  23774
All            4222     23778  28000
```

9 AVG W2V

```
In [36]: #ignore warning
         import warnings
         warnings.filterwarnings('ignore')
         from gensim.models import Word2Vec
         from gensim.models import KeyedVectors
         import pickle
         model = KeyedVectors.load_word2vec_format('GoogleNews-vectors-negative300.bin.gz', bi
         import gensim
         i=0
         #create a list of list to be used in W2V
```

```
list_of_sent_train=[]
for sent in X_train_raw:  #clean_data['CleanedText'].values:
    filtered_sentence=[]
    #sent=cleanhtml(sent)
    for w in sent.split():
        #for cleaned_words in cleanpunc(w).split():
         for cleaned_words in w.split():
            if(cleaned_words.isalpha()):
                filtered_sentence.append(cleaned_words.lower().decode('utf8'))
            else:
                continue
    list_of_sent_train.append(filtered_sentence)
#convert each sentence's words to a vector of 50 dimension. Dont construct vec if wor
#and 4 core processor
w2v_model=gensim.models.Word2Vec(list_of_sent_train,min_count=5,size=50, workers=4)

# average Word2Vec
# for each sentence make average of vectors by (vectors of each words)/(total no of w
# compute average word2vec for each review.
sent_vectors_train = []; # the avg-w2v for each sentence/review is stored in this lis
for sent in list_of_sent_train: # for each review/sentence
    sent_vec = np.zeros(50) # as word vectors are of zero length
    cnt_words =0; # num of words with a valid vector in the sentence/review
    for word in sent: # for each word in a review/sentence
        try:
            vec = w2v_model.wv[word]
            sent_vec += vec
            cnt_words += 1
        except:
            pass
    sent_vec /= cnt_words
    sent_vectors_train.append(sent_vec)


#convert W2V test data
i=0
#create a list of list to be used in W2V
list_of_sent_test=[]
for sent in X_test_raw:  #clean_data['CleanedText'].values:
    filtered_sentence=[]
    #sent=cleanhtml(sent)
    for w in sent.split():
        #for cleaned_words in cleanpunc(w).split():
         for cleaned_words in w.split():
            if(cleaned_words.isalpha()):
                filtered_sentence.append(cleaned_words.lower().decode('utf8'))
            else:
                continue
```

```
    list_of_sent_test.append(filtered_sentence)
#convert each sentence's words to a vector of 50 dimension. Dont construct vec if wor
#and 4 core processor
w2v_model=gensim.models.Word2Vec(list_of_sent_test,min_count=5,size=50, workers=4)

# average Word2Vec
# for each sentence make average of vectors by (vectors of each words)/(total no of w
# compute average word2vec for each review.
sent_vectors_test = []; # the avg-w2v for each sentence/review is stored in this list
for sent in list_of_sent_test: # for each review/sentence
    sent_vec = np.zeros(50) # as word vectors are of zero length
    cnt_words =0; # num of words with a valid vector in the sentence/review
    for word in sent: # for each word in a review/sentence
        try:
            vec = w2v_model.wv[word]
            sent_vec += vec
            cnt_words += 1
        except:
            pass
    sent_vec /= cnt_words
    sent_vectors_test.append(sent_vec)

# try
X_train = pd.DataFrame(sent_vectors_train)
X_test = pd.DataFrame(sent_vectors_test)

#X_train = sent_vectors_train
#X_test = sent_vectors_test

#X_train_w2v=X_train
#X_test_w2v=X_test
print('size of X_train, X_test, y_train , y_test ',X_train.shape, X_test.shape,y_trai
#to avoid "ValueError: Input contains NaN, infinity or a value too large for dtype('f
X_test.fillna(X_test.mean())
X_train.fillna(X_train.mean())

X_train=np.nan_to_num(X_train) # replace nan with zero and inf with finite numbers
X_test=np.nan_to_num(X_test) # replace nan with zero and inf with finite numbers

#np.nan_to_num(X_train)
#np.nan_to_num(X_test)


print("Checkinf for NaN and Inf")
print("np.inf=", np.where(np.isnan(X_train)))
print("is.inf=", np.where(np.isinf(X_train)))

n_estimators=[10,50,100]
```

```
        tuned_parameters=dict(n_estimators=n_estimators)
        model = GridSearchCV(RandomForestClassifier(), tuned_parameters, cv=5)
        model.fit(X_train, y_train)
        print('Best parameters \n',model.best_estimator_)
        optimumn_estimators=model.best_estimator_.n_estimators
        #build model with optimum parameter
        model = RandomForestClassifier(n_estimators=optimumn_estimators)
        model.fit(X_train, y_train)
        #Store scores
        pred=model.predict(X_test)
        mat=pd.crosstab(y_test, pred, rownames=['Actual'], colnames=['Predicted'], margins=Tru
        tp=mat.iloc[1,1] ;tn=mat.iloc[0,0] ;fp=mat.iloc[0,1];fn=mat.iloc[1,0];precision=tp/(tp
        recall=tp/(tp+fn);fscoretest=2*precision*recall/(precision+recall)

        pred=model.predict(X_train)
        mat=pd.crosstab(y_train, pred, rownames=['Actual'], colnames=['Predicted'], margins=Tr
        print(mat);tp=mat.iloc[1,1] ;tn=mat.iloc[0,0];fp=mat.iloc[0,1] ;fn=mat.iloc[1,0] ;prec
        recall=tp/(tp+fn);fscoretrain=2*precision*recall/(precision+recall)

        bb=pd.DataFrame({'type':['AVG W2V RF'],'depth':['na'],'estimator':[optimumn_estimators
                         'learningrate':['na'],'accuracy_train':[model.score(X_train,y_train)
                        'fscore_train':[fscoretrain],'accuracy_test':[model.score(X_test,y_te
        aa=aa.append(bb)
```

```
size of X_train, X_test, y_train , y_test  (28000, 50) (12000, 50) (28000,) (12000,)
Checkinf for NaN and Inf
np.inf= (array([], dtype=int64), array([], dtype=int64))
is.inf= (array([], dtype=int64), array([], dtype=int64))
Best parameters
 RandomForestClassifier(bootstrap=True, class_weight=None, criterion='gini',
            max_depth=None, max_features='auto', max_leaf_nodes=None,
            min_impurity_decrease=0.0, min_impurity_split=None,
            min_samples_leaf=1, min_samples_split=2,
            min_weight_fraction_leaf=0.0, n_estimators=100, n_jobs=1,
            oob_score=False, random_state=None, verbose=0,
            warm_start=False)
Predicted  negative  positive    All
Actual
negative       4226         0   4226
positive          0     23774  23774
All            4226     23774  28000
```

10 AVG TFIDF

In [37]:
```
        #ignore warning
        import warnings
```

```
warnings.filterwarnings('ignore')

from gensim.models import Word2Vec
from gensim.models import KeyedVectors
import pickle
model = KeyedVectors.load_word2vec_format('GoogleNews-vectors-negative300.bin.gz', bi
import gensim

tf_idf_vect = TfidfVectorizer()
final_tf_idf=tf_idf_vect.fit_transform(X_train_raw)
tfidf_feat = tf_idf_vect.get_feature_names() # tfidf words/col-names
# final_tf_idf is the sparse matrix with row= sentence, col=word and cell_val = tfidf

tfidf_sent_vectors_train = []; # the tfidf-w2v for each sentence/review is stored in
row=0;
#calculate avg tfidf score for each sentences
for sent in list_of_sent_train: # for each review/sentence
    sent_vec = np.zeros(50) # as word vectors are of zero length
    weight_sum =0; # num of words with a valid vector in the sentence/review
    for word in sent: # for each word in a review/sentence
        try:
            vec = w2v_model.wv[word]#calculate w2v for each word
            # obtain the tf_idfidf of a word in a sentence/review
            tf_idf = final_tf_idf[row, tfidf_feat.index(word)]#get tfidf score of eac
            sent_vec += (vec * tf_idf) # multiply vec with tfidf of each word and cum
            weight_sum += tf_idf # also add tfidf sums in each sentence
        except:
            pass
    sent_vec /= weight_sum
    tfidf_sent_vectors_train.append(sent_vec)
    row += 1
#tfidf_sent_vectors.

# do for test
final_tf_idf=tf_idf_vect.transform(X_test_raw)
tfidf_sent_vectors_test = []; # the tfidf-w2v for each sentence/review is stored in t
row=0;
#calculate avg tfidf score for each sentences
for sent in list_of_sent_test: # for each review/sentence
    sent_vec = np.zeros(50) # as word vectors are of zero length
    weight_sum =0; # num of words with a valid vector in the sentence/review
    for word in sent: # for each word in a review/sentence
        try:
            vec = w2v_model.wv[word]#calculate w2v for each word
            # obtain the tf_idfidf of a word in a sentence/review
            tf_idf = final_tf_idf[row, tfidf_feat.index(word)]#get tfidf score of eac
            sent_vec += (vec * tf_idf) # multiply vec with tfidf of each word and cum
            weight_sum += tf_idf # also add tfidf sums in each sentence
```

```
        except:
            pass
    sent_vec /= weight_sum
    tfidf_sent_vectors_test.append(sent_vec)
    row += 1

#X_train = pd.DataFrame(tfidf_sent_vectors_train)
#X_test = pd.DataFrame(tfidf_sent_vectors_test)

X_train = tfidf_sent_vectors_train
X_test = tfidf_sent_vectors_test

#print('size of X_train, X_test, y_train , y_test ',X_train.shape, X_test.shape,y_tra

#to avoid "ValueError: Input contains NaN, infinity or a value too large for dtype('f
#X_test.fillna(X_test.mean())
#X_train.fillna(X_train.mean())
X_train=np.nan_to_num(X_train) # replace nan with zero and inf with finite numbers
X_test=np.nan_to_num(X_test) # replace nan with zero and inf with finite numbers

#X_train=np.nan_to_num(X_train) # replace nan with zero and inf with finite numbers


n_estimators=[10,50,100]
tuned_parameters=dict(n_estimators=n_estimators)
model = GridSearchCV(RandomForestClassifier(), tuned_parameters, cv=5)
model.fit(X_train, y_train)
print('Best parameters \n',model.best_estimator_)
optimumn_estimators=model.best_estimator_.n_estimators
#build model with optimum parameter
model = RandomForestClassifier(n_estimators=optimumn_estimators)
model.fit(X_train, y_train)
#Store scores
pred=model.predict(X_test)
mat=pd.crosstab(y_test, pred, rownames=['Actual'], colnames=['Predicted'], margins=Tru
tp=mat.iloc[1,1] ;tn=mat.iloc[0,0] ;fp=mat.iloc[0,1];fn=mat.iloc[1,0];precision=tp/(tp
recall=tp/(tp+fn);fscoretest=2*precision*recall/(precision+recall)

pred=model.predict(X_train)
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recall=tp/(tp+fn);fscoretrain=2*precision*recall/(precision+recall)

bb=pd.DataFrame({'type':['AVG W2V RF'],'depth':['na'],'estimator':[optimumn_estimators
                 'learningrate':['na'],'accuracy_train':[model.score(X_train,y_train)
                'fscore_train':[fscoretrain],'accuracy_test':[model.score(X_test,y_te
aa=aa.append(bb)
```

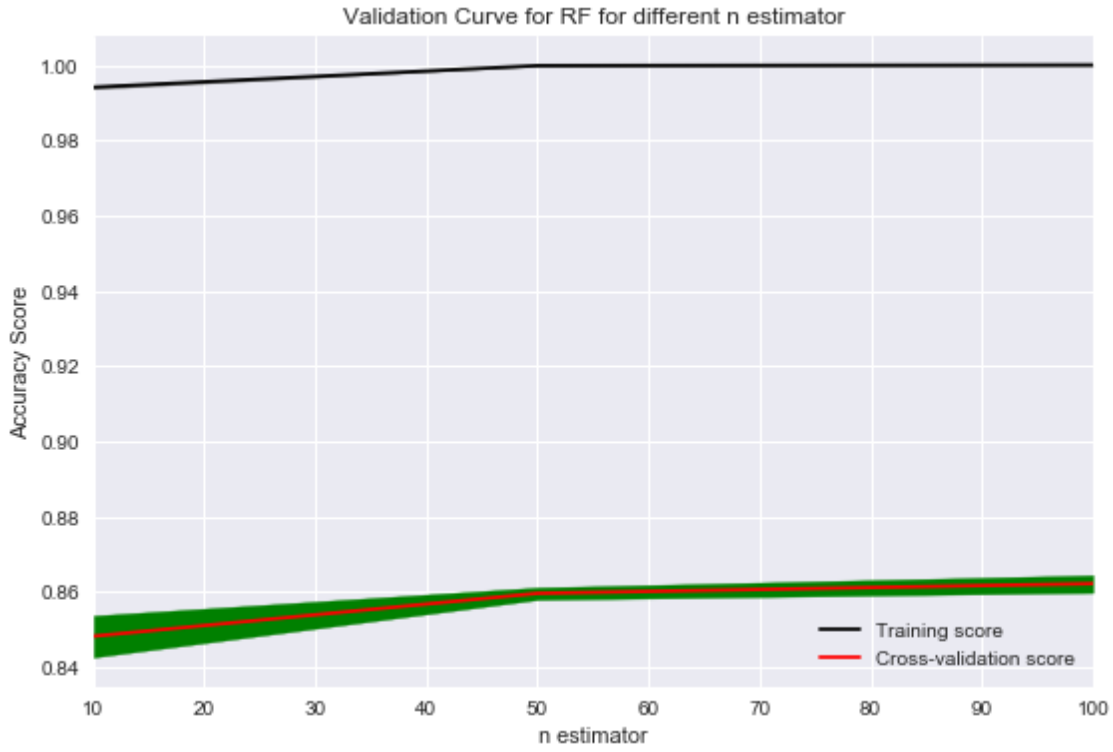
```
Best parameters
 RandomForestClassifier(bootstrap=True, class_weight=None, criterion='gini',
            max_depth=None, max_features='auto', max_leaf_nodes=None,
            min_impurity_decrease=0.0, min_impurity_split=None,
            min_samples_leaf=1, min_samples_split=2,
            min_weight_fraction_leaf=0.0, n_estimators=100, n_jobs=1,
            oob_score=False, random_state=None, verbose=0,
            warm_start=False)
Predicted  negative  positive    All
Actual
negative       4226         0   4226
positive          0     23774  23774
All            4226     23774  28000
```

11 Plot accuracy with n_extimator

```
In [38]: import warnings
         warnings.filterwarnings('ignore')
         from sklearn.model_selection import validation_curve
         #create plot for training and test validation
         # We cannot put 0 in parameter it will give error while validation_curve
         n_estimators=[10,50,100]
         param_range=[10,50,100]

         train_scores, test_scores = validation_curve(RandomForestClassifier(), X_train, y_tra
                                                      param_range=n_estimators,cv=5)
         #print(train_scores,test_scores)
         train_scores_mean = np.mean(train_scores, axis=1)
         train_scores_std = np.std(train_scores, axis=1)
         test_scores_mean = np.mean(test_scores, axis=1)
         test_scores_std = np.std(test_scores, axis=1)

         plt.plot(param_range, train_scores_mean, label="Training score", color="black")
         plt.plot(param_range, test_scores_mean, label="Cross-validation score", color="red")
         plt.fill_between(param_range, train_scores_mean - train_scores_std, train_scores_mean
         plt.fill_between(param_range, test_scores_mean - test_scores_std, test_scores_mean + t
         plt.title("Validation Curve for RF for different n estimator")
         plt.xlabel("n estimator")
         plt.ylabel("Accuracy Score")
         plt.xlim(10,100)
         plt.tight_layout()
         plt.legend(loc="best")
         plt.show()
```



12 Steps followed

Only !=3 reviews are taken Mark >3 as positive and <3 as negative. Sort data as per product id in ascending order Deduplication of entries for same profilename,userid, time, text and take first element Get stratified sampling of 50k data Clean html and punctuation Convert to uppercase and word<3 are rejected data sorted on time Split the data in train and test to 70:30

BOW BOW BOW vec created using train data test data is converted using above on train and same applied to test do grid search for different value of n_estimator best model is established with best hyperparameter. model metric is stored in dataframe and crosstable is printed.

TFIDF TFIDF form tfidf vec using train same is used in test to convert rest are same

AVG W2V gensim is used to convert train and test text to W2V AVG seperately rest are same

AVG TFIDF form tfidf vec using train same is used in test to convert gensim and above tfidf is used to convert train and test text to W2V AVG seperately

plot cv error with n_estimator

Below is metric

```
In [40]: aa
```

```
Out[40]:    accuracy_test  accuracy_train depth  estimator  fscore_test  fscore_train  \
         0       0.858583        0.999964    na         50     0.921191      0.999979
         0       0.859167        0.999857    na         50     0.921534      0.999916
         0       0.828667        1.000000    na        100     0.905558      1.000000
```

0	0.849500	1.000000	na	100	0.915536	1.000000

	learningrate	type
0	na	BOW RF
0	na	TFIDF RF
0	na	AVG W2V RF
0	na	AVG W2V RF