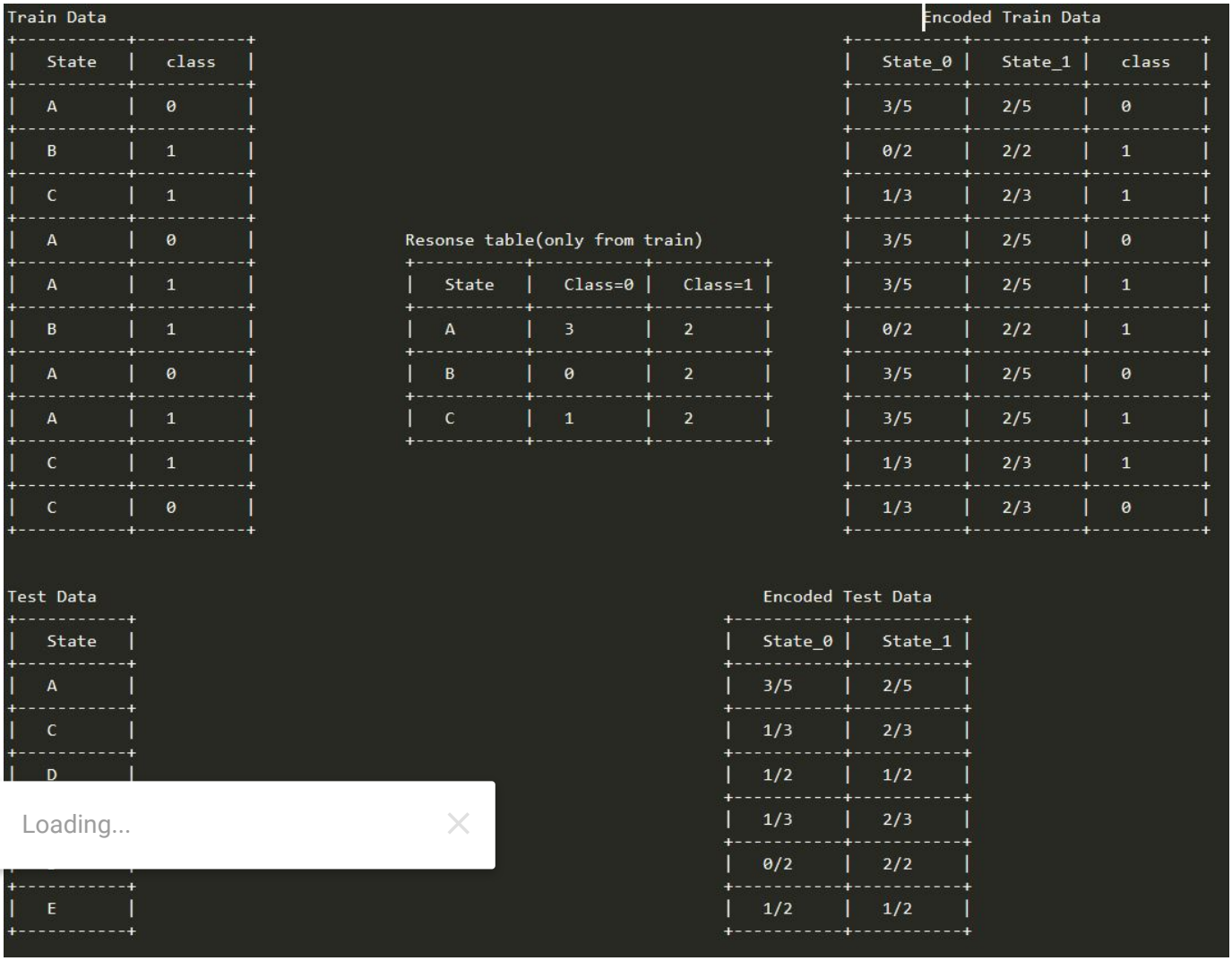
Assignment 9: GBDT

Response Coding: Example

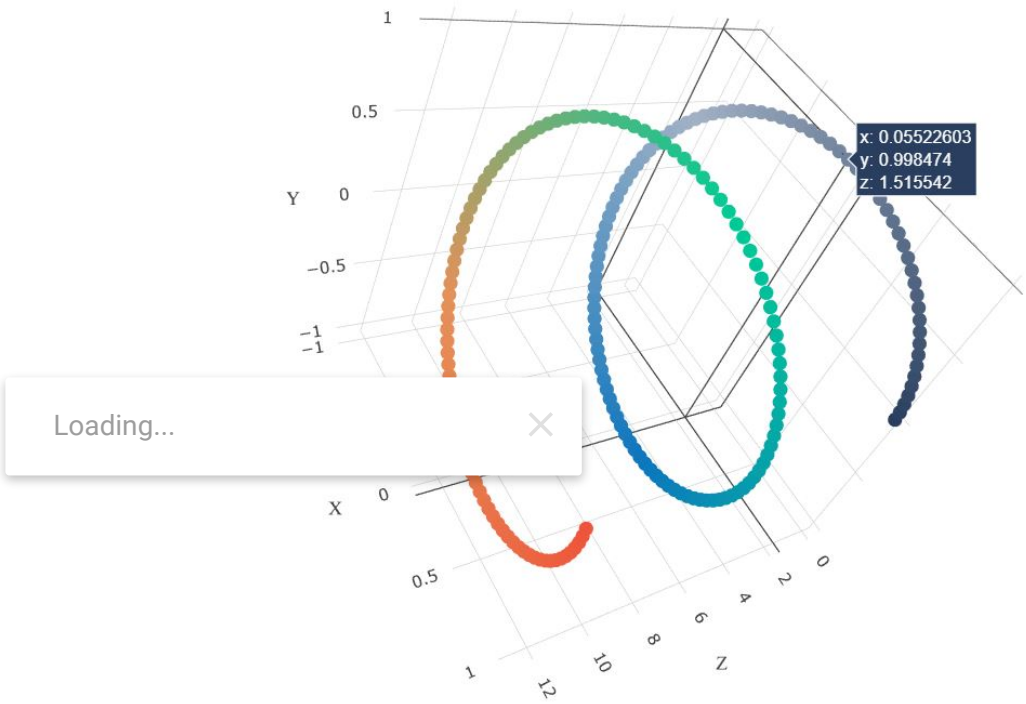


> The response tabel is built only on train dataset. For a category which is not there in train data and present in test data, we will encode them with default values Ex: in our test data if have State: D then we encode it as [0.5, 0.05]

1. **Apply GBDT on these feature sets**
   - Set 1: categorical(instead of one hot encoding, try response coding: use probability values), numerical features + project_title(TFIDF)+ preprocessed_eassay (TFIDF)+sentiment Score of eassay(check the bellow example, include all 4 values as 4 features)
   - Set 2: categorical(instead of one hot encoding, try response coding: use probability values), numerical features + project_title(TFIDF W2V)+ preprocessed_eassay (TFIDF W2V)

- Here in response encoding you need to apply the **laplase smoothing** value for test set. Laplase smoothing means, If test point is present in test but not in train then you need to apply default 0.5 as probability value for that data point (Refer the Response Encoding Image from above cell)
- Please use atleast **35k** data points

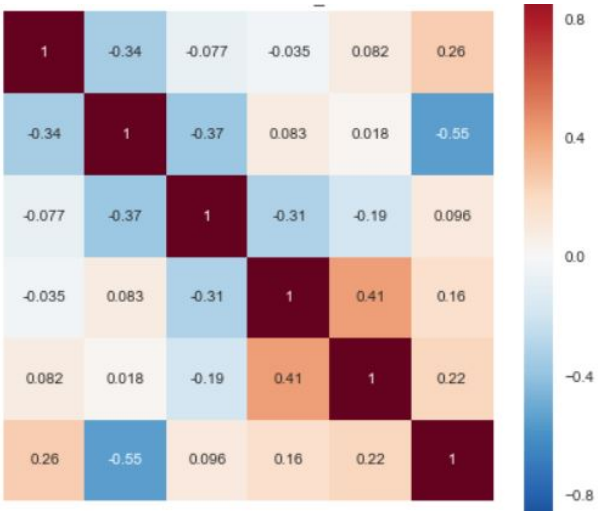
2. **The hyper paramter tuning (Consider any two hyper parameters)**
   - Find the best hyper parameter which will give the maximum AUC value
   - find the best hyper paramter using k-fold cross validation/simple cross validation data
   - use gridsearch cv or randomsearch cv or you can write your own for loops to do this task
3. **Representation of results**
   - You need to plot the performance of model both on train data and cross validation data for each hyper parameter, like shown in the figure



with X-axis as **n_estimators**, Y-axis as **max_depth**, and Z-axis as **AUC Score** , we have given the notebook which explains how to plot this 3d plot, you can find it in the same drive *3d_scatter_plot.ipynb*

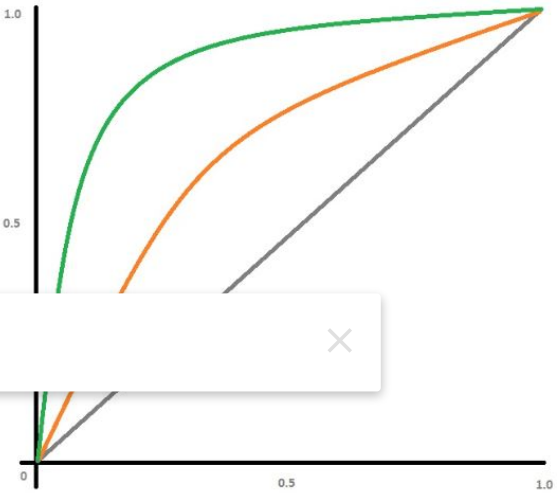
or

- You need to plot the performance of model both on train data and cross validation data for each hyper parameter, like shown in the figure



[seaborn heat maps](#) with rows as **n_estimators**, columns as **max_depth**, and values inside the cell representing **AUC Score**

- You choose either of the plotting techniques out of 3d plot or heat map
- Once after you found the best hyper parameter, you need to train your model with it, and find the AUC on test data and plot the ROC curve on both train and test. Make sure that you are using predict_proba method to calculate AUC curves, because AUC is calcualted on class probabilities and not on class labels.



Loading...

- Along with plotting ROC curve, you need to print the [confusion matrix](#) with predicted and original labels of test data points

	Predicted: NO	Predicted: YES
Actual: NO	TN = ??	FP = ??
Actual: YES	FN = ??	TP = ??

4. You need to summarize the results at the end of the notebook, summarize it in the table format

Vectorizer	Model	Hyper parameter	AUC
BOW	Brute	7	0.78
TFIDF	Brute	12	0.79
W2V	Brute	10	0.78
TFIDFW2V	Brute	6	0.78

Few Notes

1. Use atleast 35k data points
2. Use classifier.Predict_proba() method instead of predict() method while calculating roc_auc scores
3. Be sure that you are using laplase smoothing in response encoding function. Laplase smoothing means applying the default (0.5) value to test data if the test data is not present in the train set

```
import nltk
from nltk.sentiment.vader import SentimentIntensityAnalyzer
import nltk
nltk.download('vader_lexicon')
```

Loading...

```
sample_sentence_1='I am happy.'
ss_1 = sid.polarity_scores(sample_sentence_1)
print('sentiment score for sentence 1',ss_1)

sample_sentence_2='I am sad.'
ss_2 = sid.polarity_scores(sample_sentence_2)
print('sentiment score for sentence 2',ss_2)

sample_sentence_3='I am going to New Delhi tommorow.'
ss_3 = sid.polarity_scores(sample_sentence_3)
print('sentiment score for sentence 3',ss_3)
```

```
sentiment score for sentence 1 {'neg': 0.0, 'neu': 0.213, 'pos': 0.787, 'compound': 0
sentiment score for sentence 2 {'neg': 0.756, 'neu': 0.244, 'pos': 0.0, 'compound': -
sentiment score for sentence 3 {'neg': 0.0, 'neu': 1.0, 'pos': 0.0, 'compound': 0.0}
[nltk_data] Downloading package vader_lexicon to /root/nltk_data...
```

1. GBDT (xgboost/lightgbm)

```
!pip install chart-studio
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/p
Collecting chart-studio
  Downloading chart_studio-1.1.0-py3-none-any.whl (64 kB)
     |████████████████████████████████| 64 kB 2.3 MB/s
Requirement already satisfied: plotly in /usr/local/lib/python3.7/dist-packages (from
Requirement already satisfied: six in /usr/local/lib/python3.7/dist-packages (from ch
Collecting retrying>=1.3.3
  Downloading retrying-1.3.3.tar.gz (10 kB)
Requirement already satisfied: requests in /usr/local/lib/python3.7/dist-packages (fr
Requirement already satisfied: tenacity>=6.2.0 in /usr/local/lib/python3.7/dist-packa
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.7/dist-pa
Requirement already satisfied: idna<3,>=2.5 in /usr/local/lib/python3.7/dist-packages
Requirement already satisfied: chardet<4,>=3.0.2 in /usr/local/lib/python3.7/dist-pac
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in /usr/local/
Building wheels for collected packages: retrying
  Building wheel for retrying (setup.py) ... done
  Created wheel for retrying: filename=retrying-1.3.3-py3-none-any.whl size=11448 sha
  Stored in directory: /root/.cache/pip/wheels/f9/8d/8d/f6af3f7f9eea3553bc2fe6d53e4b2
Successfully built retrying
Installing collected packages: retrying, chart-studio
Successfully installed chart-studio-1.1.0 retrying-1.3.3
```

```
%matplotlib inline
import warnings
warnings.filterwarnings("ignore")
```

Loading...

```
import numpy as np
import nltk
import matplotlib.pyplot as plt
import seaborn as sns
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

import re

import pickle
from tqdm import tqdm
import os

from chart_studio import plotly
import plotly.offline as offline
import plotly.graph_objs as go
offline.init_notebook_mode()
```

```
from collections import Counter
from scipy.sparse import hstack
```

1.1 Loading Data

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```
processed_data = pd.read_csv('drive/My Drive/AI_ML Course/AAC Course Assignments/Assignmen
resource_data = pd.read_csv('drive/My Drive/AI_ML Course/AAC Course Assignments/Assignment
```

```
processed_data.head(2)
```

	school_state	teacher_prefix	project_grade_category	teacher_number_of_previousl
0	ca	mrs	grades_prek_2	
1	ut	ms	grades_3_5	

Loading...

```
print("The attributes of processed data :", processed_data.columns.values)
print("*"*100)
print("The attributes of resource data :", resource_data.columns.values)
```

```
The attributes of processed data : ['school_state' 'teacher_prefix' 'project_grade_ca
 'teacher_number_of_previously_posted_projects' 'project_is_approved'
 'clean_categories' 'clean_subcategories' 'essay' 'price']
****************************************************************************
The attributes of resource data : ['id' 'description' 'quantity' 'price']
```

```
print("Number of data points in processed data", processed_data.shape)
print("Number of data points in resource data", resource_data.shape)
```

```
Number of data points in processed data (109248, 9)
Number of data points in resource data (1541272, 4)
```

```
train_data = pd.read_csv('drive/My Drive/AI_ML Course/AAC Course Assignments/Assignment-13
```

```
train_data.head(1)
```

	Unnamed: 0	id	teacher_id	teacher_prefix	school_state
0	160221	p253737	c90749f5d961ff158d4b4d1e7dc665fc	Mrs.	IN

```
# https://stackoverflow.com/a/47091490/4084039
import re

def decontracted(phrase):
    # specific
    phrase = re.sub(r"won't", "will not", phrase)
    phrase = re.sub(r"can\'t", "can not", phrase)

    # general
    phrase = re.sub(r"n\'t", " not", phrase)
    phrase = re.sub(r"\'re", " are", phrase)
    phrase = re.sub(r"\'s", " is", phrase)
    phrase = re.sub(r"\'d", " would", phrase)
    phrase = re.sub(r"\'ll", " will", phrase)
    phrase = re.sub(r"\'t", " not", phrase)
    phrase = re.sub(r"\'ve", " have", phrase)
    phrase = re.sub(r"\'m", " am", phrase)
    return phrase
```

Loading...

```
54280
stop words list: 'no', 'nor', 'not'
stopwords= ['i', 'me', 'my', 'myself', 'we', 'our', 'ours', 'ourselves', 'you', "you're",
            "you'll", "you'd", 'your', 'yours', 'yourself', 'yourselves', 'he', 'him', 'hi
            'she', "she's", 'her', 'hers', 'herself', 'it', "it's", 'its', 'itself', 'they
            'theirs', 'themselves', 'what', 'which', 'who', 'whom', 'this', 'that', "that'
            'am', 'is', 'are', 'was', 'were', 'be', 'been', 'being', 'have', 'has', 'had',
            'did', 'doing', 'a', 'an', 'the', 'and', 'but', 'if', 'or', 'because', 'as', '
            'at', 'by', 'for', 'with', 'about', 'against', 'between', 'into', 'through', '
            'above', 'below', 'to', 'from', 'up', 'down', 'in', 'out', 'on', 'off', 'over'
            'then', 'once', 'here', 'there', 'when', 'where', 'why', 'how', 'all', 'any',
            'most', 'other', 'some', 'such', 'only', 'own', 'same', 'so', 'than', 'too', '
            's', 't', 'can', 'will', 'just', 'don', "don't", 'should', "should've", 'now',
            've', 'y', 'ain', 'aren', "aren't", 'couldn', "couldn't", 'didn', "didn't", 'd
            "hadn't", 'hasn', "hasn't", 'haven', "haven't", 'isn', "isn't", 'ma', 'mightn'
            "mustn't", 'needn', "needn't", 'shan', "shan't", 'shouldn', "shouldn't", 'wasn
            'won', "won't", 'wouldn', "wouldn't"]
```

```
# Combining all the above stundents
from tqdm import tqdm
def preprocess_text(text_data):
    preprocessed_text = []
```

```
    # tqdm is for printing the status bar
    for sentance in tqdm(text_data):
        sent = decontracted(sentance)
        sent = sent.replace('\\r', ' ')
        sent = sent.replace('\\n', ' ')
        sent = sent.replace('\\"', ' ')
        sent = re.sub('[^A-Za-z0-9]+', ' ', sent)
        # https://gist.github.com/sebleier/554280
        sent = ' '.join(e for e in sent.split() if e.lower() not in stopwords)
        preprocessed_text.append(sent.lower().strip())
    return preprocessed_text


preprocessed_titles = preprocess_text(train_data['project_title'].values)
```

```
100%|██████████| 109248/109248 [00:02<00:00, 40757.50it/s]
```

```
processed_data["project_title"] = preprocessed_titles
processed_data.head(1)
```

	school_state	teacher_prefix	project_grade_category	teacher_number_of_previousl
0	ca	mrs	grades_prek_2	

Loading...

```
tle'].values[34])
print(64, processed_data['project_title'].values[64])
print(252, processed_data['project_title'].values[252])
```

```
printing some random reviews
34 ball
64 read art
252 robotics future interactive minds create
```

```
#Finding unique value counts in project_grade_category column
processed_data['project_grade_category'].value_counts()
```

```
grades_prek_2    44225
grades_3_5       37137
grades_6_8       16923
grades_9_12      10963
Name: project_grade_category, dtype: int64
```

```
#Finding unique value counts in clean_categories column
processed_data['clean_categories'].value_counts()
```

```
literacy_language                       23655
math_science                            17072
literacy_language math_science          14636
health_sports                           10177
music_arts                               5180
specialneeds                             4226
literacy_language specialneeds           3961
appliedlearning                          3771
math_science literacy_language           2289
appliedlearning literacy_language        2191
history_civics                           1851
math_science specialneeds                1840
literacy_language music_arts             1757
math_science music_arts                  1642
appliedlearning specialneeds             1467
history_civics literacy_language         1421
health_sports specialneeds               1391
warmth care_hunger                       1309
math_science appliedlearning             1220
appliedlearning math_science             1052
literacy_language history_civics          809
health_sports literacy_language           803
appliedlearning music_arts                758
math_science history_civics               652
literacy_language appliedlearning         636
appliedlearning health_sports             608
math_science health_sports                414
history_civics math_science               322
history_civics music_arts                 312
specialneeds music_arts                   302
health_sports math_science                271
history_civics specialneeds               252
health_sports appliedlearning             192
appliedlearning history_civics            178
                                          155
                                          138
                                           72
health_sports history_civics               43
history_civics appliedlearning             42
specialneeds health_sports                 42
health_sports warmth care_hunger           23
specialneeds warmth care_hunger            23
music_arts health_sports                   19
music_arts history_civics                  18
history_civics health_sports               13
math_science warmth care_hunger            11
music_arts appliedlearning                 10
appliedlearning warmth care_hunger         10
literacy_language warmth care_hunger        9
music_arts warmth care_hunger               2
history_civics warmth care_hunger           1
Name: clean_categories, dtype: int64
```

Loading...

```
#Finding unique value counts in teacher_prefix column
processed_data['teacher_prefix'].value_counts()
```

```
mrs        57272
ms         38955
```

```
mr         10648
teacher     2360
dr            13
Name: teacher_prefix, dtype: int64
```

```
#Finding unique value counts in clean_subcategories column
processed_data['clean_subcategories'].value_counts()
```

```
literacy                                  9486
literacy mathematics                      8325
literature_writing mathematics            5923
literacy literature_writing               5571
mathematics                               5379
                                          ...
economics nutritioneducation                 1
communityservice music                       1
history_geography warmth care_hunger         1
communityservice gym_fitness                 1
college_careerprep warmth care_hunger        1
Name: clean_subcategories, Length: 401, dtype: int64
```

```
#Finding unique value counts in school_state column
processed_data['school_state'].value_counts()
```

```
ca    15388
tx     7396
ny     7318
fl     6185
nc     5091
il     4350
ga     3963
sc     3936
```

Loading...

```
mo     2576
oh     2467
la     2394
ma     2389
wa     2334
ok     2276
nj     2237
az     2147
va     2045
wi     1827
al     1762
ut     1731
tn     1688
ct     1663
md     1514
nv     1367
ms     1323
ky     1304
or     1242
mn     1208
co     1111
ar     1049
id      693
```

```
ia      666
ks      634
nm      557
dc      516
hi      507
me      505
wv      503
nh      348
ak      345
de      343
ne      309
sd      300
ri      285
mt      245
nd      143
wy       98
vt       80
Name: school_state, dtype: int64
```

```
print("printing some random essay")
print(10, processed_data['essay'].values[10])
print('-'*50)
print(42, processed_data['essay'].values[42])
print('-'*50)
print(160, processed_data['essay'].values[160])
```

```
printing some random essay
10 my students yearn classroom environment matches desire learn with education changi
--------------------------------------------------
42 the art room sculpture class beehive activity students buzz around room working di
--------------------------------------------------
160 i title i reading intervention teacher work lowest students grade level kindergar
```

Loading...

e/neg/neutral/compound to the data matrix

```
import nltk
nltk.download('vader_lexicon')
from nltk.sentiment.vader import SentimentIntensityAnalyzer
sia  = SentimentIntensityAnalyzer()

negative_sentiments = []
positive_sentiments = []
neutral_sentiments = []
compound_sentiments = []

for i in tqdm(processed_data['essay']):
  sia_sentiments = sia.polarity_scores(i)
  negative_sentiments.append(sia_sentiments['neg'])
  positive_sentiments.append(sia_sentiments['pos'])
  neutral_sentiments.append(sia_sentiments['neu'])
  compound_sentiments.append(sia_sentiments['compound'])

# Now append these sentiments columns/freatures to original preprocessed dataframe
processed_data['negative_sent'] = negative_sentiments
```

```
processed_data['positive_sent'] = positive_sentiments
processed_data['neutral_sent'] = neutral_sentiments
processed_data['compound_sent'] = compound_sentiments

processed_data.head(1)
```

```
[nltk_data] Downloading package vader_lexicon to /root/nltk_data...
[nltk_data]   Package vader_lexicon is already up-to-date!
100%|██████████| 109248/109248 [03:05<00:00, 588.63it/s]
```

	school_state	teacher_prefix	project_grade_category	teacher_number_of_previousl
0	ca	mrs	grades_prek_2	

```
processed_data.columns
```

```
Index(['school_state', 'teacher_prefix', 'project_grade_category',
       'teacher_number_of_previously_posted_projects', 'project_is_approved',
       'clean_categories', 'clean_subcategories', 'essay', 'price',
       'project_title', 'negative_sent', 'positive_sent', 'neutral_sent',
       'compound_sent'],
      dtype='object')
```

Loading...

```
(109248, 14)
```

```
processed_data = processed_data.sample(frac=0.35)
processed_data.shape
```

```
(38237, 14)
```

```
processed_data.isnull().sum()
```

```
school_state                                0
teacher_prefix                              0
project_grade_category                      0
teacher_number_of_previously_posted_projects    0
project_is_approved                         0
clean_categories                            0
clean_subcategories                         0
essay                                       0
price                                       0
project_title                               0
negative_sent                               0
```

```
positive_sent                                   0
neutral_sent                                    0
compound_sent                                   0
dtype: int64
```

1.2 Splitting data into Train and cross validation(or test): Stratified Sampling

```
# please write all the code with proper documentation, and proper titles for each subsecti
# go through documentations and blogs before you start coding
# first figure out what to do, and then think about how to do.
# reading and understanding error messages will be very much helpfull in debugging your co
# when you plot any graph make sure you use
    # a. Title, that describes your plot, this will be very helpful to the reader
    # b. Legends if needed
    # c. X-axis label
    # d. Y-axis label
```

```
# Splitting data
y = processed_data['project_is_approved'].values
processed_data.drop(['project_is_approved'], axis=1, inplace=True)
X = processed_data
processed_data.shape
```

```
(38237, 13)
```

```
X.columns
```

Loading...

```
_prefix', 'project_grade_category',
ously_posted_projects', 'clean_categories',
'clean_subcategories', 'essay', 'price', 'project_title',
'negative_sent', 'positive_sent', 'neutral_sent', 'compound_sent'],
dtype='object')
```

```
# Split Train, CV and Test data
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3)

print('Train Data Set', X_train.shape, y_train.shape)
print('Test Data Set', X_test.shape, y_test.shape)
```

```
Train Data Set (26765, 13) (26765,)
Test Data Set (11472, 13) (11472,)
```

1.3 Make Data Model Ready: encoding eassay, and project_title

```
# please write all the code with proper documentation, and proper titles for each subsecti
# go through documentations and blogs before you start coding
# first figure out what to do, and then think about how to do.
# reading and understanding error messages will be very much helpfull in debugging your co
# make sure you featurize train and test data separatly

# when you plot any graph make sure you use
    # a. Title, that describes your plot, this will be very helpful to the reader
    # b. Legends if needed
    # c. X-axis label
    # d. Y-axis label
```

TFIDF-for Essay column

```
# As required for Task-1, applying TFIDF on the Essay column
vectorizer_essay_tfidf = TfidfVectorizer(min_df=10)

# Apply .fit() on this vectorizer on Train data
# Note .fit() is applied only on the train data, as test and cv should not be fitted
vectorizer_essay_tfidf.fit(X_train['essay'].values)

# Now use the fitted TfidfVectorizer for converting 'essay' text to Vector form
X_train_vectorized_tfidf_essay = vectorizer_essay_tfidf.transform(X_train['essay'].values)
X_test_vectorized_tfidf_essay = vectorizer_essay_tfidf.transform(X_test['essay'].values)

print('After TFIDF on Essay column checking the shapes')
print(X_train_vectorized_tfidf_essay.shape, y_train.shape)
print(X_test_vectorized_tfidf_essay.shape, y_test.shape)
```

```
After TFIDF on Essay column checking the shapes
(26765, 9511) (26765,)
```

Loading...

TFIDF-for project_title

```
# As required for Task-1, applying TFIDF on the Essay column
vectorizer_project_title_tfidf = TfidfVectorizer(min_df=10)

# Apply .fit() on this vectorizer on Train data
# Note .fit() is applied only on the train data, as test and cv should not be fitted
vectorizer_project_title_tfidf.fit(X_train['project_title'].values)

# Now use the fitted TfidfVectorizer for converting 'essay' text to Vector form
X_train_vectorized_tfidf_project_title = vectorizer_project_title_tfidf.transform(X_train[
X_test_vectorized_tfidf_project_title = vectorizer_project_title_tfidf.transform(X_test['p

print('After TFIDF on Essay column checking the shapes')
print(X_train_vectorized_tfidf_project_title.shape, y_train.shape)
print(X_test_vectorized_tfidf_project_title.shape, y_test.shape)
```

```
After TFIDF on Essay column checking the shapes
(26765, 1307) (26765,)
(11472, 1307) (11472,)
```

```
dictionary = dict(zip(vectorizer_essay_tfidf.get_feature_names(), list(vectorizer_essay_tf
tfidf_words = set(vectorizer_essay_tfidf.get_feature_names())


#please use below code to load glove vectors
with open('drive/My Drive/AI_ML Course/AAC Course Assignments/Assignment-13/glove_vectors'
    model = pickle.load(f)
    glove_words =  set(model.keys())


# Hence we are now converting a dictionary with word as a key, and the idf as a value
# Function to generate Word2Vec referencing "4_Reference_Vectorization.ipynb" given in the
def generate_tfidf_w2v_from_text(text_arr):
    tfidf_w2v_vectors = []

    for sentence in tqdm(text_arr):  # for each sentence
        vector = np.zeros(300)  # as word vectors are of zero length
        tf_idf_weight = 0       # num of words with a valid vector in the sentence
        for word in sentence.split():  # for each word in a sentence
            if (word in glove_words) and (word in tfidf_words):
                vec = model[word]  # getting the vector for each word
                # here we are multiplying idf value(dictionary[word]) and the tf value((se
                tf_idf = dictionary[word] * (sentence.count(word) / len(sentence.split()))
                vector += vec * tf_idf  # calculating tfidf weighted w2v
                tf_idf_weight += tf_idf

        if tf_idf_weight != 0:
            vector = vector / tf_idf_weight
        tfidf_w2v_vectors.append(vector)
    return tfidf_w2v_vectors
```

Loading...

TFIDF-W2V Essay

```
X_train_vectorized_tfidf_w2v_essay = generate_tfidf_w2v_from_text(X_train['essay'].values)
X_test_vectorized_tfidf_w2v_essay = generate_tfidf_w2v_from_text(X_test['essay'].values)
```

```
100%|██████████| 26765/26765 [00:49<00:00, 540.23it/s]
100%|██████████| 11472/11472 [00:20<00:00, 563.43it/s]
```

```
from scipy import sparse
X_train_vectorized_tfidf_w2v_essay = sparse.csr_matrix(X_train_vectorized_tfidf_w2v_essay)
X_test_vectorized_tfidf_w2v_essay = sparse.csr_matrix(X_test_vectorized_tfidf_w2v_essay)


print('After TFIDF-W2V on essay column checking the shapes')
print(X_train_vectorized_tfidf_w2v_essay.shape, y_train.shape)
print(X_test_vectorized_tfidf_w2v_essay.shape, y_test.shape)
```

```
After TFIDF-W2V on essay column checking the shapes
(26765, 300) (26765,)
(11472, 300) (11472,)
```

TFIDF-W2V Project_Title

```
X_train_vectorized_tfidf_w2v_project_title = generate_tfidf_w2v_from_text(X_train['project
X_test_vectorized_tfidf_w2v_project_title = generate_tfidf_w2v_from_text(X_test['project_t
```

```
100%|██████████| 26765/26765 [00:00<00:00, 40538.78it/s]
100%|██████████| 11472/11472 [00:00<00:00, 38210.22it/s]
```

```
X_train_vectorized_tfidf_w2v_project_title = sparse.csr_matrix(X_train_vectorized_tfidf_w2
X_test_vectorized_tfidf_w2v_project_title = sparse.csr_matrix(X_test_vectorized_tfidf_w2v_
```

```
print('After TFIDF-W2V on project_title column checking the shapes')
print(X_train_vectorized_tfidf_w2v_project_title.shape, y_train.shape)
print(X_test_vectorized_tfidf_w2v_project_title.shape, y_test.shape)
```

```
After TFIDF-W2V on project_title column checking the shapes
(26765, 300) (26765,)
(11472, 300) (11472,)
```

1.4 Make Data Model Ready: encoding numerical, categorical features

Response Encoding

Loading...

```
per documentation, and proper titles for each subsecti
s before you start coding
hen think about how to do.
# reading and understanding error messages will be very much helpfull in debugging your co
# make sure you featurize train and test data separatly

# when you plot any graph make sure you use
    # a. Title, that describes your plot, this will be very helpful to the reader
    # b. Legends if needed
    # c. X-axis label
    # d. Y-axis label


#https://medium.com/@thewingedwolf.winterfell/response-coding-for-categorical-data-7bb8916

def response_table(ctg_clmn_name,X_data,y_data):
    feature_proba_0 = {}
    feature_proba_1 = {}

    feature_count_0 = dict(X_data[y_data == 0].groupby(ctg_clmn_name).size())
    feature_count_1 = dict(X_data[y_data  == 1].groupby(ctg_clmn_name).size())

    unique_cat_labels = X_data[ctg_clmn_name].unique()
```

```
    for value in unique_cat_labels:
        if (value in feature_count_0.keys()) and (value in feature_count_1.keys()):
            total = feature_count_0[value] + feature_count_1[value]
            prob_0 = feature_count_0[value]/(total)
            feature_proba_0[value] = prob_0

            prob_1 = feature_count_1[value]/(feature_count_0[value]+ feature_count_1[value
            feature_proba_1[value] = prob_1

        elif (value in feature_count_0.keys()) and (value not in feature_count_1.keys()):
            feature_proba_0[value] = 1
            feature_proba_1[value] = 0

        else:
            feature_proba_0[value] = 0
            feature_proba_1[value] = 1

    return feature_proba_0,feature_proba_1
```

Response Encoding for Categorical Columns

```
feature_proba_0_school_state,feature_proba_1_school_state  = response_table("school_state"
```

```
def response_encoded_table(ctg_clmn_name,feature_proba_0,feature_proba_1,X_data,y_data):
    feature_data_prob_0 = []
    feature_data_prob_1 = []

    for value in unique_cat_labels:
        if (value in feature_proba_0.keys()) and (value in feature_proba_1.keys()):
            feature_data_prob_0.append(feature_proba_0[value])
            feature_data_prob_1.append(feature_proba_1[value])

        else:
            feature_data_prob_0.append(0.5)
            feature_data_prob_1.append(0.5)

    return np.array(feature_data_prob_0).reshape(-1,1),np.array(feature_data_prob_1).resha
```

Loading...

```
X_train_response_table_school_state_proba_0, X_train_response_table_school_state_proba_1 =

print(X_train_response_table_school_state_proba_0.shape, y_train.shape)
```

```
(26765, 1) (26765,)
```

```
X_test_response_table_school_state_proba_0, X_test_response_table_school_state_proba_1 = r

print(X_test_response_table_school_state_proba_0.shape, y_test.shape)
```

```
(11472, 1) (11472,)
```

```
feature_proba_0_teacher_prefix,feature_proba_1_teacher_prefix = response_table("teacher_pr

X_train_response_table_teacher_prefix_proba_0, X_train_response_table_teacher_prefix_proba

X_test_response_table_teacher_prefix_proba_0, X_test_response_table_teacher_prefix_proba_1


print(X_train_response_table_teacher_prefix_proba_0.shape, y_train.shape)
print(X_test_response_table_teacher_prefix_proba_0.shape, y_test.shape)
```

```
(26765, 1) (26765,)
(11472, 1) (11472,)
```

```
feature_proba_0_project_grade_category,feature_proba_1_project_grade_category = response_t

X_train_response_table_project_grade_category_proba_0, X_train_response_table_project_grad

X_test_response_table_project_grade_category_proba_0, X_test_response_table_project_grade_


print(X_train_response_table_project_grade_category_proba_1.shape, y_train.shape)
print(X_test_response_table_project_grade_category_proba_0.shape, y_test.shape)
```

```
(26765, 1) (26765,)
(11472, 1) (11472,)
```

```
feature_proba_0_clean_categories ,feature_proba_1_clean_categories = response_table("clean

X_train_response_table_clean_categories_proba_0, X_train_response_table_clean_categories_p

Loading...                                                                es_proba_0, X_test_response_table_clean_categories_pro


print(X_train_response_table_clean_categories_proba_0.shape, y_train.shape)
print(X_test_response_table_clean_categories_proba_0.shape, y_test.shape)
```

```
(26765, 1) (26765,)
(11472, 1) (11472,)
```

```
feature_proba_0_clean_subcategories,feature_proba_1_clean_subcategories = response_table("

X_train_response_table_clean_subcategories_proba_0, X_train_response_table_clean_subcatego
X_test_response_table_clean_subcategories_proba_0, X_test_response_table_clean_subcategori


print(X_train_response_table_clean_subcategories_proba_0.shape, y_train.shape)
print(X_test_response_table_clean_subcategories_proba_0.shape, y_test.shape)
```

```
(26765, 1) (26765,)
(11472, 1) (11472,)
```

Apply Normalization on Price Column

```
from sklearn.preprocessing import Normalizer

normalizer = Normalizer()

normalizer.fit(X_train['price'].values.reshape(-1, 1))

X_train_normalized_price = normalizer.transform(X_train['price'].values.reshape(-1,1))
X_test_normalized_price = normalizer.transform(X_test['price'].values.reshape(-1,1))

print('After Normalizing on price column checking the shapes ')
print(X_train_normalized_price.shape, y_train.shape)
print(X_test_normalized_price.shape, y_test.shape)
```

```
After Normalizing on price column checking the shapes
(26765, 1) (26765,)
(11472, 1) (11472,)
```

Now will Standardize and then .fit() and .transform() all the Sentiments related Columns

```
from sklearn.preprocessing import StandardScaler

sentiments_standardizer = StandardScaler()

def sentiment_standardizer(snmt_colmn_name,X_train,X_test,y_train,y_test):
    # First applying the .fit() on the train data to find Mean and SD
    sentiments_standardizer.fit(X_train[snmt_colmn_name].values.reshape(-1,1))

    # Now applying .transform() to train, test and cv data
    s_standardizer.transform(X_train[snmt_colmn_name].valu
    _standardizer.transform(X_test[snmt_colmn_name].values

    print('After Standardizing on {} column checking the shapes '.format(snmt_colmn_name))
    print(X_train_standardized.shape, y_train.shape)
    print(X_test_standardized.shape, y_test.shape)

    return X_train_standardized,X_test_standardized


X_train_negative_sent_standardized,X_test_negative_sent_standardized = sentiment_standardi
```

```
After Standardizing on negative_sent column checking the shapes
(26765, 1) (26765,)
(11472, 1) (11472,)
```

```
X_train_positive_sent_standardized,X_test_positive_sent_standardized = sentiment_standardi
```

```
After Standardizing on positive_sent column checking the shapes
(26765, 1) (26765,)
(11472, 1) (11472,)
```

```
X_train_neutral_sent_standardized,X_test_neutral_sent_standardized = sentiment_standardize
```

```
After Standardizing on neutral_sent column checking the shapes
(26765, 1) (26765,)
(11472, 1) (11472,)
```

```
X_train_compound_sent_standardized,X_test_compound_sent_standardized = sentiment_standardi
```

```
After Standardizing on compound_sent column checking the shapes
(26765, 1) (26765,)
(11472, 1) (11472,)
```

Set S1 - Merging (with hstack) all the above vectorized features that we created above(TFIDF)

```
X_train_s1_merged = hstack((X_train_vectorized_tfidf_essay,X_train_vectorized_tfidf_projec

# Shape of the data-matrix after mergeing as above
print('Shape of X_train_s1_merged ', X_train_s1_merged.shape, 'Shape of y_train ', y_train
```

```
Shape of X_train_s1_merged  (26765, 10833) Shape of y_train  (26765,)
```

```
X_test_s1_merged = hstack((X_test_vectorized_tfidf_essay,X_test_vectorized_tfidf_project_t

print('Shape of X_test_s1_merged ', X_test_s1_merged.shape, 'Shape of y_test ', y_test.sha
```

```
Shape of X_test_s1_merged  (11472, 10833) Shape of y_test  (11472,)
```

Set S2 - Merging (with hstack) all the above vectorized features that we created above(TFIDF_W2V)

Loading...

```
vectorized_tfidf_w2v_essay,X_train_vectorized_tfidf_w2

X_test_s2_merged = hstack((X_test_vectorized_tfidf_w2v_essay,X_test_vectorized_tfidf_w2v_p


# Shape of the data-matrix after mergeing as above
print('Shape of X_train_s2_merged ', X_train_s2_merged.shape, 'Shape of y_train ', y_train
print('Shape of X_test_s2_merged ', X_test_s2_merged.shape, 'Shape of y_test ', y_test.sha
```

```
Shape of X_train_s2_merged  (26765, 615) Shape of y_train  (26765,)
Shape of X_test_s2_merged  (11472, 615) Shape of y_test  (11472,)
```

1.5 Appling Models on different kind of featurization as mentioned in the instructions

Apply GBDT on different kind of featurization as mentioned in the instructions

For Every model that you work on make sure you do the step 2 and step 3 of instrucations

```
# please write all the code with proper documentation, and proper titles for each subsecti
# go through documentations and blogs before you start coding
# first figure out what to do, and then think about how to do.
# reading and understanding error messages will be very much helpfull in debugging your co
# when you plot any graph make sure you use
    # a. Title, that describes your plot, this will be very helpful to the reader
    # b. Legends if needed
    # c. X-axis label
    # d. Y-axis label


from sklearn.model_selection import GridSearchCV
from xgboost.sklearn import XGBClassifier

xgb_clf_s1 = XGBClassifier()

params = {
"max_depth":[10,20,30],
'n_estimators': [50,150,200]
}

grid_search_s1 = GridSearchCV(xgb_clf_s1, params, cv=3, scoring='roc_auc',verbose = 2,retu

grid_search_s1.fit(X_train_s1_merged, y_train)

best_params_gridsearch_xgb_s1 = grid_search_s1.best_params_
best_score_s1 = grid_search_s1.best_score_

print("Best Params from GridSearchCV with XGB for Set s1 ", best_params_gridsearch_xgb_s1)
print("Best score",best_score_s1)
```

Loading...

```
andidates, totalling 27 fits
[CV] END .....max_depth=10, n_estimators=50; total time=  35.3s
[CV] END .....max_depth=10, n_estimators=50; total time=  35.8s
[CV] END .....max_depth=10, n_estimators=50; total time=  35.9s
[CV] END .....max_depth=10, n_estimators=150; total time= 1.6min
[CV] END .....max_depth=10, n_estimators=150; total time= 1.6min
[CV] END .....max_depth=10, n_estimators=150; total time= 1.6min
[CV] END .....max_depth=10, n_estimators=200; total time= 2.2min
[CV] END .....max_depth=10, n_estimators=200; total time= 2.1min
[CV] END .....max_depth=10, n_estimators=200; total time= 2.2min
[CV] END .....max_depth=20, n_estimators=50; total time= 1.1min
[CV] END .....max_depth=20, n_estimators=50; total time= 1.1min
[CV] END .....max_depth=20, n_estimators=50; total time= 1.1min
[CV] END .....max_depth=20, n_estimators=150; total time= 3.2min
[CV] END .....max_depth=20, n_estimators=150; total time= 3.2min
[CV] END .....max_depth=20, n_estimators=150; total time= 3.2min
[CV] END .....max_depth=20, n_estimators=200; total time= 4.2min
[CV] END .....max_depth=20, n_estimators=200; total time= 4.2min
[CV] END .....max_depth=20, n_estimators=200; total time= 4.3min
[CV] END .....max_depth=30, n_estimators=50; total time= 1.6min
[CV] END .....max_depth=30, n_estimators=50; total time= 1.6min
[CV] END .....max_depth=30, n_estimators=50; total time= 1.6min
[CV] END .....max_depth=30, n_estimators=150; total time= 4.5min
[CV] END .....max_depth=30, n_estimators=150; total time= 4.5min
```

```
[CV] END .....................max_depth=30, n_estimators=150; total time= 4.4min
[CV] END .....................max_depth=30, n_estimators=200; total time= 5.8min
[CV] END .....................max_depth=30, n_estimators=200; total time= 5.7min
[CV] END .....................max_depth=30, n_estimators=200; total time= 5.6min
Best Params from GridSearchCV with XGB for Set s1  {'max_depth': 10, 'n_estimators':
Best score 0.6903363546490361
```

```
results_from_gridsearchcv_s1 = pd.DataFrame(grid_search_s1.cv_results_)
results_from_gridsearchcv_s1.head(2)
```

	mean_fit_time	std_fit_time	mean_score_time	std_score_time	param_max_depth	pa
0	35.386141	0.246976	0.296622	0.007394	10	
1	98.257868	0.161131	0.372990	0.003908	10	

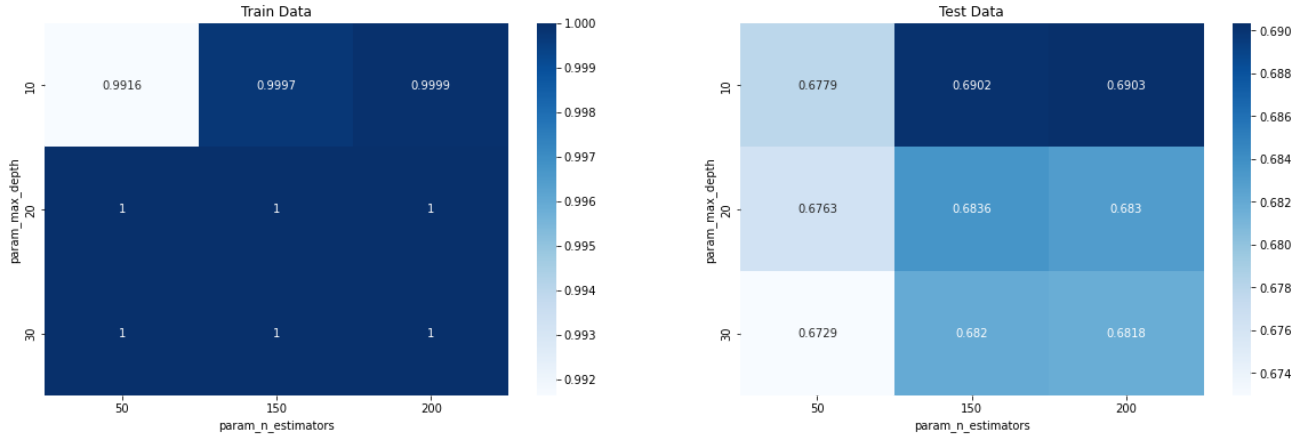
```
pip install pygments
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/p
Requirement already satisfied: pygments in /usr/local/lib/python3.7/dist-packages (2
```

Loading...

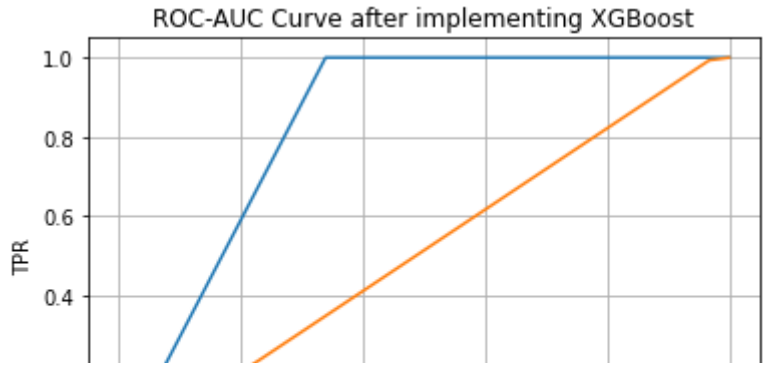
del both on train data and cross validation data for each hyper parameter, with rows as learning_rate, columns as n_estimators, and values inside the cell representing AUC Score

```
max_auc_scores = results_from_gridsearchcv_s1.groupby(['param_max_depth', 'param_n_estimat

max_auc_scores = max_auc_scores.unstack()[['mean_test_score', 'mean_train_score']]

fig, ax = plt.subplots(1, 2, figsize=(20, 6))

sns.heatmap(max_auc_scores.mean_train_score, annot = True, fmt='.4g', cmap="Blues", ax=ax[
sns.heatmap(max_auc_scores.mean_test_score, annot = True, fmt='.4g', cmap="Blues", ax=ax[1

ax[0].set_title('Train Data')
ax[1].set_title('Test Data')
plt.show()
```



TESTING the performance of the model on test data, plotting ROC Curves

```
xgb_clf_bh_s1 = XGBClassifier(max_depth = 10, n_estimators= 200)
xgb_clf_bh_s1.fit(X_train_s1_merged, y_train)

y_train_predicted_s1 = xgb_clf_bh_s1.predict(X_train_s1_merged)
y_test_predicted_s1 = xgb_clf_bh_s1.predict(X_test_s1_merged)

s1_train_fpr, s1_train_tpr, s1_train_threshold = roc_curve(y_train, y_train_predicted_s1)
s1_test_fpr, s1_test_tpr, s1_test_threshold = roc_curve(y_test, y_test_predicted_s1)

#Accuracy_of_Model_s1 = accuracy_score(y_test,y_test_predicted_s1)
                                      s1)

# calculate scores
train_auc_s1 = str(auc(s1_train_fpr, s1_train_tpr))
test_auc_s1 = str(auc(s1_test_fpr, s1_test_tpr))


plt.plot(s1_train_fpr, s1_train_tpr, label="Train AUC = "+train_auc_s1)
plt.plot(s1_test_fpr, s1_test_tpr, label="Test AUC = "+test_auc_s1)


plt.legend()
plt.xlabel('FPR')
plt.ylabel('TPR')
plt.grid()
plt.title('ROC-AUC Curve after implementing XGBoost')
plt.show()
```




```
def predict_y_vector_from_threshold(probability, threshold, fpr, tpr):

    optimal_threshold = threshold[np.argmax(tpr * (1-fpr))]

    predicted_y_vector = []
    for i in probability:
        if i >= optimal_threshold:
            predicted_y_vector.append(1)
        else:
            predicted_y_vector.append(0)

    return predicted_y_vector


confusion_matrix_s1_train = confusion_matrix(y_train, predict_y_vector_from_threshold(y_tr
confusion_matrix_s1_test = confusion_matrix(y_test, predict_y_vector_from_threshold(y_test

print('confusion_matrix_s1_train ', confusion_matrix_s1_train)
print("*"*50)
print('confusion_matrix_s1_test ', confusion_matrix_s1_test)
```

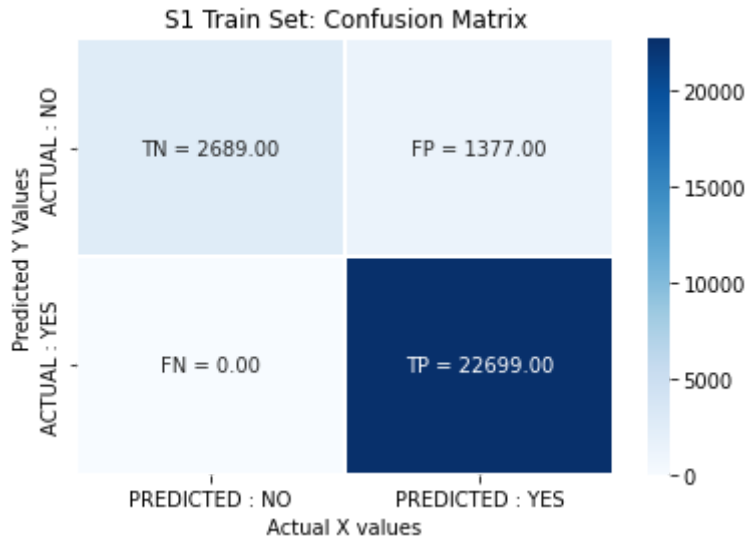
Loading...

```
      [    0 22699]]
     **************************************************
     confusion_matrix_s1_test  [[  55 1626]
      [  66 9725]]


key = (np.asarray([['TN','FP'], ['FN', 'TP']]))


label_train = (np.asarray(["{0} = {1:.2f}" .format(key, value) for key, value in zip(key.f
label_test = (np.asarray(["{0} = {1:.2f}" .format(key, value) for key, value in zip(key.fl
```

Confusion matrix with predicted and original labels of train data points

```
# Heatmap for Confusion Matrix: Train and SET 1
sns.heatmap(confusion_matrix_s1_train, linewidths=.5, xticklabels=['PREDICTED : NO', 'PRED

plt.title('S1 Train Set: Confusion Matrix')
plt.xlabel('Actual X values')
```

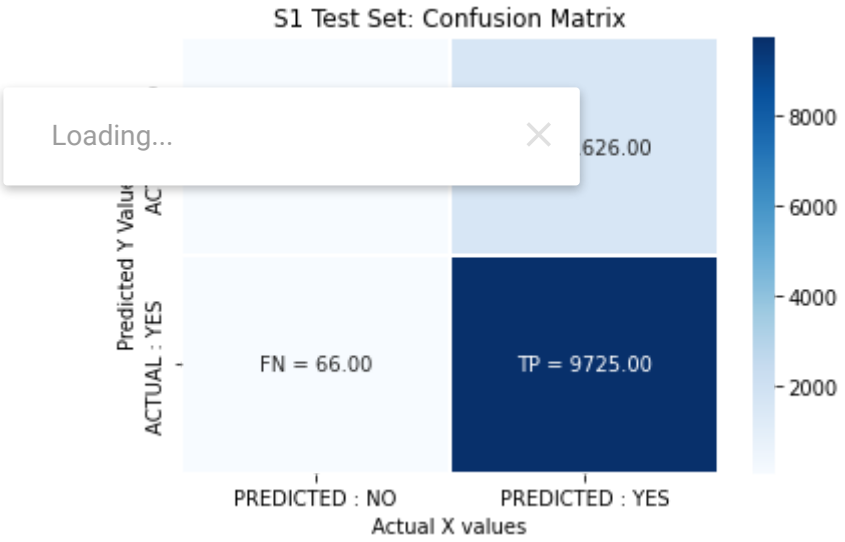
```
plt.ylabel('Predicted Y Values')
plt.show()
```



Confusion matrix with predicted and original labels of test data points

```
sns.heatmap(confusion_matrix_s1_test, linewidths=.5, xticklabels=['PREDICTED : NO', 'PREDI
```

```
plt.title('S1 Test Set: Confusion Matrix')
plt.xlabel('Actual X values')
plt.ylabel('Predicted Y Values')
plt.show()
```



Train XGBoost model on set-2

```
from sklearn.model_selection import GridSearchCV
from xgboost.sklearn import XGBClassifier

xgb_clf_s2 = XGBClassifier()

params = {
```

```
"max_depth":[10,20,30],
'n_estimators': [50,150,200]
}

grid_search_s2 = GridSearchCV(xgb_clf_s2, params, cv=3, scoring='roc_auc',verbose = 2,retu

grid_search_s2.fit(X_train_s2_merged, y_train)

best_params_gridsearch_xgb_s2 = grid_search_s2.best_params_
best_score_s2 = grid_search_s2.best_score_

print("Best Params from GridSearchCV with XGB for Set s2 ", best_params_gridsearch_xgb_s2)
print("Best score",best_score_s2)
```

```
Fitting 3 folds for each of 9 candidates, totalling 27 fits
[CV] END .....................max_depth=10, n_estimators=50; total time= 2.3min
[CV] END .....................max_depth=10, n_estimators=50; total time= 2.3min
[CV] END .....................max_depth=10, n_estimators=50; total time= 2.3min
[CV] END .....................max_depth=10, n_estimators=150; total time= 7.2min
[CV] END .....................max_depth=10, n_estimators=150; total time= 7.3min
[CV] END .....................max_depth=10, n_estimators=150; total time= 7.2min
[CV] END .....................max_depth=10, n_estimators=200; total time= 9.4min
[CV] END .....................max_depth=10, n_estimators=200; total time= 9.3min
[CV] END .....................max_depth=10, n_estimators=200; total time= 9.2min
[CV] END .....................max_depth=20, n_estimators=50; total time= 3.7min
[CV] END .....................max_depth=20, n_estimators=50; total time= 3.7min
[CV] END .....................max_depth=20, n_estimators=50; total time= 3.7min
[CV] END .....................max_depth=20, n_estimators=150; total time= 9.6min
[CV] END .....................max_depth=20, n_estimators=150; total time= 9.7min
[CV] END .....................max_depth=20, n_estimators=150; total time= 9.6min
[CV] END .....................max_depth=20, n_estimators=200; total time=11.9min
[CV] END .....................max_depth=20, n_estimators=200; total time=12.2min
[CV] END .....................max_depth=20, n_estimators=200; total time=12.0min
                              max_depth=30, n_estimators=50; total time= 4.1min
                              max_depth=30, n_estimators=50; total time= 4.1min
                              max_depth=30, n_estimators=50; total time= 4.1min
[CV] END .....................max_depth=30, n_estimators=150; total time=10.0min
[CV] END .....................max_depth=30, n_estimators=150; total time=10.1min
[CV] END .....................max_depth=30, n_estimators=150; total time=10.0min
[CV] END .....................max_depth=30, n_estimators=200; total time=12.4min
[CV] END .....................max_depth=30, n_estimators=200; total time=12.6min
[CV] END .....................max_depth=30, n_estimators=200; total time=12.5min
Best Params from GridSearchCV with XGB for Set s2  {'max_depth': 10, 'n_estimators':
Best score 0.6794772484704256
```

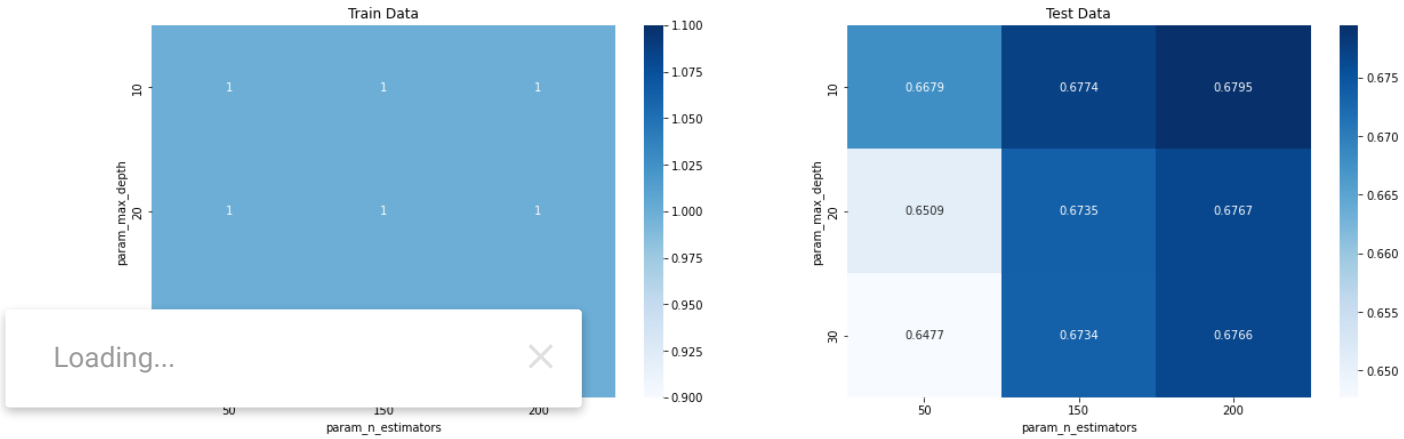
Loading...

```
results_from_gridsearchcv_s2 = pd.DataFrame(grid_search_s2.cv_results_)
results_from_gridsearchcv_s2.head(2)
```

	mean_fit_time	std_fit_time	mean_score_time	std_score_time	param_max_depth	pa
0	138.767930	0.419758	1.272412	0.014535	10	

Heat-Map for Set-2

```
max_auc_scores = results_from_gridsearchcv_s2.groupby(['param_max_depth', 'param_n_estimat

max_auc_scores = max_auc_scores.unstack()[['mean_test_score', 'mean_train_score']]

fig, ax = plt.subplots(1, 2, figsize=(20, 6))

sns.heatmap(max_auc_scores.mean_train_score, annot = True, fmt='.4g', cmap="Blues", ax=ax[
sns.heatmap(max_auc_scores.mean_test_score, annot = True, fmt='.4g', cmap="Blues", ax=ax[1

ax[0].set_title('Train Data')
ax[1].set_title('Test Data')
plt.show()
```



ROC curve - After finding the best hyper parameter, training our model with it, and finding the AUC on test data and plot the ROC curve on both train and test.

```
xgb_clf_bh_s2 = XGBClassifier(max_depth = 10, n_estimators= 200)
xgb_clf_bh_s2.fit(X_train_s2_merged, y_train)

y_train_predicted_s2 = xgb_clf_bh_s2.predict(X_train_s2_merged)
y_test_predicted_s2 = xgb_clf_bh_s2.predict(X_test_s2_merged)
```

```
s2_train_fpr, s2_train_tpr, s2_train_threshold = roc_curve(y_train, y_train_predicted_s2)
s2_test_fpr, s2_test_tpr, s2_test_threshold = roc_curve(y_test, y_test_predicted_s2)

#Accuracy_of_Model_s2 = accuracy_score(y_test,y_test_predicted_s2)
#print("Accuracy",Accuracy_of_Model_s2)

# calculate scores
train_auc_s2 = str(auc(s2_train_fpr, s2_train_tpr))
test_auc_s2 = str(auc(s2_test_fpr, s2_test_tpr))


plt.plot(s2_train_fpr, s2_train_tpr, label="Train AUC = "+train_auc_s2)
plt.plot(s2_test_fpr, s2_test_tpr, label="Test AUC = "+test_auc_s2)


plt.legend()
plt.xlabel('FPR')
plt.ylabel('TPR')
plt.grid()
plt.title('ROC-AUC Curve after implementing XGBoost')
plt.show()
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-1-40ac986525de> in <module>
----> 1 xgb_clf_bh_s2 = XGBClassifier(max_depth = 10, n_estimators= 200)
      2 xgb_clf_bh_s2.fit(X_train_s2_merged, y_train)
      3
      4 y_train_predicted_s2 = xgb_clf_bh_s2.predict(X_train_s2_merged)
      5 y_test_predicted_s2 = xgb_clf_bh_s2.predict(X_test_s2_merged)

 is not defined
```

Loading...

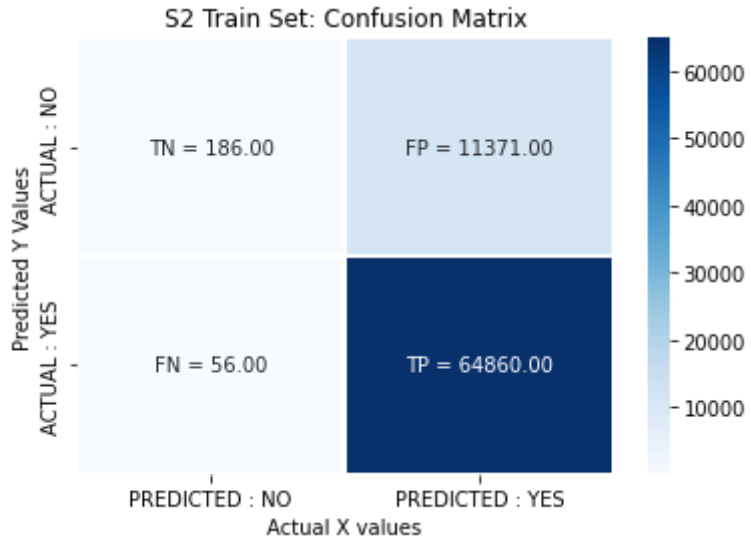
```
confusion_matrix_s2_train = confusion_matrix(y_train, predict_y_vector_from_threshold(y_tr
confusion_matrix_s2_test = confusion_matrix(y_test, predict_y_vector_from_threshold(y_test

print('confusion_matrix_s2_train ', confusion_matrix_s2_train)
print("*"*50)
print('confusion_matrix_s2_test ', confusion_matrix_s2_test)
```

```
confusion_matrix_s2_train  [[  186 11371]
 [   56 64860]]
**************************************************
confusion_matrix_s2_test  [[   44  4941]
 [   48 27742]]
```

```
label_train = (np.asarray(["{0} = {1:.2f}" .format(key, value) for key, value in zip(key.f
label_test = (np.asarray(["{0} = {1:.2f}" .format(key, value) for key, value in zip(key.fl
```

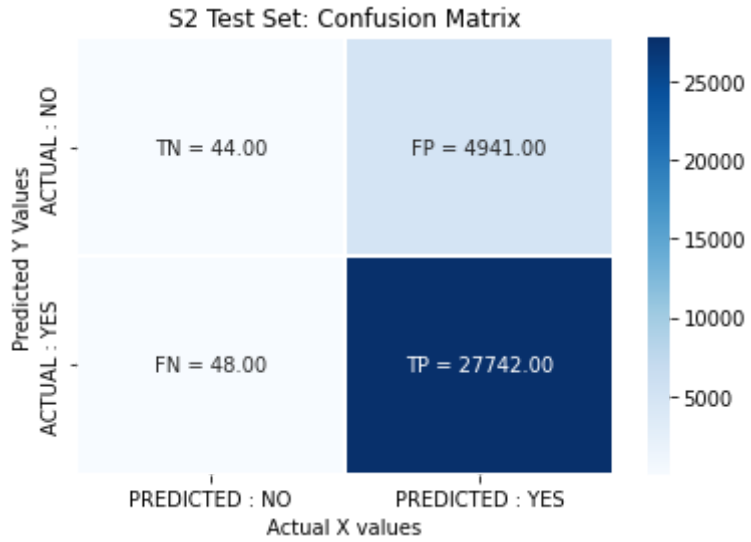
Confusion matrix for train data

```
# Heatmap for Confusion Matrix: Train and SET 1
sns.heatmap(confusion_matrix_s2_train, linewidths=.5, xticklabels=['PREDICTED : NO', 'PRED

plt.title('S2 Train Set: Confusion Matrix')
plt.xlabel('Actual X values')
plt.ylabel('Predicted Y Values')
plt.show()
```



Confusion Matrix for test data

```
sns.heatmap(confusion_matrix_s2_test, linewidths=.5, xticklabels=['PREDICTED : NO', 'PREDI

                                                                    trix')
plt.show()
```

3. Summary

as mentioned in the step 4 of instructions

```
from sklearn.metrics import accuracy_score


Accuracy_of_Model_s2 = accuracy_score(y_test,y_test_predicted_s2)
pretty_table = pd.DataFrame(columns = ['Model','Hyper-parameter_max_depth','Hyper-paramete
pretty_table['Model'] = ["XGB-TFIDF","XGB-TFIDF-W2V"]
pretty_table['Hyper-parameter_max_depth'] = [10,10]
pretty_table['Hyper-parameter_n_estimators'] = [200,200]
pretty_table['Train-AUC'] = [0.7639248146232109,train_auc_s2]
pretty_table['Test-AUC'] = [0.5137137173711016,test_auc_s2]
pretty_table
```

	Model	Hyper-parameter_learning_rate	Hyper-parameter_n_estimators	Train-AUC	
0	XGB-TFIDF	0.2	75	0.5038185242077444	0.501

Loading...