Using Sklearn for model creation with seaborn for data visualization.

In [1]:
```
import numpy as np
import pandas as pd
import os
import gc
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.impute import SimpleImputer
from sklearn.pipeline import FeatureUnion
from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import OneHotEncoder
from sklearn.base import BaseEstimator,TransformerMixin
from sklearn.pipeline import Pipeline, FeatureUnion
from sklearn.compose import ColumnTransformer
import seaborn as sns
from sklearn.metrics import accuracy_score
from sklearn.metrics import roc_auc_score
from sklearn.metrics import f1_score
from sklearn.metrics import RocCurveDisplay
from sklearn.model_selection import GridSearchCV
from sklearn.model_selection import RandomizedSearchCV
from sklearn.metrics import plot_confusion_matrix
from sklearn.metrics import RocCurveDisplay
from sklearn.ensemble import RandomForestClassifier
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.linear_model import SGDClassifier
from sklearn.neighbors import KNeighborsClassifier
```

In [2]:
```
# !pip install --upgrade --user scikit-learn
```

```
Requirement already satisfied: scikit-learn in c:\users\prath\appdata\roaming\python\pyt
hon38\site-packages (1.0.2)
Requirement already satisfied: threadpoolctl>=2.0.0 in c:\programdata\anaconda3\lib\site
-packages (from scikit-learn) (2.1.0)
Requirement already satisfied: joblib>=0.11 in c:\programdata\anaconda3\lib\site-package
s (from scikit-learn) (1.0.1)
Requirement already satisfied: numpy>=1.14.6 in c:\programdata\anaconda3\lib\site-packag
es (from scikit-learn) (1.20.1)
Requirement already satisfied: scipy>=1.1.0 in c:\programdata\anaconda3\lib\site-package
s (from scikit-learn) (1.6.2)
```

Importing the dataset and storing in a dataframe

In [2]:
```
df = pd.read_csv("data/train_dataset.csv",index_col=False)
```

In [3]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3216 entries, 0 to 3215
Data columns (total 35 columns):
 #   Column                    Non-Null Count  Dtype
---  ------                    --------------  -----
 0   Unnamed: 0                3216 non-null   int64
 1   Unnamed: 0.1              3216 non-null   int64
```

```
 2   key                       3216 non-null   object
 3   ID                        3216 non-null   float64
 4   create_date               3216 non-null   object
 5   user                      3216 non-null   object
 6   userID                    3216 non-null   float64
 7   RT_TF                     3216 non-null   bool
 8   full_text                 3216 non-null   object
 9   Sample.ID.x               3216 non-null   int64
 10  Sample.ID.y               3216 non-null   int64
 11  Still.Exists.x            3216 non-null   bool
 12  Still.Exists.y            3216 non-null   bool
 13  In.English.x              3216 non-null   bool
 14  In.English.y              3216 non-null   bool
 15  Sarcasm.x                 3216 non-null   bool
 16  Sarcasm.y                 3216 non-null   bool
 17  Additional.Comments.x     3216 non-null   object
 18  Additional.Comments.y     3216 non-null   object
 19  User.x                    3216 non-null   object
 20  User.y                    3216 non-null   object
 21  Disagree.With.x           3216 non-null   bool
 22  Disagree.With.y           3216 non-null   bool
 23  Sentiment.Rating.x        3216 non-null   int64
 24  Sentiment.Rating.y        3216 non-null   int64
 25  Calling.Out.x             3216 non-null   int64
 26  Calling.Out.y             3216 non-null   int64
 27  Is.About.the.Holocaust.x  2264 non-null   float64
 28  Is.About.the.Holocaust.y  2264 non-null   float64
 29  IHRA.Section.x            3216 non-null   int64
 30  IHRA.Section.y            3216 non-null   int64
 31  sample_name               3216 non-null   object
 32  Is.About.The.Holocaust.x  952 non-null    float64
 33  Is.About.The.Holocaust.y  952 non-null    float64
 34  Target                    3216 non-null   int64
dtypes: bool(9), float64(6), int64(11), object(9)
memory usage: 681.6+ KB
```

The memreduce function defined below is used to transform the integer defined in python into int8 and int16 so that the integer is compressed in python and the size of the dataframe is reduced. This results in lesser memory usage during the analysis of the data and lesser memory usage during the model training.

In [5]:

```
def memreduce(df):
    mem_before = df.memory_usage().sum() / 1024**2
    print("Memory Usage of DataFrame is "+ str(mem_before))
    for col in df.columns:
        coltype=df[col].dtype
        if coltype!=object:
            c_min=df[col].min()
            c_max=df[col].max()
            if(str(coltype)[:3]=='int'):
                if(c_min>=np.iinfo(np.int8).min and c_max<=np.iinfo(np.int8).max):
                    df[col]=df[col].astype(np.int8)
                elif(c_min>=np.iinfo(np.int16).min and c_max<=np.iinfo(np.int16).max):
                    df[col]=df[col].astype(np.int16)
                elif(c_min>=np.iinfo(np.int16).min and c_max<=np.iinfo(np.int16).max):
                    df[col]=df[col].astype(np.int16)

            elif(str(coltype)[:5]=='float'):
```

```
                if(c_min>=np.finfo(np.float16).min and c_max<=np.finfo(np.float16).max)
                    df[col]=df[col].astype(np.float16)
                elif(c_min>=np.finfo(np.float32).min and c_max<=np.finfo(np.float32).ma
                    df[col]=df[col].astype(np.float32)
    mem_before = df.memory_usage().sum() / 1024**2
    print("Memory Usage of DataFrame after optimization is "+ str(mem_before))
    return df
```

In [6]:
```
df=memreduce(df)
gc.collect()
```

```
Memory Usage of DataFrame is 0.6656646728515625
Memory Usage of DataFrame after optimization is 0.3436279296875
23
```

Out[6]:

The memreduce function reduced the memory from 0.66 to 0.34

In [7]:
```
df.head(10)
```

Out[7]:

	Unnamed: 0	Unnamed: 0.1	key	ID	create_date	user	userID	RT_TF	
0	2454	2454	JewNAS	1.232290e+18	Tue Feb 25 07:54:26 -0500 2020	Leafy13222544	1.209270e+18	True	
1	870	870	JewAS	1.272910e+18	Tue Jun 16 11:13:24 -0400 2020	sharonka3	9.752547e+08	True	
2	763	763	JewAS	1.233040e+18	Thu Feb 27 09:53:39 -0500 2020	SpruceYelverton	1.114823e+09	True	Je
3	3744	3744	KikesAS	1.202940e+18	Fri Dec 06 08:25:54 -0500 2019	plive_calmer	8.404970e+17	False	Th
4	1525	1525	JewNAS	1.168870e+18	Tue Sep 03 08:53:53 -0400 2019	emzeekg	2.975341e+09	True	R n
5	2363	2363	JewNAS	1.231520e+18	Sun Feb 23 05:09:05 -0500 2020	mksharma4269	4.355702e+09	True	T
6	1737	1737	JewNAS	1.110570e+18	Tue Mar 26 11:42:27 -0400 2019	DrKlep	2.481168e+07	True	C
7	1436	1436	JewNAS	1.105120e+18	Mon Mar 11 11:02:53 -0400 2019	Noetic_Karma	5.166556e+07	False	W

	Unnamed: 0	Unnamed: 0.1	key	ID	create_date	user	userID	RT_TF	
8	1322	1322	JewNAS	1.146550e+18	Wed Jul 03 18:34:35 -0400 2019	sagetwitting	3.257236e+09	True	sta
9	1577	1577	JewNAS	1.115660e+18	Tue Apr 09 12:39:16 -0400 2019	Charlot38927993	2.793329e+09	True	

10 rows × 35 columns

Created a function to find the missing values in the dataset. This function returns the list of attributes with missing values.

In [8]:
```
def misval(df):
        mis_val = df.isnull().sum()
        mis_val_percent = 100 * df.isnull().sum() / len(df)
        mis_val = pd.concat([mis_val, mis_val_percent], axis=1)
        mis_val = mis_val.rename(
        columns = {0 : 'Missing Values', 1 : 'per'})
        mis_val['Data Type'] = df.dtypes
        mis_val = mis_val[
            mis_val.iloc[:,1] != 0].sort_values('per', ascending=False).round(1)
        mis_val['per']=mis_val['per']
        mis_val['per']=mis_val['per'].astype(np.float16)

        return mis_val

sum_missing=misval(df)
sum_missing
```

Out[8]:

	Missing Values	per	Data Type
Is.About.The.Holocaust.x	2264	70.37500	float16
Is.About.The.Holocaust.y	2264	70.37500	float16
Is.About.the.Holocaust.x	952	29.59375	float16
Is.About.the.Holocaust.y	952	29.59375	float16

Describing the Features in te dataset

In [ ]:
```
df.describe()
```

	Unnamed: 0.1	Unnamed: 0	ID	userID	Sample.ID.x	Sample.ID.y	Sentiment.Rati
count	3216.000000	3216.000000	3.216000e+03	3.216000e+03	3216.000000	3216.000000	3216.000
mean	1999.877799	1999.877799	1.215330e+18	4.117402e+17	242.249378	242.249378	2.768
std	1168.858979	1168.858979	6.075276e+16	5.062683e+17	144.527845	144.527845	0.637

	Unnamed: 0.1	Unnamed: 0	ID	userID	Sample.ID.x	Sample.ID.y	Sentiment.Rati
min	0.000000	0.000000	1.079900e+18	1.994321e+06	1.000000	1.000000	1.00(
25%	982.500000	982.500000	1.167218e+18	2.608568e+08	118.000000	118.000000	3.00(
50%	1990.000000	1990.000000	1.225400e+18	2.742042e+09	237.000000	237.000000	3.00(
75%	3023.500000	3023.500000	1.266367e+18	9.545080e+17	366.250000	366.250000	3.00(
max	4018.000000	4018.000000	1.300530e+18	1.294950e+18	500.000000	500.000000	5.00(

Describing All features in the Train Dataset

In [ ]:
```
df.describe(include="all")
```

	Unnamed: 0.1	Unnamed: 0	key	ID	create_date	user	userID	RT_
count	3216.000000	3216.000000	3216	3.216000e+03	3216	3216	3.216000e+03	32
unique	NaN	NaN	8	NaN	3211	2931	NaN	
top	NaN	NaN	JewNAS	NaN	Mon Jul 27 20:43:01 -0400 2020	theforeverman	NaN	Ti
freq	NaN	NaN	1763	NaN	4	32	NaN	16
mean	1999.877799	1999.877799	NaN	1.215330e+18	NaN	NaN	4.117402e+17	N
std	1168.858979	1168.858979	NaN	6.075276e+16	NaN	NaN	5.062683e+17	N
min	0.000000	0.000000	NaN	1.079900e+18	NaN	NaN	1.994321e+06	N
25%	982.500000	982.500000	NaN	1.167218e+18	NaN	NaN	2.608568e+08	N
50%	1990.000000	1990.000000	NaN	1.225400e+18	NaN	NaN	2.742042e+09	N
75%	3023.500000	3023.500000	NaN	1.266367e+18	NaN	NaN	9.545080e+17	N
max	4018.000000	4018.000000	NaN	1.300530e+18	NaN	NaN	1.294950e+18	N

11 rows × 35 columns

In [ ]:
```
sum_missing = (df.isna().sum())
```

In [ ]:
```
print('Features missing values',sum_missing[sum_missing > 0].count())
```

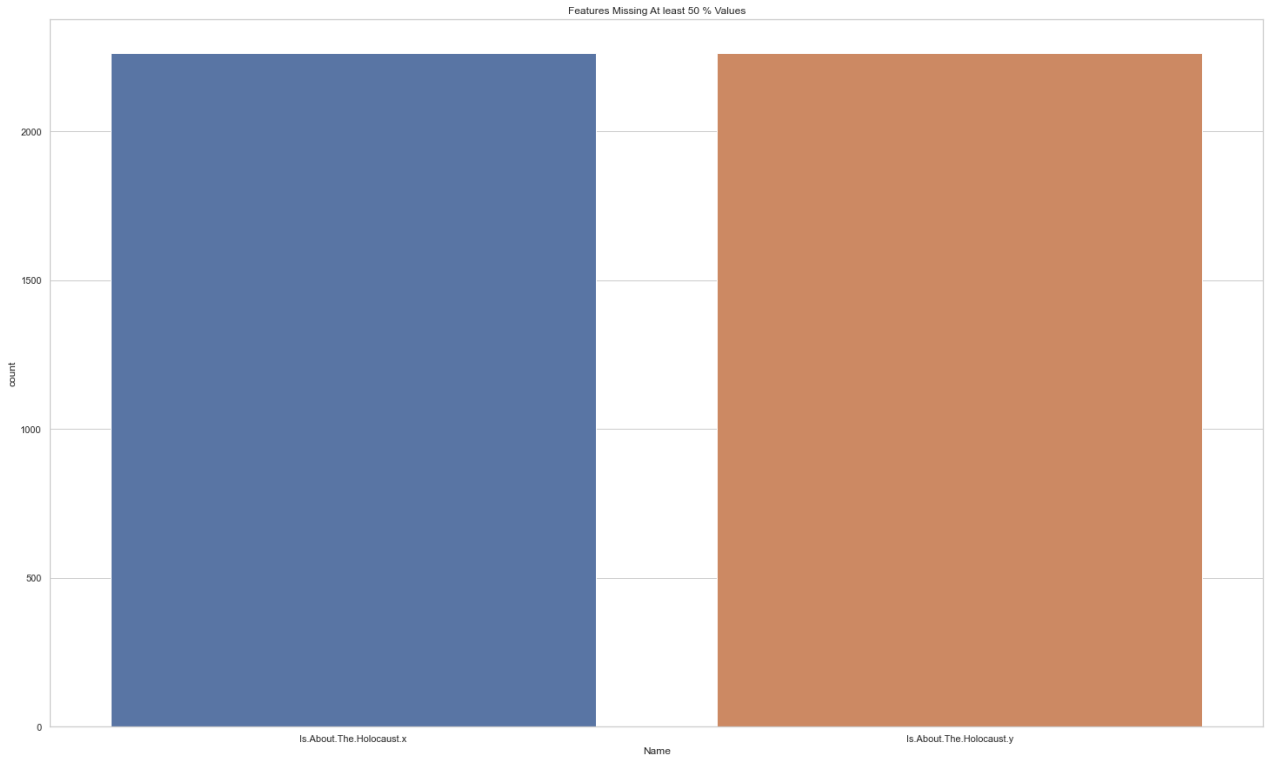
```
Features missing values 4
```

In [ ]:
```
sum_missing = pd.DataFrame(sum_missing)
sum_missing.columns = ['count']
```

```
sum_missing.index.names = ['Name']
sum_missing['Name'] = sum_missing.index
```

In [ ]:

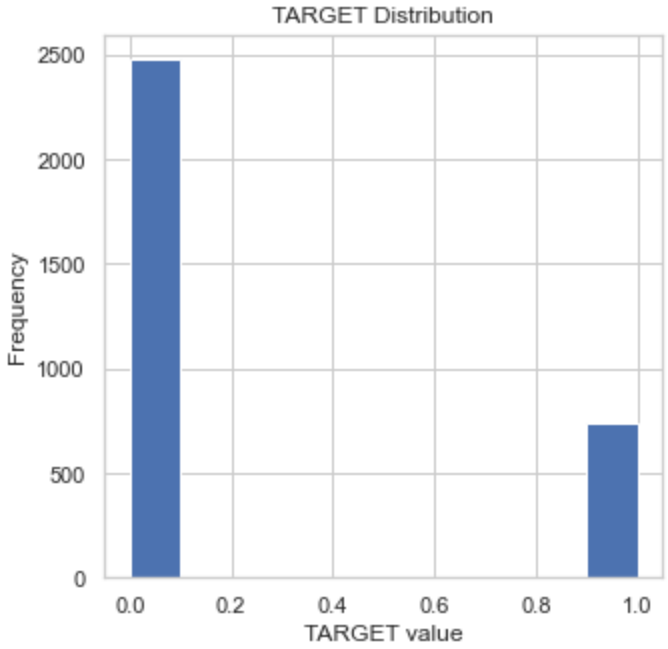
```
sns.set(style="whitegrid", color_codes=True,rc={'figure.figsize':(25,15)})
sns.barplot(x = 'Name', y = 'count', data=sum_missing[sum_missing['count']>len(df)/2]).
# plt.xticks(rotation = 90)
plt.show()
```



Checking if the target variable is balanced

In [ ]:

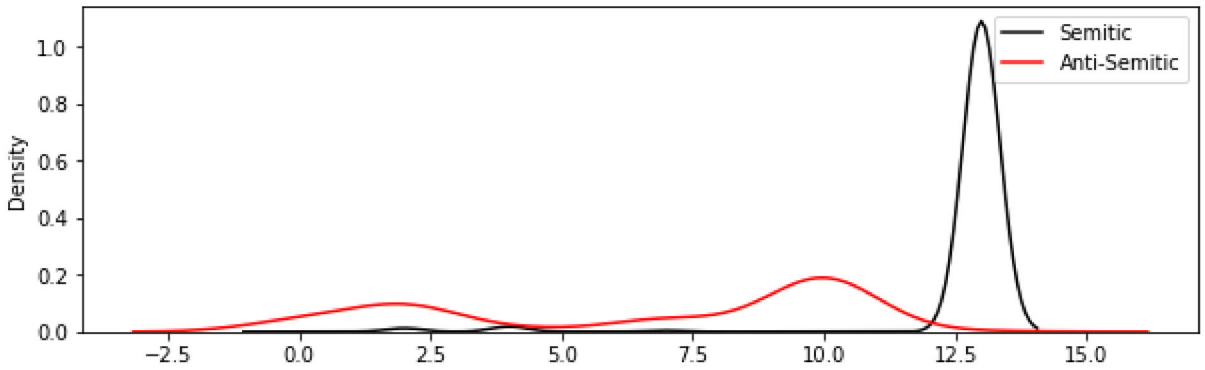
```
plt.figure(figsize=(5,5))
df['Target'].plot.hist(label=True);
plt.title('TARGET Distribution')
plt.xlabel('TARGET value')
plt.ylabel('Frequency');
plt.show()
```



Analysis on Numerical Features: IHRA section

In [4]:
```
plt.figure(figsize=(10,3))
sns.distplot(df[df['Target']==0]['IHRA.Section.x'].values,hist=False,label="Semitic", c
sns.distplot(df[df['Target']==1]['IHRA.Section.x'].values,hist=False,label="Anti-Semiti
plt.legend()
plt.show()
```

```
C:\Users\gavin\anaconda3\lib\site-packages\seaborn\distributions.py:2619: FutureWarning:
`distplot` is a deprecated function and will be removed in a future version. Please adap
t your code to use either `displot` (a figure-level function with similar flexibility) o
r `kdeplot` (an axes-level function for kernel density plots).
  warnings.warn(msg, FutureWarning)
C:\Users\gavin\anaconda3\lib\site-packages\seaborn\distributions.py:2619: FutureWarning:
`distplot` is a deprecated function and will be removed in a future version. Please adap
t your code to use either `displot` (a figure-level function with similar flexibility) o
r `kdeplot` (an axes-level function for kernel density plots).
  warnings.warn(msg, FutureWarning)
```



In [5]:
```
plt.figure(figsize=(10,3))
sns.distplot(df[df['Target']==0]['IHRA.Section.y'].values,hist=False,label="Semitic", c
sns.distplot(df[df['Target']==1]['IHRA.Section.y'].values,hist=False,label="Anti-Semiti
plt.legend()
plt.show()
```

```
C:\Users\gavin\anaconda3\lib\site-packages\seaborn\distributions.py:2619: FutureWarning:
`distplot` is a deprecated function and will be removed in a future version. Please adap
t your code to use either `displot` (a figure-level function with similar flexibility) o
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t your code to use either `displot` (a figure-level function with similar flexibility) o
r `kdeplot` (an axes-level function for kernel density plots).
  warnings.warn(msg, FutureWarning)
```
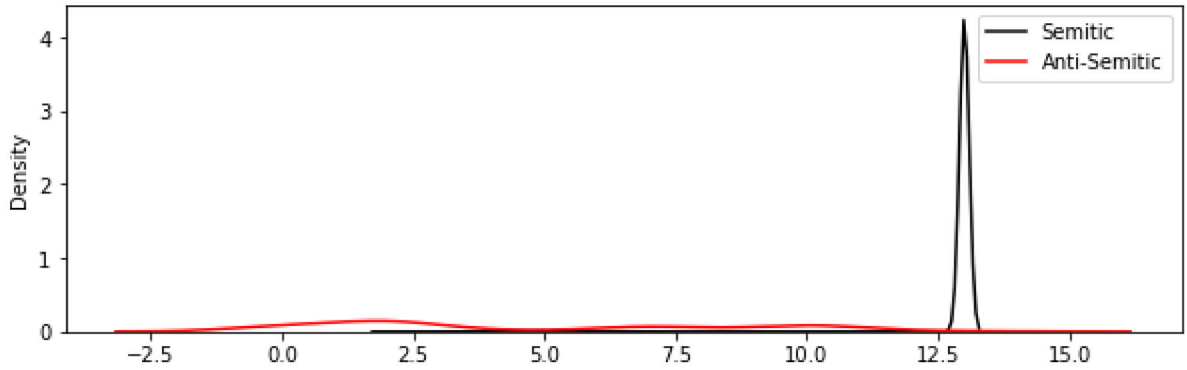
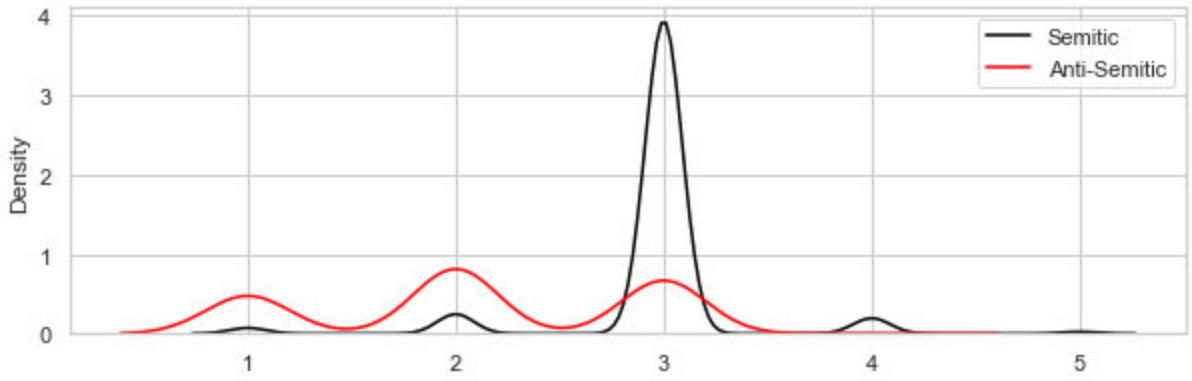



Analysis on Numerical Features: Sentiment Rating section

In [ ]:

```
plt.figure(figsize=(10,3))
sns.distplot(df[df['Target']==0]['Sentiment.Rating.x'].values,hist=False,label="Semitic
sns.distplot(df[df['Target']==1]['Sentiment.Rating.x'].values,hist=False,label="Anti-Se
plt.legend()
plt.show()
```

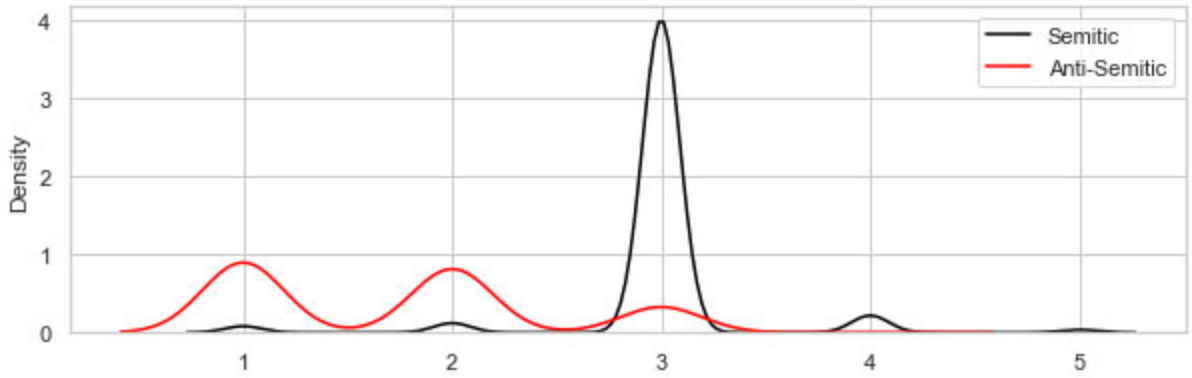
```
C:\Users\gavin\AppData\Local\Programs\Python\Python39\lib\site-packages\seaborn\distribu
tions.py:2619: FutureWarning: `distplot` is a deprecated function and will be removed in
a future version. Please adapt your code to use either `displot` (a figure-level functio
n with similar flexibility) or `kdeplot` (an axes-level function for kernel density plot
s).
  warnings.warn(msg, FutureWarning)
C:\Users\gavin\AppData\Local\Programs\Python\Python39\lib\site-packages\seaborn\distribu
tions.py:2619: FutureWarning: `distplot` is a deprecated function and will be removed in
a future version. Please adapt your code to use either `displot` (a figure-level functio
n with similar flexibility) or `kdeplot` (an axes-level function for kernel density plot
s).
  warnings.warn(msg, FutureWarning)
```



In [ ]:

```
plt.figure(figsize=(10,3))
sns.distplot(df[df['Target']==0]['Sentiment.Rating.y'].values,hist=False,label="Semitic
sns.distplot(df[df['Target']==1]['Sentiment.Rating.y'].values,hist=False,label="Anti-Se
plt.legend()
plt.show()
```

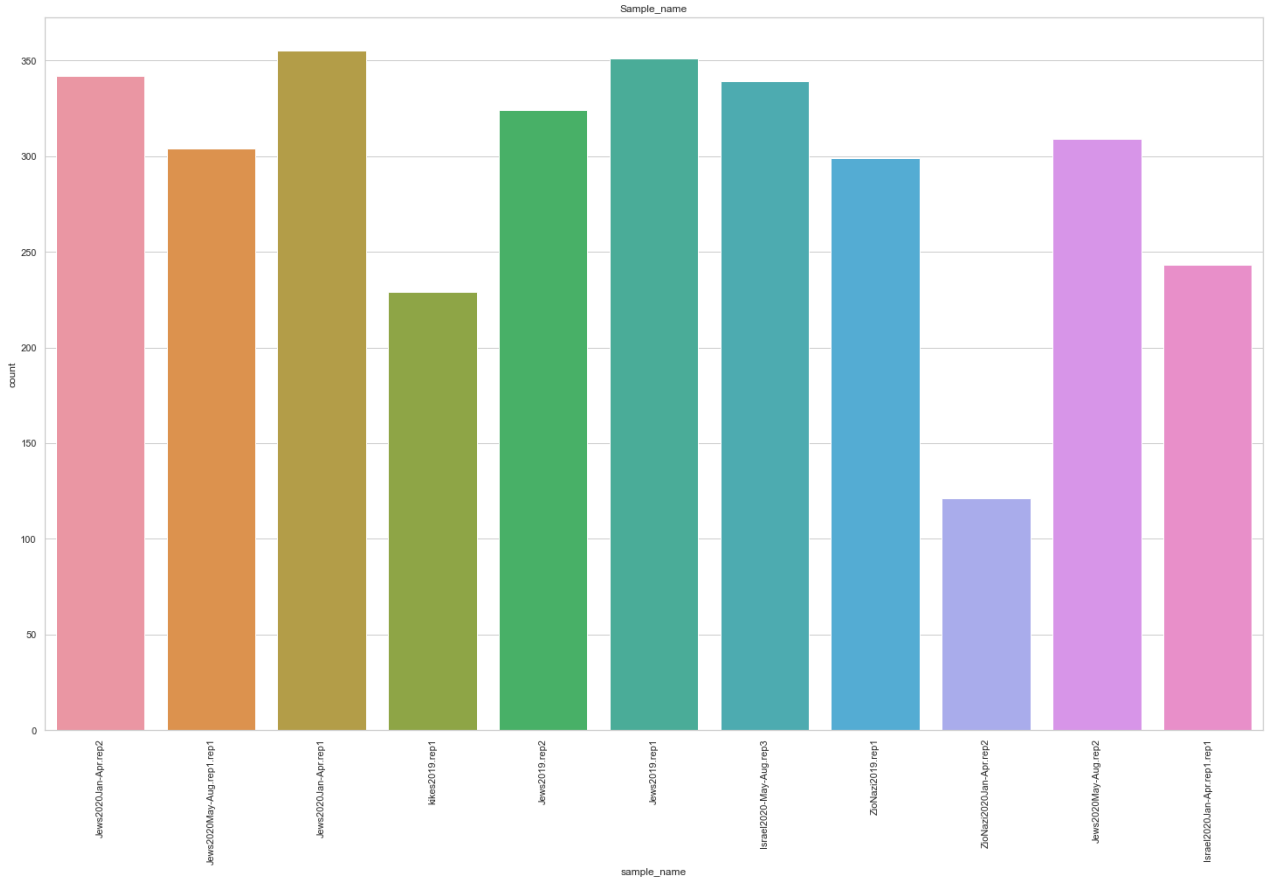
```
C:\Users\gavin\AppData\Local\Programs\Python\Python39\lib\site-packages\seaborn\distribu
tions.py:2619: FutureWarning: `distplot` is a deprecated function and will be removed in
a future version. Please adapt your code to use either `displot` (a figure-level functio
n with similar flexibility) or `kdeplot` (an axes-level function for kernel density plot
s).
  warnings.warn(msg, FutureWarning)
C:\Users\gavin\AppData\Local\Programs\Python\Python39\lib\site-packages\seaborn\distribu
tions.py:2619: FutureWarning: `distplot` is a deprecated function and will be removed in
a future version. Please adapt your code to use either `displot` (a figure-level functio
n with similar flexibility) or `kdeplot` (an axes-level function for kernel density plot
s).
  warnings.warn(msg, FutureWarning)
```



Distribution of Sample_name

In [ ]:

```
sns.countplot(x='sample_name', data=df)
plt.title('Sample_name')
plt.xticks(rotation=90)
plt.show()
```



Correlation

Created a correlation map of the dataset with the target variable.

In [9]:
```
corr_mat = df.corr(method='pearson')
upper_corr_mat = corr_mat.where(np.triu(np.ones(corr_mat.shape), k=1).astype(bool))
unique_corr_pairs = upper_corr_mat.unstack().dropna()
sorted_mat = unique_corr_pairs.sort_values()

cm=pd.DataFrame(sorted_mat)
cm=cm.loc[((cm[0]>-0.9) | (cm[0]<0.9)),:]
# df[df.index.str.contains('foo')]
cm.reset_index(inplace=True)
```

In [10]:
```
cm[cm['level_0'].str.contains('Target') | cm['level_1'].str.contains('Target') ]
```

Out[10]:

	level_0	level_1	0
0	Target	IHRA.Section.y	-0.872644
1	Target	IHRA.Section.x	-0.729260
2	Target	Sentiment.Rating.y	-0.723462
3	Target	Sentiment.Rating.x	-0.571269
4	Target	RT_TF	-0.281357
7	Target	Calling.Out.x	-0.198643

	level_0	level_1	0
10	Target	Is.About.the.Holocaust.x	-0.161212
11	Target	ID	-0.157218
12	Target	Calling.Out.y	-0.148500
16	Target	Still.Exists.x	-0.124562
19	Target	Is.About.the.Holocaust.y	-0.122588
22	Target	Still.Exists.y	-0.115336
29	Target	Is.About.The.Holocaust.x	-0.077513
43	Target	Sample.ID.x	-0.055638
44	Target	Sample.ID.y	-0.055638
53	Target	Disagree.With.x	-0.047500
67	Target	Sarcasm.x	-0.032951
78	Target	Is.About.The.Holocaust.y	-0.022162
83	Target	Sarcasm.y	-0.017971
89	Target	Disagree.With.y	-0.016569
215	Target	userID	0.088735
241	Target	Unnamed: 0.1	0.163121
242	Target	Unnamed: 0	0.163121

In [ ]:
```
df.corr()['Target']
```

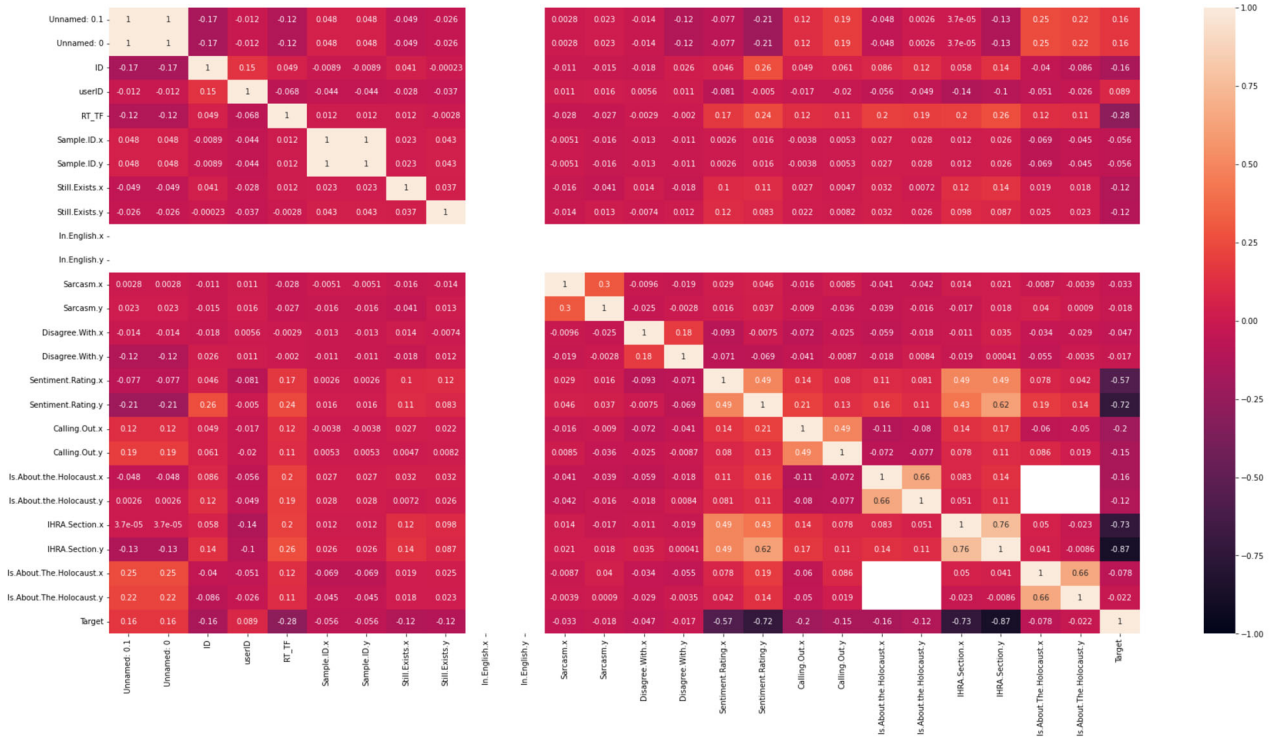
```
Unnamed: 0.1               0.163121
Unnamed: 0                 0.163121
ID                        -0.157218
userID                     0.088735
RT_TF                     -0.281357
Sample.ID.x               -0.055638
Sample.ID.y               -0.055638
Still.Exists.x            -0.124562
Still.Exists.y            -0.115336
In.English.x                    NaN
In.English.y                    NaN
Sarcasm.x                 -0.032951
Sarcasm.y                 -0.017971
Disagree.With.x           -0.047500
Disagree.With.y           -0.016569
Sentiment.Rating.x        -0.571269
Sentiment.Rating.y        -0.723462
Calling.Out.x             -0.198643
Calling.Out.y             -0.148500
Is.About.the.Holocaust.x  -0.161212
Is.About.the.Holocaust.y  -0.122588
IHRA.Section.x            -0.729260
IHRA.Section.y            -0.872644
Is.About.The.Holocaust.x  -0.077513
```

```
Is.About.The.Holocaust.y   -0.022162
Target                      1.000000
Name: Target, dtype: float64
```

In [ ]:

```
plt.figure(figsize=(30, 15))
sns.heatmap(df.corr(),vmin=-1, vmax=1,annot=True)
```

```
<AxesSubplot:>
```



Pipeline

Creating a dataframe selector along with an imputer so that the pipleline can be created.

In [11]:

```
class DataFrameSelector(BaseEstimator, TransformerMixin):
    def __init__(self, attribute_names):
        self.attribute_names = attribute_names
    def fit(self, X, y=None):
        return self
    def transform(self, X):
        return X[self.attribute_names].values

class Imputewithother(BaseEstimator, TransformerMixin):
    def __init__(self):
        super()
    def fit(self, X, y=None):
        return self
    def transform(self, X):
        X=pd.DataFrame(X,columns=['a','b','c','d'])
        h1,h2,h3,h4='a','b','c','d'
        X[h1].fillna(X[h3],inplace=True)
        X[h2].fillna(X[h4],inplace=True)
        X.drop(columns=['c','d'],inplace=True)
        return X.values
```

Creating a test train split from the input data.

In [13]:
```
y=df['Target']
X=df.drop(['Target'],axis=1)
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.20, random_state=
```

In [14]:
```
num_cols =list(X_train._get_numeric_data().columns)
catcols=list(set(X_train.columns) - set(num_cols))
print(num_cols,"\n")
print(catcols)
```

```
['Unnamed: 0', 'Unnamed: 0.1', 'ID', 'userID', 'RT_TF', 'Sample.ID.x', 'Sample.ID.y', 'S
till.Exists.x', 'Still.Exists.y', 'In.English.x', 'In.English.y', 'Sarcasm.x', 'Sarcasm.
y', 'Disagree.With.x', 'Disagree.With.y', 'Sentiment.Rating.x', 'Sentiment.Rating.y', 'C
alling.Out.x', 'Calling.Out.y', 'Is.About.the.Holocaust.x', 'Is.About.the.Holocaust.y',
'IHRA.Section.x', 'IHRA.Section.y', 'Is.About.The.Holocaust.x', 'Is.About.The.Holocaust.
y']

['User.x', 'create_date', 'full_text', 'Additional.Comments.x', 'key', 'sample_name', 'u
ser', 'Additional.Comments.y', 'User.y']
```

In [15]:
```
[(i,v) for i,v in enumerate(list(X_train.columns))]
```

Out[15]:
```
[(0, 'Unnamed: 0'),
 (1, 'Unnamed: 0.1'),
 (2, 'key'),
 (3, 'ID'),
 (4, 'create_date'),
 (5, 'user'),
 (6, 'userID'),
 (7, 'RT_TF'),
 (8, 'full_text'),
 (9, 'Sample.ID.x'),
 (10, 'Sample.ID.y'),
 (11, 'Still.Exists.x'),
 (12, 'Still.Exists.y'),
 (13, 'In.English.x'),
 (14, 'In.English.y'),
 (15, 'Sarcasm.x'),
 (16, 'Sarcasm.y'),
 (17, 'Additional.Comments.x'),
 (18, 'Additional.Comments.y'),
 (19, 'User.x'),
 (20, 'User.y'),
 (21, 'Disagree.With.x'),
 (22, 'Disagree.With.y'),
 (23, 'Sentiment.Rating.x'),
 (24, 'Sentiment.Rating.y'),
 (25, 'Calling.Out.x'),
 (26, 'Calling.Out.y'),
 (27, 'Is.About.the.Holocaust.x'),
 (28, 'Is.About.the.Holocaust.y'),
 (29, 'IHRA.Section.x'),
 (30, 'IHRA.Section.y'),
 (31, 'sample_name'),
 (32, 'Is.About.The.Holocaust.x'),
 (33, 'Is.About.The.Holocaust.y')]
```

In [16]:
```
pipedefault =['RT_TF','Still.Exists.x','Still.Exists.y','Sarcasm.x','Sarcasm.y','Disagr
              'Sentiment.Rating.x','Sentiment.Rating.y','Calling.Out.x','Calling.Out.y'

pipefilter1 = ['Is.About.the.Holocaust.x', 'Is.About.the.Holocaust.y','Is.About.The.Hol
pipefilter2 = ['IHRA.Section.x','IHRA.Section.y','sample_name','key']

pipe0 = Pipeline([
        ('selector', DataFrameSelector(pipedefault)),
    ])

pipe1 = Pipeline([
        ('selector', DataFrameSelector(pipefilter1)),
        ('Imputewithother', Imputewithother()),
        ('imputer', SimpleImputer(strategy='median')),
    ])

pipe2 = Pipeline([
        ('selector', DataFrameSelector(pipefilter2)),
        #('imputer', SimpleImputer(strategy='most_frequent')),
        ('ohe', OneHotEncoder(sparse=False, handle_unknown="ignore"))
    ])

data_prep_pipeline = FeatureUnion(transformer_list=[
        ("pipe0", pipe0),
        ("pipe1", pipe1),
        ("pipe2", pipe2),
    ])
```

In [17]:
```
gc.collect()
```

Out[17]: 90

Creating an experiment log to create store the model test and train metrics during model training.

In [35]:
```
try:
    expLog
except NameError:
    expLog = pd.DataFrame(columns=["exp_name",
                                   "Train Acc",
                                   "Test  Acc",
                                   "Train AUC",
                                   "Test  AUC",
                                   "Train F1",
                                   "Test F1"
                                  ])
```

In [77]:
```
def addresultotable(model,name):
    exp_name = name
    expLog.loc[len(expLog)] = [f"{exp_name}"] + list(np.round(
                   [accuracy_score(y_train, model.predict(X_train)),
                    accuracy_score(y_test, model.predict(X_test)),
                    roc_auc_score(y_train, model.predict(X_train)),
                    roc_auc_score(y_test, model.predict(X_test)),
                    f1_score(y_train, model.predict(X_train), average='weighted'),
                    f1_score(y_test, model.predict(X_test), average='weighted')],
```

```
        4))

def plotConf(model):
    plt.clf()
    plot_confusion_matrix(model, X_train, y_train)
    plt.title('Confusion Matrix ')
    plt.show()

def plotROC(model):
    RocCurveDisplay.from_predictions(y_test, model.predict(X_test))
    plt.show()

def trainmodel(regressor,datapipeline,paramgrid,scoring):
    pipe = Pipeline([
        ("preparation", datapipeline),
        ("reg", regressor)
    ])
    model=RandomizedSearchCV(pipe,param_distributions=paramgrid,n_iter=10,scoring=scori
    model.fit(X_train,y_train)
    return model
```

In [37]:

```
MODELS={}
```

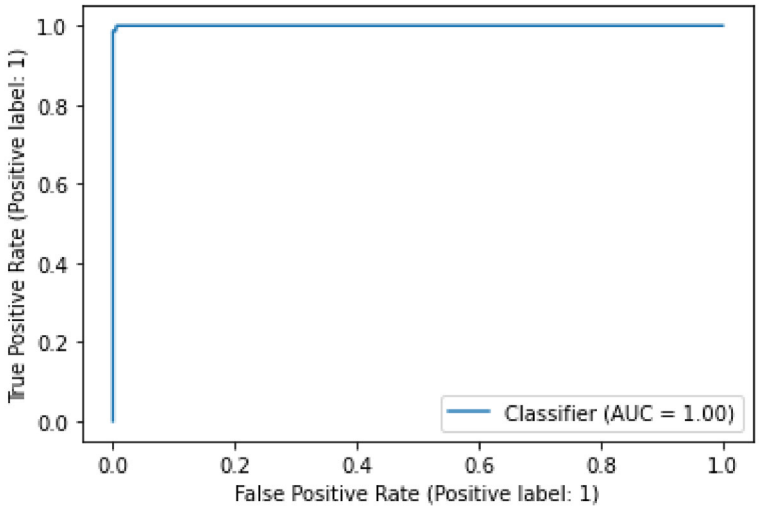
XGBoost

Creating the XGBoost model using the Sklearn package. The XGBoost Model is initilaized using the init parameters that are described below.

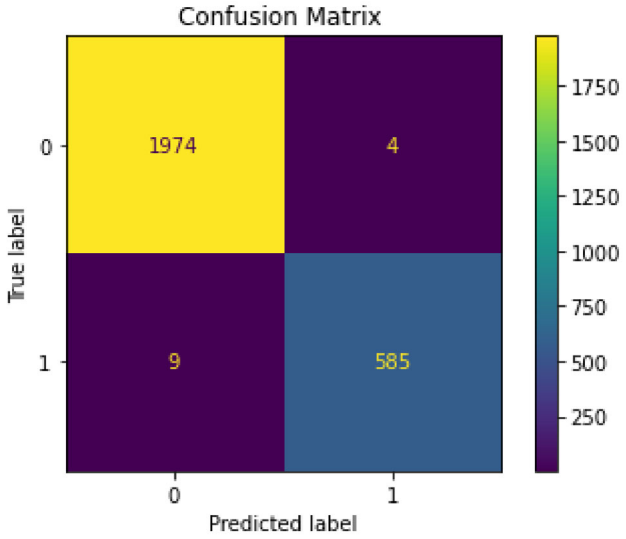
In [38]:

```
parameters = {
    "reg__loss":["deviance"],
    "reg__learning_rate": [0.01, 0.025, 0.05, 0.075, 0.1, 0.15, 0.2],
    "reg__min_samples_split": np.linspace(0.1, 0.5, 12),
    "reg__min_samples_leaf": np.linspace(0.1, 0.5, 12),
    "reg__max_depth":[3,5,8],
    "reg__max_features":["log2","sqrt"],
    "reg__criterion": ["friedman_mse",  "mae"],
    "reg__subsample":[0.5,1.0],
    "reg__n_estimators":[10,50,100]
    }

model=trainmodel(GradientBoostingClassifier(),data_prep_pipeline,parameters,'accuracy')
addresultotable(model,"XGB")

plotROC(model)
plotConf(model)
```

```
Fitting 5 folds for each of 10 candidates, totalling 50 fits
```




```
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\utils\deprecation.p
y:87: FutureWarning: Function plot_confusion_matrix is deprecated; Function `plot_confus
ion_matrix` is deprecated in 1.0 and will be removed in 1.2. Use one of the class method
s: ConfusionMatrixDisplay.from_predictions or ConfusionMatrixDisplay.from_estimator.
  warnings.warn(msg, category=FutureWarning)
<Figure size 432x288 with 0 Axes>
```



In [39]:
```
model_XGB=model
MODELS['xgb']=model_XGB
```

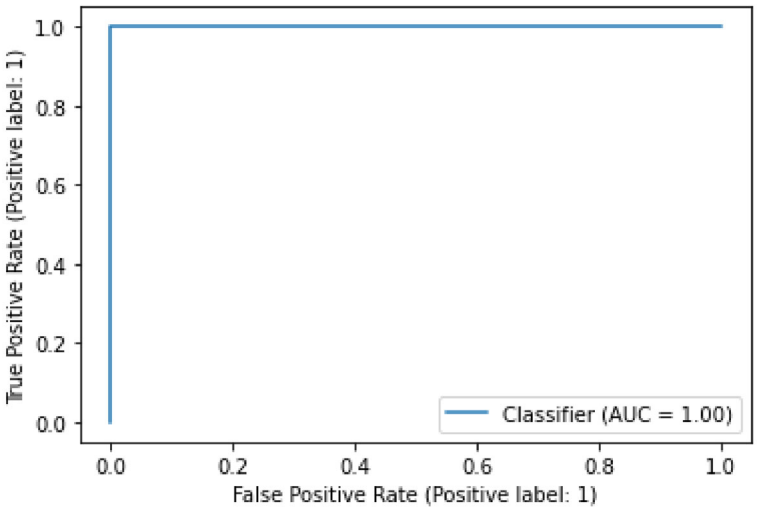
In [40]:
```
model.best_params_
```

Out[40]:
```
{'reg__subsample': 1.0,
 'reg__n_estimators': 50,
 'reg__min_samples_split': 0.390909090909091,
 'reg__min_samples_leaf': 0.13636363636363638,
 'reg__max_features': 'log2',
 'reg__max_depth': 8,
 'reg__loss': 'deviance',
 'reg__learning_rate': 0.2,
 'reg__criterion': 'friedman_mse'}
```

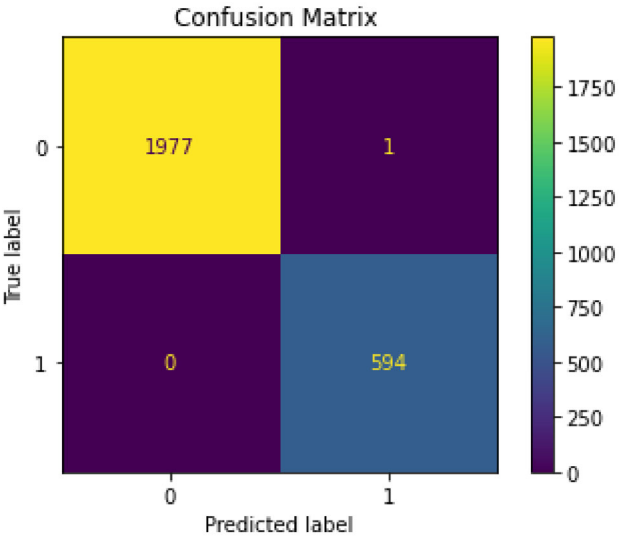
SVD/LOG

In [41]:
```
param_grid = {
    'reg__loss': ['hinge','log'],
    'reg__penalty':['l2', 'l1', 'elasticnet'],
    'reg__alpha': [0.0001, 0.001,0.01, 0.1]
}

model=trainmodel(SGDClassifier(),data_prep_pipeline,param_grid,'accuracy')
if(model.best_params_['reg__loss']=='hinge'):
    from sklearn.calibration import CalibratedClassifierCV
    cal=CalibratedClassifierCV(model, cv='prefit')
    model=trainmodel(cal,data_prep_pipeline,param_grid,'accuracy')
addresultotable(model,"SVD_LOG")
plotROC(model)
plotConf(model)
model_SVD_LOG=model
MODELS['SVD_LOG']=model_SVD_LOG
```

```
Fitting 5 folds for each of 10 candidates, totalling 50 fits
```




```
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\utils\deprecation.py:87: FutureWarning: Function plot_confusion_matrix is deprecated; Function `plot_confusion_matrix` is deprecated in 1.0 and will be removed in 1.2. Use one of the class methods: ConfusionMatrixDisplay.from_predictions or ConfusionMatrixDisplay.from_estimator.
  warnings.warn(msg, category=FutureWarning)
<Figure size 432x288 with 0 Axes>
```



In [43]:
```
model.best_params_
```

Out[43]:
```
{'reg__penalty': 'l2', 'reg__loss': 'log', 'reg__alpha': 0.0001}
```

In [42]:
```
expLog
```

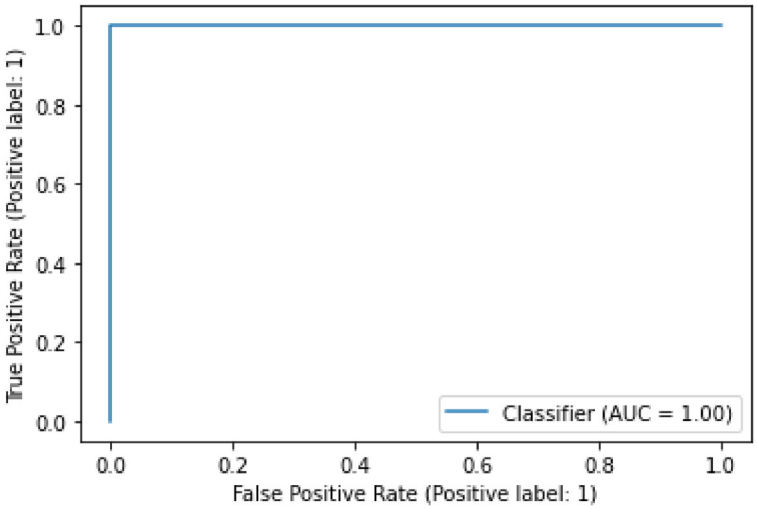
Out[42]:

	exp_name	Train Acc	Test Acc	Train AUC	Test AUC	Train F1	Test F1
0	XGB	0.9949	0.9938	0.9914	0.9913	0.9949	0.9938
1	SVD_LOG	0.9996	1.0000	0.9997	1.0000	0.9996	1.0000

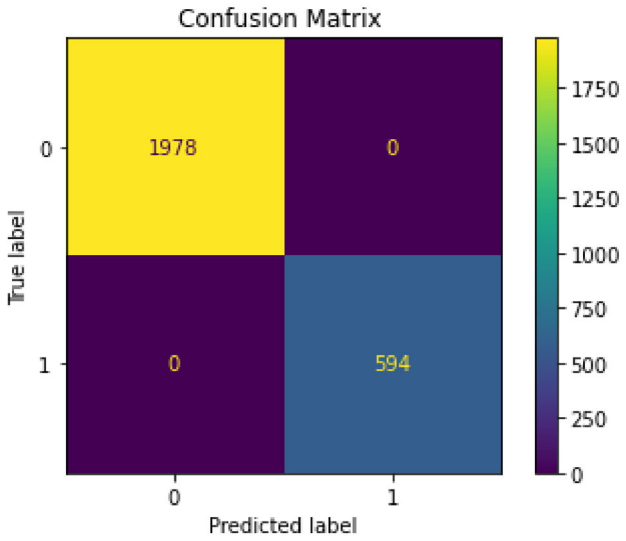
RandomForest

In [46]:
```
param_grid = {
    'reg__bootstrap': [True],
    'reg__max_depth': [10, 20,50,100],
    'reg__max_features': [2, 5,10,50],
    'reg__n_estimators': [100, 200,500]
}
model=trainmodel(RandomForestClassifier(),data_prep_pipeline,param_grid,'accuracy')
addresultotable(model,"RF")
model_RF=model
MODELS['RF']=model_RF
plotROC(model)
plotConf(model)
```

```
Fitting 5 folds for each of 10 candidates, totalling 50 fits
```




```
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\utils\deprecation.py:87: FutureWarning: Function plot_confusion_matrix is deprecated; Function `plot_confusion_matrix` is deprecated in 1.0 and will be removed in 1.2. Use one of the class methods: ConfusionMatrixDisplay.from_predictions or ConfusionMatrixDisplay.from_estimator.
  warnings.warn(msg, category=FutureWarning)
<Figure size 432x288 with 0 Axes>
```



In [47]:
```
model.best_params_
```

Out[47]:
```
{'reg__n_estimators': 500,
 'reg__max_features': 2,
 'reg__max_depth': 50,
 'reg__bootstrap': True}
```

In [48]:
```
expLog
```

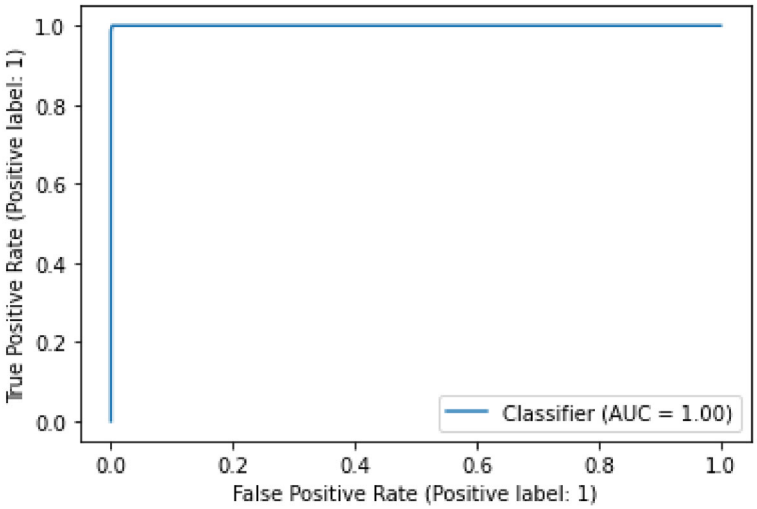
Out[48]:

	exp_name	Train Acc	Test Acc	Train AUC	Test AUC	Train F1	Test F1
0	XGB	0.9949	0.9938	0.9914	0.9913	0.9949	0.9938
1	SVD_LOG	0.9996	1.0000	0.9997	1.0000	0.9996	1.0000
2	RF	1.0000	0.9984	1.0000	0.9990	1.0000	0.9984

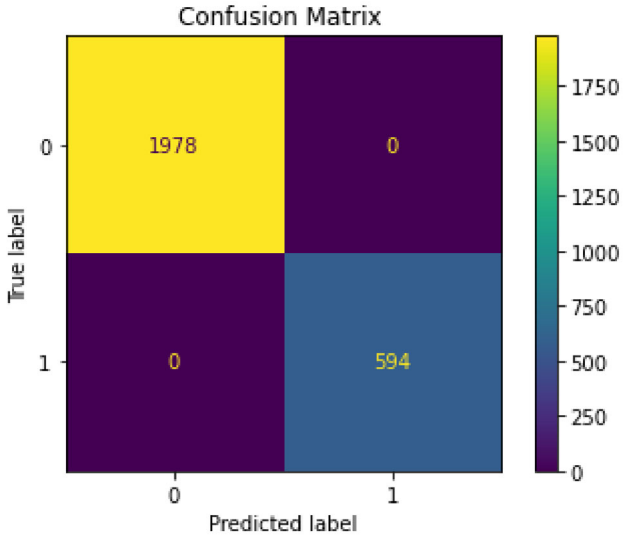
KNN

In [49]:
```
param_grid = {
    'reg__n_neighbors': [2,5,10],
    'reg__weights':['uniform', 'distance'],
    'reg__p': [1,2]
}
model=trainmodel(KNeighborsClassifier(),data_prep_pipeline,param_grid,'accuracy')
addresultotable(model,"KNN")
model_Knn=model
MODELS['Knn']=model_Knn
plotROC(model)
plotConf(model)
```

```
Fitting 5 folds for each of 10 candidates, totalling 50 fits
```




```
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\utils\deprecation.p
y:87: FutureWarning: Function plot_confusion_matrix is deprecated; Function `plot_confus
ion_matrix` is deprecated in 1.0 and will be removed in 1.2. Use one of the class method
s: ConfusionMatrixDisplay.from_predictions or ConfusionMatrixDisplay.from_estimator.
  warnings.warn(msg, category=FutureWarning)
<Figure size 432x288 with 0 Axes>
```



In [50]:
```
model.best_params_
```

Out[50]:
```
{'reg__weights': 'distance', 'reg__p': 1, 'reg__n_neighbors': 2}
```

In [51]:
```
expLog
```

Out[51]:

	exp_name	Train Acc	Test Acc	Train AUC	Test AUC	Train F1	Test F1
0	XGB	0.9949	0.9938	0.9914	0.9913	0.9949	0.9938
1	SVD_LOG	0.9996	1.0000	0.9997	1.0000	0.9996	1.0000
2	RF	1.0000	0.9984	1.0000	0.9990	1.0000	0.9984
3	KNN	1.0000	0.9969	1.0000	0.9933	1.0000	0.9969

Best model predictions/

In [60]:
```
model_SVD_LOG = MODELS['SVD_LOG']
```

In [89]:
```
testdata = pd.read_csv("data/test_dataset.csv",index_col=False)
```

In [62]:
```
ytest=model_SVD_LOG.predict(testdata)
```

In [63]:
```
submission = pd.DataFrame({

        "ID": testdata["ID"],

        "Target": ytest

    })
```

In [64]:
```
submission.head(5)
```

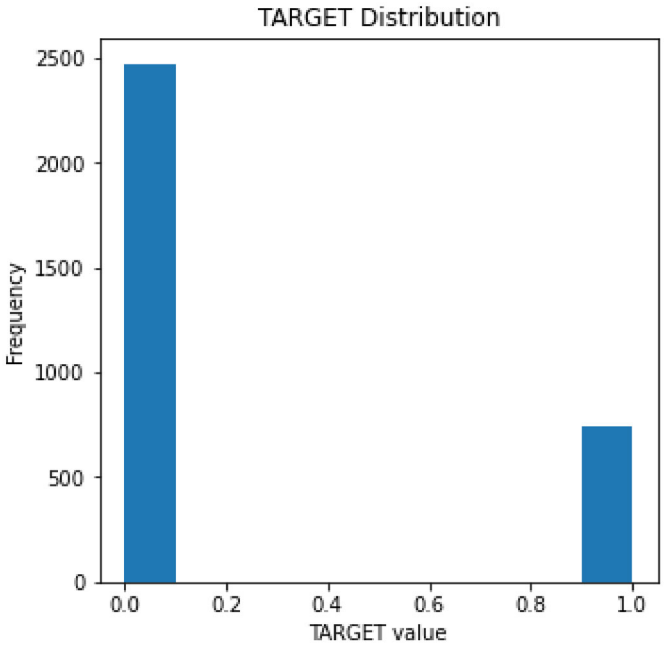
Out[64]:

	ID	Target
0	1.228840e+18	0
1	1.284940e+18	0
2	1.240280e+18	0
3	1.243150e+18	0
4	1.296620e+18	0

In [65]:
```
submission.to_csv('submission_SVDLOG.csv', index=False)
```

In [66]:
```
model = MODELS['RF']
ytest=model.predict(testdata)
submission = pd.DataFrame({

        "ID": testdata["ID"],

        "Target": ytest

    })
submission.to_csv('submission_RF.csv', index=False)
```

In [67]:
```
plt.figure(figsize=(5,5))
df['Target'].plot.hist(label=True);
plt.title('TARGET Distribution')
plt.xlabel('TARGET value')
plt.ylabel('Frequency');
plt.show()
```



In [90]:
```
train_data = pd.concat([X_train, y_train], axis=1)
train_data.head()

from sklearn.utils import resample

zerodata = train_data[train_data.Target==0]
onedata = train_data[train_data.Target==1]

default_sampled_data = resample(zerodata,
                           replace=True,
                           n_samples=int(len(onedata)*1.5),
                           random_state=123)

train_data = pd.concat([onedata, default_sampled_data])

train_data.Target.value_counts()
```

Out[90]:
```
0    712
1    475
Name: Target, dtype: int64
```

In [92]:
```
y=train_data['Target']
X=train_data.drop(['Target'],axis=1)
print(X.shape,train_data.shape)
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.20, random_state=
```

```
(1187, 34) (1187, 35)
```

In [93]:
```
parameters = {
    "reg__loss":["deviance"],
    "reg__learning_rate": [0.01, 0.025, 0.05, 0.075, 0.1, 0.15, 0.2],
    "reg__min_samples_split": np.linspace(0.1, 0.5, 12),
    "reg__min_samples_leaf": np.linspace(0.1, 0.5, 12),
    "reg__max_depth":[3,5,8],
    "reg__max_features":["log2","sqrt"],
    "reg__criterion": ["friedman_mse",  "mae"],
```

```
    "reg__subsample":[0.5,1.0],
    "reg__n_estimators":[10,50,100]
    }

model=trainmodel(GradientBoostingClassifier(),data_prep_pipeline,parameters,'accuracy')
addresultotable(model,"XGB_b")

plotROC(model)
plotConf(model)
model_XGB=model
MODELS['xgb_b']=model_XGB
model.best_params_
```

```
Fitting 5 folds for each of 10 candidates, totalling 50 fits
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\ensemble\_gb.py:128
4: FutureWarning: criterion='mae' was deprecated in version 0.24 and will be removed in
version 1.1 (renaming of 0.26). Use criterion='friedman_mse' or 'squared_error' instead,
as trees should use a squared error criterion in Gradient Boosting.
  warnings.warn(
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\tree\_classes.py:36
6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
1.2. Use `criterion='absolute_error'` which is equivalent.
  warnings.warn(
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\tree\_classes.py:36
6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
1.2. Use `criterion='absolute_error'` which is equivalent.
  warnings.warn(
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\tree\_classes.py:36
6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
1.2. Use `criterion='absolute_error'` which is equivalent.
  warnings.warn(
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\tree\_classes.py:36
6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
1.2. Use `criterion='absolute_error'` which is equivalent.
  warnings.warn(
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\tree\_classes.py:36
6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
1.2. Use `criterion='absolute_error'` which is equivalent.
  warnings.warn(
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\tree\_classes.py:36
6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
1.2. Use `criterion='absolute_error'` which is equivalent.
  warnings.warn(
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\tree\_classes.py:36
6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
1.2. Use `criterion='absolute_error'` which is equivalent.
  warnings.warn(
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\tree\_classes.py:36
6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
1.2. Use `criterion='absolute_error'` which is equivalent.
  warnings.warn(
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\tree\_classes.py:36
6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
1.2. Use `criterion='absolute_error'` which is equivalent.
  warnings.warn(
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\tree\_classes.py:36
6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
1.2. Use `criterion='absolute_error'` which is equivalent.
  warnings.warn(
```

```
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\tree\_classes.py:36
6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
1.2. Use `criterion='absolute_error'` which is equivalent.
  warnings.warn(
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\tree\_classes.py:36
6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
1.2. Use `criterion='absolute_error'` which is equivalent.
  warnings.warn(
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\tree\_classes.py:36
6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
1.2. Use `criterion='absolute_error'` which is equivalent.
  warnings.warn(
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\tree\_classes.py:36
6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
1.2. Use `criterion='absolute_error'` which is equivalent.
  warnings.warn(
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\tree\_classes.py:36
6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
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```

```
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```

```
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  warnings.warn(
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6: FutureWarning: Criterion 'mae' was deprecated in v1.0 and will be removed in version
1.2. Use `criterion='absolute_error'` which is equivalent.
  warnings.warn(
```
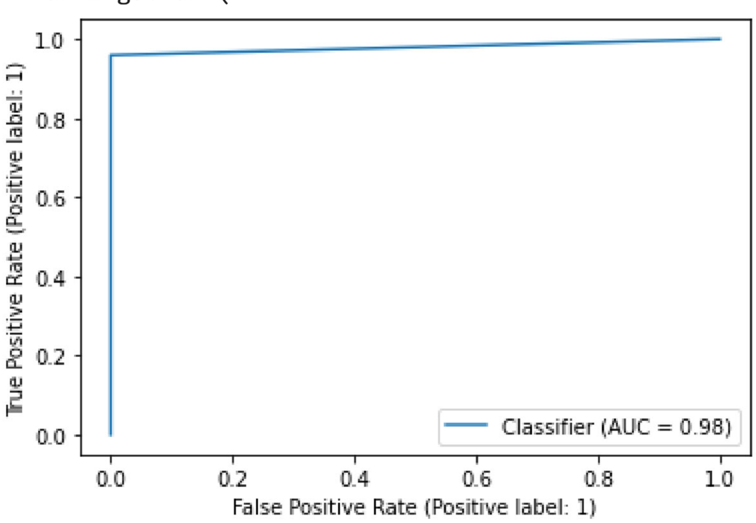
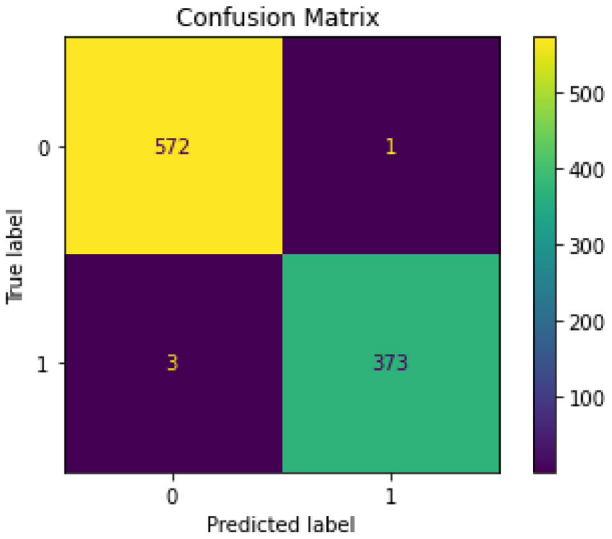




```
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\utils\deprecation.p
y:87: FutureWarning: Function plot_confusion_matrix is deprecated; Function `plot_confus
ion_matrix` is deprecated in 1.0 and will be removed in 1.2. Use one of the class method
```

```
s: ConfusionMatrixDisplay.from_predictions or ConfusionMatrixDisplay.from_estimator.
  warnings.warn(msg, category=FutureWarning)
<Figure size 432x288 with 0 Axes>
```



Out[93]:
```
{'reg__subsample': 1.0,
 'reg__n_estimators': 50,
 'reg__min_samples_split': 0.13636363636363638,
 'reg__min_samples_leaf': 0.3545454545454546,
 'reg__max_features': 'log2',
 'reg__max_depth': 3,
 'reg__loss': 'deviance',
 'reg__learning_rate': 0.2,
 'reg__criterion': 'mae'}
```

In [94]:
```
expLog
```

Out[94]:

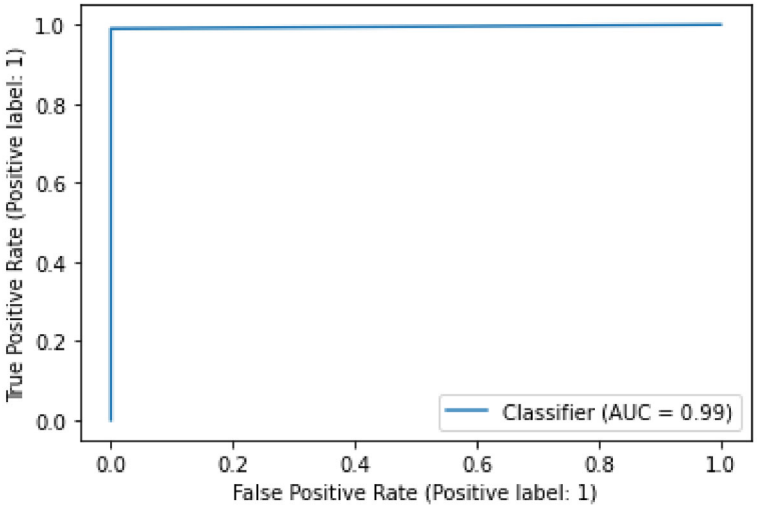
	exp_name	Train Acc	Test Acc	Train AUC	Test AUC	Train F1	Test F1
0	XGB	0.9949	0.9938	0.9914	0.9913	0.9949	0.9938
1	SVD_LOG	0.9996	1.0000	0.9997	1.0000	0.9996	1.0000
2	RF	1.0000	0.9984	1.0000	0.9990	1.0000	0.9984
3	KNN	1.0000	0.9969	1.0000	0.9933	1.0000	0.9969
4	XGB_b	0.9916	0.9933	0.9905	0.9916	0.9916	0.9933
5	SVD_LOG_b	0.9983	1.0000	0.9986	1.0000	0.9983	1.0000
6	SVD_LOG_b	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	SVD_LOG_b	1.0000	0.9966	1.0000	0.9958	1.0000	0.9966
8	RF_b	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
9	KNN_b	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
10	XGB_b	0.9958	0.9832	0.9951	0.9798	0.9958	0.9831

SVD

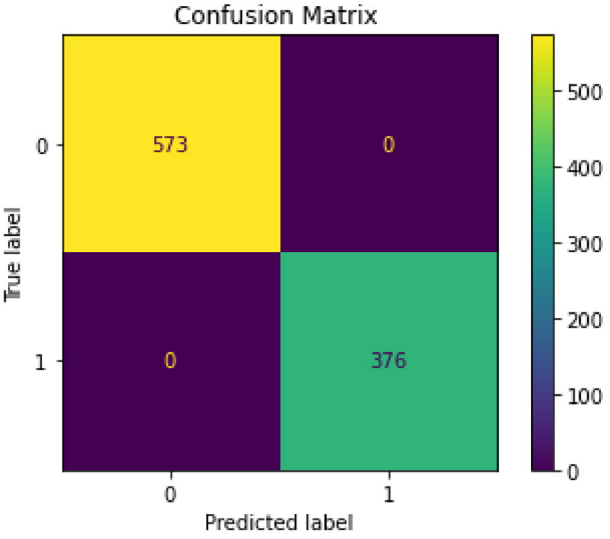
In [95]:
```
param_grid = {
```

```
    'reg__loss': ['hinge','log'],
    'reg__penalty':['l2', 'l1', 'elasticnet'],
    'reg__alpha': [0.0001, 0.001,0.01, 0.1]
}

model=trainmodel(SGDClassifier(),data_prep_pipeline,param_grid,'accuracy')
# if(model.best_params_['reg__loss']=='hinge'):
#     from sklearn.calibration import CalibratedClassifierCV
#     cal=CalibratedClassifierCV(model, cv='prefit')
#     model=trainmodel(cal,data_prep_pipeline,param_grid,'accuracy')
addresultotable(model,"SVD_LOG_b")
plotROC(model)
plotConf(model)
model_SVD_LOG=model
MODELS['SVD_LOG_b']=model_SVD_LOG
```

```
Fitting 5 folds for each of 10 candidates, totalling 50 fits
```




```
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\utils\deprecation.py:87: FutureWarning: Function plot_confusion_matrix is deprecated; Function `plot_confusion_matrix` is deprecated in 1.0 and will be removed in 1.2. Use one of the class methods: ConfusionMatrixDisplay.from_predictions or ConfusionMatrixDisplay.from_estimator.
  warnings.warn(msg, category=FutureWarning)
<Figure size 432x288 with 0 Axes>
```



In [96]:

```
expLog
```

Out[96]:

	exp_name	Train Acc	Test Acc	Train AUC	Test AUC	Train F1	Test F1
0	XGB	0.9949	0.9938	0.9914	0.9913	0.9949	0.9938
1	SVD_LOG	0.9996	1.0000	0.9997	1.0000	0.9996	1.0000
2	RF	1.0000	0.9984	1.0000	0.9990	1.0000	0.9984
3	KNN	1.0000	0.9969	1.0000	0.9933	1.0000	0.9969
4	XGB_b	0.9916	0.9933	0.9905	0.9916	0.9916	0.9933
5	SVD_LOG_b	0.9983	1.0000	0.9986	1.0000	0.9983	1.0000
6	SVD_LOG_b	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	SVD_LOG_b	1.0000	0.9966	1.0000	0.9958	1.0000	0.9966
8	RF_b	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
9	KNN_b	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
10	XGB_b	0.9958	0.9832	0.9951	0.9798	0.9958	0.9831
11	SVD_LOG_b	1.0000	0.9958	1.0000	0.9949	1.0000	0.9958

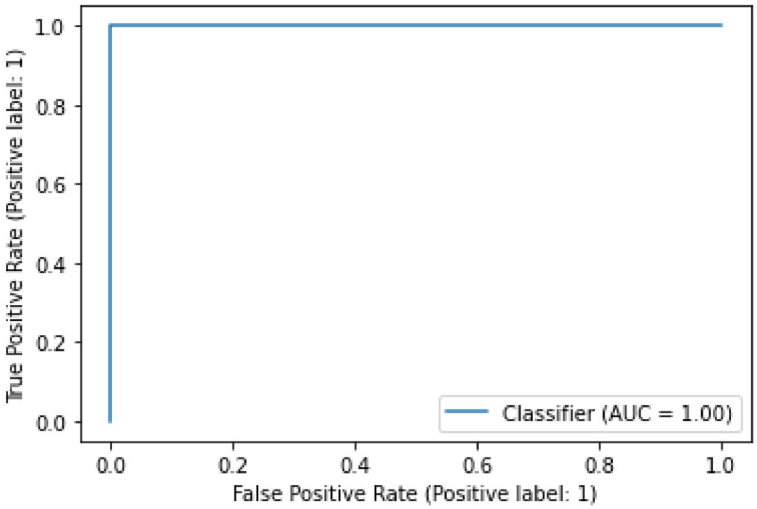
In [97]:
```
model.best_params_
```

Out[97]:
```
{'reg__penalty': 'l2', 'reg__loss': 'log', 'reg__alpha': 0.001}
```

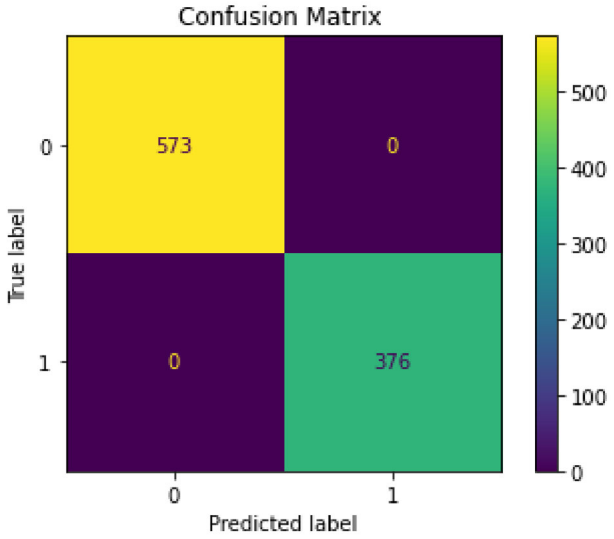
RandomForest

In [98]:
```
param_grid = {
    'reg__bootstrap': [True],
    'reg__max_depth': [10, 20,50,100],
    'reg__max_features': [2, 5,10,50],
    'reg__n_estimators': [100, 200,500]
}
model=trainmodel(RandomForestClassifier(),data_prep_pipeline,param_grid,'accuracy')
addresultotable(model,"RF_b")
model_RF=model
MODELS['RF_b']=model_RF
plotROC(model)
plotConf(model)
```

```
Fitting 5 folds for each of 10 candidates, totalling 50 fits
```




```
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\utils\deprecation.p
y:87: FutureWarning: Function plot_confusion_matrix is deprecated; Function `plot_confus
ion_matrix` is deprecated in 1.0 and will be removed in 1.2. Use one of the class method
s: ConfusionMatrixDisplay.from_predictions or ConfusionMatrixDisplay.from_estimator.
  warnings.warn(msg, category=FutureWarning)
<Figure size 432x288 with 0 Axes>
```



In [99]:
```
model.best_params_
```

Out[99]:
```
{'reg__n_estimators': 200,
 'reg__max_features': 5,
 'reg__max_depth': 10,
 'reg__bootstrap': True}
```

In [100…
```
expLog
```

Out[100…

	exp_name	Train Acc	Test Acc	Train AUC	Test AUC	Train F1	Test F1
0	XGB	0.9949	0.9938	0.9914	0.9913	0.9949	0.9938
1	SVD_LOG	0.9996	1.0000	0.9997	1.0000	0.9996	1.0000
2	RF	1.0000	0.9984	1.0000	0.9990	1.0000	0.9984
3	KNN	1.0000	0.9969	1.0000	0.9933	1.0000	0.9969

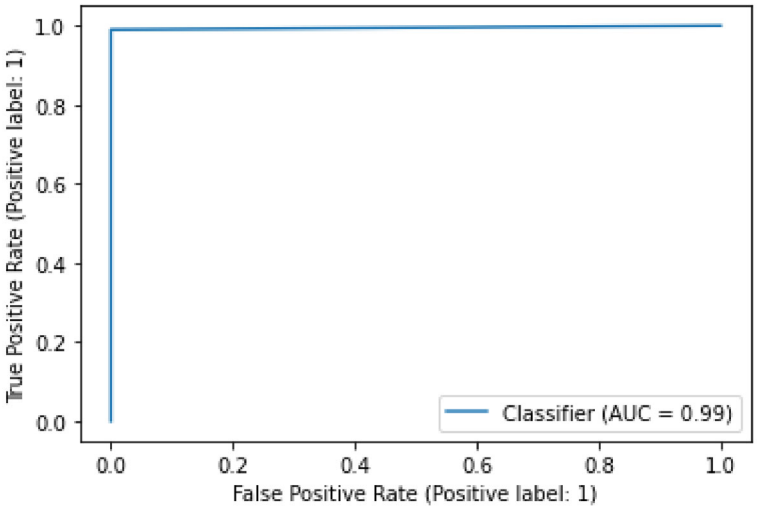
	exp_name	Train Acc	Test Acc	Train AUC	Test AUC	Train F1	Test F1
4	XGB_b	0.9916	0.9933	0.9905	0.9916	0.9916	0.9933
5	SVD_LOG_b	0.9983	1.0000	0.9986	1.0000	0.9983	1.0000
6	SVD_LOG_b	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	SVD_LOG_b	1.0000	0.9966	1.0000	0.9958	1.0000	0.9966
8	RF_b	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
9	KNN_b	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
10	XGB_b	0.9958	0.9832	0.9951	0.9798	0.9958	0.9831
11	SVD_LOG_b	1.0000	0.9958	1.0000	0.9949	1.0000	0.9958
12	RF_b	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

KNN

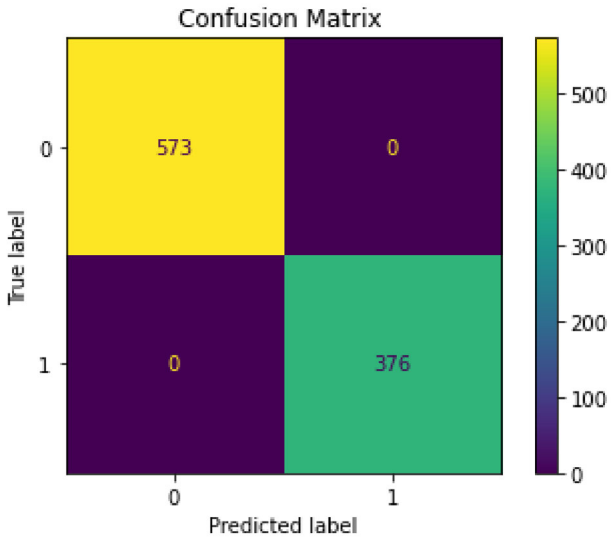
In [101…

```
param_grid = {
    'reg__n_neighbors': [2,5,10],
    'reg__weights':['uniform', 'distance'],
    'reg__p': [1,2]
}
model=trainmodel(KNeighborsClassifier(),data_prep_pipeline,param_grid,'accuracy')
addresultotable(model,"KNN_b")
model_Knn=model
MODELS['Knn_b']=model_Knn
plotROC(model)
plotConf(model)
```

```
Fitting 5 folds for each of 10 candidates, totalling 50 fits
```




```
C:\Users\prath\AppData\Roaming\Python\Python38\site-packages\sklearn\utils\deprecation.p
y:87: FutureWarning: Function plot_confusion_matrix is deprecated; Function `plot_confus
ion_matrix` is deprecated in 1.0 and will be removed in 1.2. Use one of the class method
s: ConfusionMatrixDisplay.from_predictions or ConfusionMatrixDisplay.from_estimator.
  warnings.warn(msg, category=FutureWarning)
<Figure size 432x288 with 0 Axes>
```



In [102…
```
model.best_params_
```

Out[102…
```
{'reg__weights': 'distance', 'reg__p': 1, 'reg__n_neighbors': 2}
```

In [103…
```
expLog
```

Out[103…

	exp_name	Train Acc	Test Acc	Train AUC	Test AUC	Train F1	Test F1
0	XGB	0.9949	0.9938	0.9914	0.9913	0.9949	0.9938
1	SVD_LOG	0.9996	1.0000	0.9997	1.0000	0.9996	1.0000
2	RF	1.0000	0.9984	1.0000	0.9990	1.0000	0.9984
3	KNN	1.0000	0.9969	1.0000	0.9933	1.0000	0.9969
4	XGB_b	0.9916	0.9933	0.9905	0.9916	0.9916	0.9933
5	SVD_LOG_b	0.9983	1.0000	0.9986	1.0000	0.9983	1.0000
6	SVD_LOG_b	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	SVD_LOG_b	1.0000	0.9966	1.0000	0.9958	1.0000	0.9966
8	RF_b	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
9	KNN_b	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
10	XGB_b	0.9958	0.9832	0.9951	0.9798	0.9958	0.9831
11	SVD_LOG_b	1.0000	0.9958	1.0000	0.9949	1.0000	0.9958
12	RF_b	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
13	KNN_b	1.0000	0.9958	1.0000	0.9949	1.0000	0.9958

In [104…
```
model = MODELS['RF_b']
ytest=model.predict(testdata)
submission = pd.DataFrame({

        "ID": testdata["ID"],
```

```
        "Target": ytest

    })
submission.to_csv('submission_RF_b.csv', index=False)


model = MODELS['Knn_b']
ytest=model.predict(testdata)
submission = pd.DataFrame({

        "ID": testdata["ID"],

        "Target": ytest

    })
submission.to_csv('submission_Knn_b.csv', index=False)
```

In [106…

```
gc.collect()
```

Out[106…

```
15
```

In [108…

```
!pip install --upgrade --user nltk
```

```
Requirement already satisfied: nltk in c:\programdata\anaconda3\lib\site-packages (3.6.
1)
Collecting nltk
  Downloading nltk-3.7-py3-none-any.whl (1.5 MB)
Requirement already satisfied: joblib in c:\programdata\anaconda3\lib\site-packages (fro
m nltk) (1.0.1)
Collecting regex>=2021.8.3
  Downloading regex-2022.3.2-cp38-cp38-win_amd64.whl (274 kB)
Requirement already satisfied: tqdm in c:\programdata\anaconda3\lib\site-packages (from
nltk) (4.59.0)
Requirement already satisfied: click in c:\programdata\anaconda3\lib\site-packages (from
nltk) (7.1.2)
Installing collected packages: regex, nltk
Successfully installed nltk-3.7 regex-2022.3.2
  WARNING: The script nltk.exe is installed in 'C:\Users\prath\AppData\Roaming\Python\Py
thon38\Scripts' which is not on PATH.
  Consider adding this directory to PATH or, if you prefer to suppress this warning, use
--no-warn-script-location.
```

In [120…

```
import nltk
import nltk
from nltk.tokenize import word_tokenize
from nltk.tag import pos_tag
from nltk.chunk import tree2conlltags
```

In [137…

```
#nltk.download('punkt')
#nltk.download('averaged_perceptron_tagger')
# nltk.download('maxent_ne_chunker')
# nltk.download('words')
df2 = df
df2['tokTw'] = df2['full_text'].apply(word_tokenize).apply(pos_tag).apply(nltk.ne_chunk
```

In [136…
```
df2['tokTw'][4]
```

Out[136…
```
[('21', 'CD', 'O'),
 ('year', 'NN', 'O'),
 ('old', 'JJ', 'O'),
 ('palestinian', 'JJ', 'O'),
 ('woman', 'NN', 'O'),
 ('murdered', 'VBN', 'O'),
 ('by', 'IN', 'O'),
 ('her', 'PRP$', 'O'),
 ('brother', 'NN', 'O'),
 ('in', 'IN', 'O'),
 ('honor', 'NN', 'O'),
 ('killing', 'VBG', 'O'),
 ('-', ':', 'O'),
 ('anti', 'NN', 'O'),
 ('smite', 'JJ', 'O'),
 ('rashida', 'NN', 'O'),
 ('talib', 'NN', 'O'),
 ('blames', 'VBZ', 'O'),
 ('jews', 'NNS', 'O'),
 ('.', '.', 'O'),
 ('darn', 'VB', 'O'),
 ('jews', 'NNS', 'O'),
 ('get', 'VB', 'O'),
 ('away', 'RB', 'O'),
 ('with', 'IN', 'O'),
 ('everything', 'NN', 'O'),
 ('.', '.', 'O'),
 ('arnt', 'IN', 'O'),
 ('we', 'PRP', 'O'),
 ('lucky', 'VBP', 'O'),
 ('to', 'TO', 'O'),
 ('have', 'VB', 'O'),
 ('this', 'DT', 'O'),
 ('tool', 'NN', 'O'),
 ('in', 'IN', 'O'),
 ('congress', 'NN', 'O'),
 ('?', '.', 'O'),
 ('?', '.', 'O'),
 ('?', '.', 'O'),
 ('paint', 'NN', 'O'),
 ('my', 'PRP$', 'O'),
 ('country', 'NN', 'O'),
 ('red', 'VBD', 'O'),
 ('https', 'NN', 'O'),
 (':', ':', 'O'),
 ('//t.co/5w43zoichc', 'NN', 'O')]
```

In [ ]:
```

```