32.19.Amazon_food_review_GBDT

July 1, 2018

1 Amazon food review dataset apply GBDT 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 GBDT(no of base learner,depth,learning rate)
# Import data and libraries

```
In [15]: 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 [16]: 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=Fal
         #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 [17]: #take only 2500 + 2500 data
         from sklearn.cross_validation import train_test_split,KFold
         _ , clean_data = train_test_split(sorted_data, test_size = 10000, random_state=0,strat
         clean_data['Score'].value_counts()

Out[17]: positive    8432
         negative    1568
         Name: Score, dtype: int64

In [18]: # 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[18]:

```
            Id   ProductId          UserId            ProfileName  \
69317    75358  B002YR97QA   AJ1CD7OI9YFFZ  Mary Frost "mrtshome"
163375  177139  B005ZAULI6  A2TG5JHF4CCPGY  Jacqueline A. Johnson

        HelpfulnessNumerator  HelpfulnessDenominator     Score        Time  \
69317                      0                       0  positive  1327795200
163375                     0                       0  positive  1328918400

                       Summary  \
69317   Teatulie tea with neem
163375            We will see.

                                                     Text  \
69317   This tea is interesting.  My friend says neem ...
163375  I have not had any of this tea yet as it only ...

                                              CleanedText
69317   b'tea interest friend say neem tast take get u...
163375  b'tea yet arriv today told compani would recei...
```

4 Split train and test data

```
In [19]: 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.shap
         print("positive and negative review in train and test\n",y_train.value_counts(),"\n",
```

```
size of X_train, X_test, y_train , y_test  (7000,) (3000,) (7000,) (3000,)
positive and negative review in train and test
 positive    5939
negative    1061
Name: Score, dtype: int64
 positive    2493
negative     507
Name: Score, dtype: int64
```

5 Use GDDT

6 BOW

```
In [20]: #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())
         X_train_BOW=X_train
         X_test_BOW=X_test

         #print(final_counts[0,:])# this is stored like dict format only non zero values. spar
         #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])
```

```
(7000, 11134) (3000, 11134)
```

```
In [21]: from sklearn.cross_validation import train_test_split
         from sklearn.neighbors import KNeighborsClassifier
         from sklearn.metrics import accuracy_score
         from sklearn.cross_validation import cross_val_score
         from collections import Counter
         from sklearn.metrics import accuracy_score
         from sklearn import cross_validation

         # Use GBDT
         from sklearn.tree import DecisionTreeClassifier
         from sklearn.ensemble import GradientBoostingClassifier
         from sklearn.grid_search import GridSearchCV
         learning_rate=[.9,.8,.1,.2]
         n_estimators=[10,20,30]
         max_depth=[3,4,5,6,7,8]
         tuned_parameters=dict(learning_rate=learning_rate,n_estimators=n_estimators,max_depth=
         #Using GridSearchCV
         model = GridSearchCV(GradientBoostingClassifier(), tuned_parameters, cv=5)
         model.fit(X_train, y_train)
         print('Best parameters \n',model.best_estimator_)
         optimumlearning_rate=model.best_estimator_.learning_rate
         optimumn_estimators=model.best_estimator_.n_estimators
         optimummax_depth=model.best_estimator_.max_depth
         #build model with optimum parameter
         model = GradientBoostingClassifier(learning_rate=optimumlearning_rate,n_estimators=opt
                             max_depth=optimummax_depth)
         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 GDDT'],'depth':[optimummax_depth],'estimator':[optimumn_
                           'learningrate':[optimumlearning_rate],'accuracy_train':[model.score
                          'fscore_train':[fscoretrain],'accuracy_test':[model.score(X_test,y_te
```

```
Best parameters
 GradientBoostingClassifier(criterion='friedman_mse', init=None,
              learning_rate=0.2, loss='deviance', max_depth=7,
              max_features=None, 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=30,
             presort='auto', random_state=None, subsample=1.0, verbose=0,
             warm_start=False)
Predicted  negative  positive   All
Actual
negative        601       460  1061
positive          4      5935  5939
All             605      6395  7000
```

7 TFIDF

```
In [22]: 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)
         X_train_tfidf=X_train
         X_test_tfidf=X_test

         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


         learning_rate=[.9,.8,.1,.2]
         n_estimators=[10,20,30]
         max_depth=[3,4,5,6,7,8]
         tuned_parameters=dict(learning_rate=learning_rate,n_estimators=n_estimators,max_depth=
         #Using GridSearchCV
         model = GridSearchCV(GradientBoostingClassifier(), tuned_parameters, cv=5)
         model.fit(X_train, y_train)
         print('Best parameters \n',model.best_estimator_)
         optimumlearning_rate=model.best_estimator_.learning_rate
         optimumn_estimators=model.best_estimator_.n_estimators
         optimummax_depth=model.best_estimator_.max_depth
         #build model with optimum parameter
         model = GradientBoostingClassifier(learning_rate=optimumlearning_rate,n_estimators=op
                             max_depth=optimummax_depth)
         model.fit(X_train, y_train)

         #Store scores
         pred=model.predict(X_test)
         mat=pd.crosstab(y_test, pred, rownames=['Actual'], colnames=['Predicted'], margins=Tr
         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=T
         print(mat);tp=mat.iloc[1,1] ;tn=mat.iloc[0,0];fp=mat.iloc[0,1] ;fn=mat.iloc[1,0] ;pre
         recall=tp/(tp+fn);fscoretrain=2*precision*recall/(precision+recall)


         bb=pd.DataFrame({'type':['TFIDF GDDT'],'depth':[optimummax_depth],'estimator':[optimum
                           'learningrate':[optimumlearning_rate],'accuracy_train':[model.score
                          'fscore_train':[fscoretrain],'accuracy_test':[model.score(X_test,y_te
         aa=aa.append(bb)
```

```
(7000, 11134) (3000, 11134)
size of X_train, X_test, y_train , y_test  (7000, 11134) (3000, 11134) (7000,) (3000,)
Best parameters
 GradientBoostingClassifier(criterion='friedman_mse', init=None,
              learning_rate=0.2, loss='deviance', max_depth=7,
              max_features=None, 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=30,
              presort='auto', random_state=None, subsample=1.0, verbose=0,
              warm_start=False)
Predicted  negative  positive   All
Actual
negative        602       459  1061
positive          5      5934  5939
All             607      6393  7000
```

8 AVG W2V

```
In [23]: #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_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

# Use GBDT
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.grid_search import GridSearchCV

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

learning_rate=[.9,.8,.1,.2]
n_estimators=[8,12,15]
max_depth=[3,4,5,6,7,8]

tuned_parameters=dict(learning_rate=learning_rate,n_estimators=n_estimators,max_depth

#Using GridSearchCV
model = GridSearchCV(GradientBoostingClassifier(), 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))

optimumlearning_rate=model.best_estimator_.learning_rate
optimumn_estimators=model.best_estimator_.n_estimators
```

```
         optimummax_depth=model.best_estimator_.max_depth

         #build model with optimum parameter
         model = GradientBoostingClassifier(learning_rate=optimumlearning_rate,n_estimators=opt
                                     max_depth=optimummax_depth)
         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/(t
         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=T
         print(mat);tp=mat.iloc[1,1] ;tn=mat.iloc[0,0];fp=mat.iloc[0,1] ;fn=mat.iloc[1,0] ;pre
         recall=tp/(tp+fn);fscoretrain=2*precision*recall/(precision+recall)

         bb=pd.DataFrame({'type':['AVG W2V GDDT'],'depth':[optimummax_depth],'estimator':[opti
                           'learningrate':[optimumlearning_rate],'accuracy_train':[model.score
                          '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  (7000, 50) (3000, 50) (7000,) (3000,)
Best parameters
 GradientBoostingClassifier(criterion='friedman_mse', init=None,
              learning_rate=0.2, loss='deviance', max_depth=4,
              max_features=None, 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=12,
              presort='auto', random_state=None, subsample=1.0, verbose=0,
              warm_start=False)
Predicted  negative  positive   All
Actual
negative         57      1004  1061
positive          3      5936  5939
All              60      6940  7000
```

9 AVG TFIDF W2V

```
In [24]: #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_w2vtfidf=X_train
X_test_w2vtfidf=X_test

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

# Use GBDT
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.grid_search import GridSearchCV

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

learning_rate=[.9,.8,.2]
n_estimators=[5,8,10]
max_depth=[3,4,5,6,7]

tuned_parameters=dict(learning_rate=learning_rate,n_estimators=n_estimators,max_depth

#Using GridSearchCV
model = GridSearchCV(GradientBoostingClassifier(), 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))

optimumlearning_rate=model.best_estimator_.learning_rate
optimumn_estimators=model.best_estimator_.n_estimators
optimummax_depth=model.best_estimator_.max_depth



#build model with optimum parameter
model = GradientBoostingClassifier(learning_rate=optimumlearning_rate,n_estimators=op
                    max_depth=optimummax_depth,random_state=0)
model.fit(X_train, y_train)

#Store scores
pred=model.predict(X_test)
mat=pd.crosstab(y_test, pred, rownames=['Actual'], colnames=['Predicted'], margins=Tr
tp=mat.iloc[1,1] ;tn=mat.iloc[0,0] ;fp=mat.iloc[0,1];fn=mat.iloc[1,0];precision=tp/(t
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=T
        print(mat);tp=mat.iloc[1,1] ;tn=mat.iloc[0,0];fp=mat.iloc[0,1] ;fn=mat.iloc[1,0] ;pre
        recall=tp/(tp+fn);fscoretrain=2*precision*recall/(precision+recall)


        bb=pd.DataFrame({'type':['AVG W2V TFIDF GBDT'],'depth':[optimummax_depth],'estimator'
                          'learningrate':[optimumlearning_rate],'accuracy_train':[model.score
                         'fscore_train':[fscoretrain],'accuracy_test':[model.score(X_test,y_t
        aa=aa.append(bb)
```

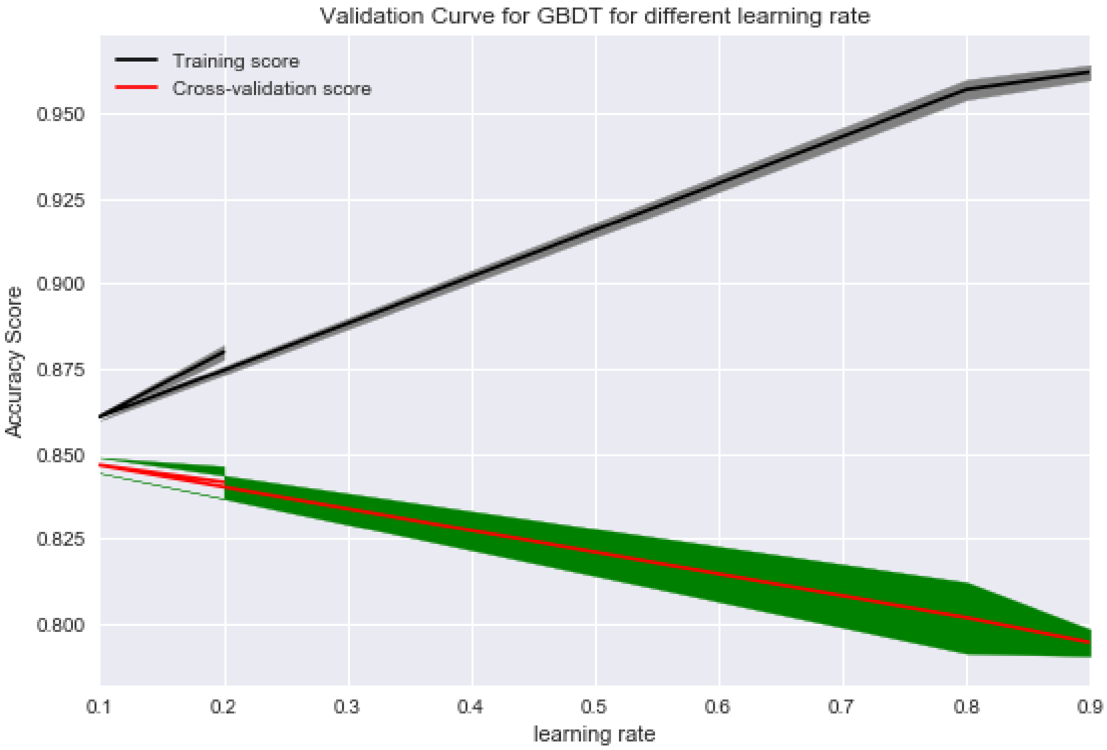
```
size of X_train, X_test, y_train , y_test  (7000, 50) (3000, 50) (7000,) (3000,)
Best parameters
 GradientBoostingClassifier(criterion='friedman_mse', init=None,
              learning_rate=0.2, loss='deviance', max_depth=3,
              max_features=None, max_leaf_nodes=None,
              min_impurity_decrease=0.0, min_impurity_split=None,
              min_samples_leaf=1, min_samples_split=2,
              min_weight_fraction_leaf=0.0, n_estimators=5, presort='auto',
              random_state=None, subsample=1.0, verbose=0,
              warm_start=False)
Predicted  negative  positive   All
Actual
negative          2      1059  1061
positive          0      5939  5939
All               2      6998  7000
```

10 plot for different values and accuracy

```
In [25]: 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
         learning_rate=[.9,.8,.1,.2]
         n_estimators=[5,8,10]
         max_depth=[3,4,5,6,7]
         param_range=[.9,.8,.1,.2]

         train_scores, test_scores = validation_curve(GradientBoostingClassifier(), X_train, y
                                                      param_range=learning_rate,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)
```

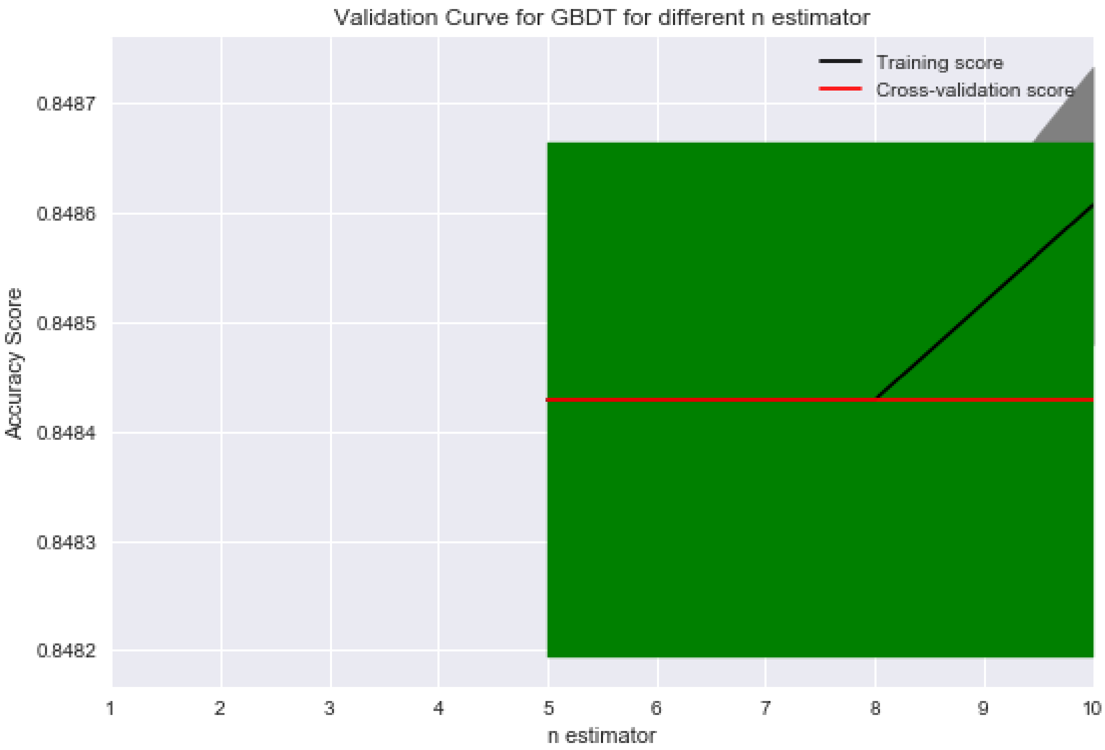
```
plt.plot(param_range, train_scores_mean, label="Training score", color="black")
plt.plot(param_range, test_scores_mean, label="Cross-validation score", color="red")
plt.fill_between(param_range, train_scores_mean - train_scores_std, train_scores_mean
plt.fill_between(param_range, test_scores_mean - test_scores_std, test_scores_mean + t
plt.title("Validation Curve for GBDT for different learning rate")
plt.xlabel("learning rate")
plt.ylabel("Accuracy Score")
plt.xlim(.1,.9)
plt.tight_layout()
plt.legend(loc="best")
plt.show()
```



In [26]:
```
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
learning_rate=[.9,.8,.1,.2]
n_estimators=[5,8,10]
max_depth=[3,4,5,6,7]
param_range=[5,8,10]

train_scores, test_scores = validation_curve(GradientBoostingClassifier(), X_train, y
                                             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 +
plt.title("Validation Curve for GBDT for different n estimator")
plt.xlabel("n estimator")
plt.ylabel("Accuracy Score")
plt.xlim(1,10)
plt.tight_layout()
plt.legend(loc="best")
plt.show()
```

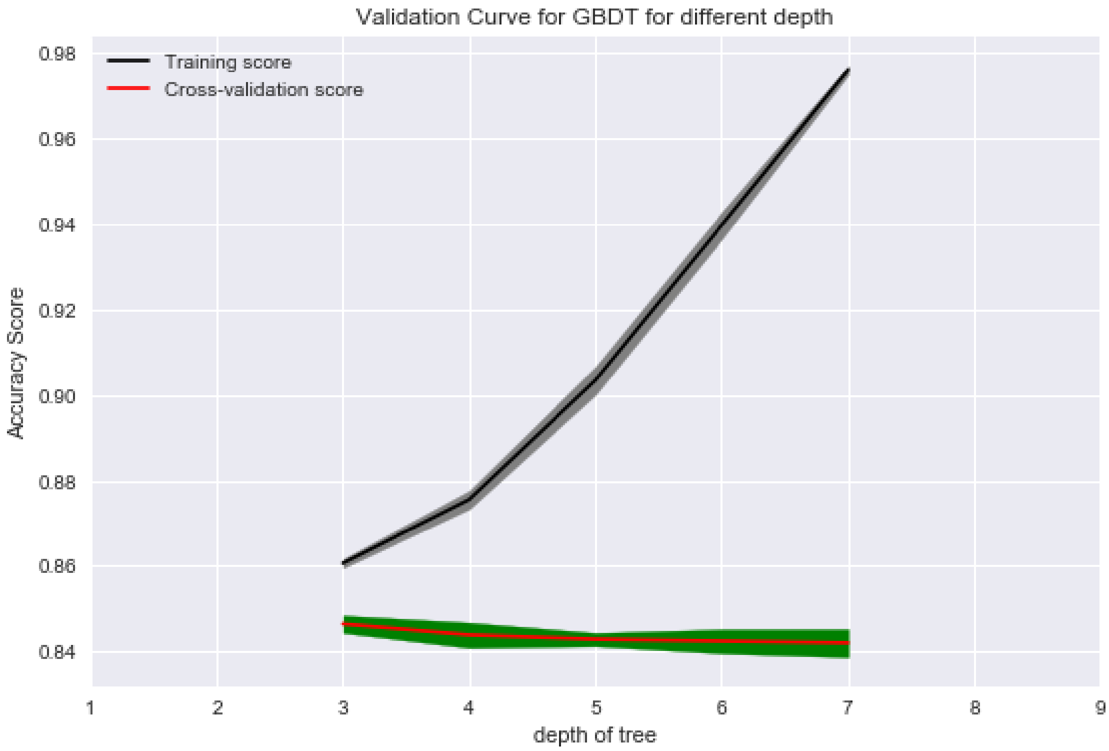


```
In [27]: import warnings
         warnings.filterwarnings('ignore')
         from sklearn.model_selection import validation_curve
         #create plot for training and test validation
```

```
# We cannot put 0 in parameter it will give error while validation_curve
learning_rate=[.9,.8,.1,.2]
n_estimators=[5,8,10]
max_depth=[3,4,5,6,7]
param_range=[3,4,5,6,7]

train_scores, test_scores = validation_curve(GradientBoostingClassifier(), X_train, y_
                                             param_range=max_depth,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 +
plt.title("Validation Curve for GBDT for different depth")
plt.xlabel("depth of tree")
plt.ylabel("Accuracy Score")
plt.xlim(1,9)
plt.tight_layout()
plt.legend(loc="best")
plt.show()
```



11 Conclusion

GBDT is taking a lot of time for estimator 20/30

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 10k 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 learning_rate,n_estimators,max_depth. 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 learning_rate,n_estimators,max_depth

Below is metric

```
In [29]: aa
```

```
Out[29]:    accuracy_test  accuracy_train  depth  estimator  fscore_test  fscore_train  \
         0       0.864667        0.933714      7         30     0.923367      0.962380
         0       0.866667        0.933714      7         30     0.924699      0.962374
         0       0.828667        0.856143      4         12     0.906033      0.921811
         0       0.831000        0.848714      3          5     0.624343      0.918142

            learningrate               type
         0           0.2           BOW GDDT
         0           0.2         TFIDF GDDT
         0           0.2       AVG W2V GDDT
         0           0.2  AVG W2V TFIDF GBDT
```