In [1]:
```
import numpy as np
import pandas as pd

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))
```

In [2]:
```
import tensorflow as tf
from tensorflow import keras
tf.config.list_physical_devices('GPU')
import pandas as pd
from sklearn.model_selection import train_test_split
from keras.preprocessing import text,sequence
from keras.utils import pad_sequences
from keras.models import Sequential
from keras.layers import Embedding,SimpleRNN,LSTM,SpatialDropout1D,GRU,Bidirecti
import matplotlib.pyplot as plt
from sklearn.metrics import roc_curve, auc
from sklearn.metrics import confusion_matrix
import seaborn as sns
# from keras.layers.core import Dense#,Activation,Dropout
```

In [3]:
```
import tensorflow as tf
print("Num of GPUs: ", len(tf.config.experimental.list_physical_devices('GPU')))
tf.test.is_built_with_cuda()
print(tf.version.VERSION)
import sys
sys.version
```

```
Num of GPUs:  0
2.13.0
```

Out[3]:
```
'3.8.2rc1 (tags/v3.8.2rc1:8623e68, Feb 11 2020, 10:46:21) [MSC v.1916 64 bit (A
MD64)]'
```

In [4]:
```
from tqdm import tqdm
```

In [5]:
```
#configuring TPU
try:
    tpu = tf.distribute.cluster_resolver.TPUClusterResolver()
    print('Running on TPU', tpu.master())
except ValueError:
    tpu = None
```

In [6]:
```
if tpu:
    tf.config.experimental_connect_to_cluster(tpu)
    tf.tpu.experimental.initialize_tpu_system(tpu)
    strategy = tf.distribute.experimental.TPUStrategy(tpu)
else:
    #default distribution strategy in tensorflow, Works on CPU and single GPU
    strategy = tf.distribute.OneDeviceStrategy("CPU:0")
```

In [7]:
```
train = pd.read_csv('C:/Users/Richa/OneDrive/Documents/Desktop/TARP PROJECT_TOXI
validation = pd.read_csv('C:/Users/Richa/OneDrive/Documents/Desktop/TARP PROJECT
test = pd.read_csv('C:/Users/Richa/OneDrive/Documents/Desktop/TARP PROJECT_TOXIC
```

In [8]:
```
train.shape
```

Out[8]: (223549, 8)

In [9]:
```
train.head()
```

Out[9]:

	id	comment_text	toxic	severe_toxic	obscene	threat	insult	ide
0	0000997932d777bf	Explanation\nWhy the edits made under my usern...	0	0	0	0	0	
1	000103f0d9cfb60f	D'aww! He matches this background colour I'm s...	0	0	0	0	0	
2	000113f07ec002fd	Hey man, I'm really not trying to edit war. It...	0	0	0	0	0	
3	0001b41b1c6bb37e	"\nMore\nI can't make any real suggestions on ...	0	0	0	0	0	
4	0001d958c54c6e35	You, sir, are my hero. Any chance you remember...	0	0	0	0	0	

In [10]:
```
train.drop(['severe_toxic','obscene','threat','insult','identity_hate'],axis = 1
```

In [11]:
```
#check max len of comment_text column to use this for padding in future
pad_len = train['comment_text'].apply(lambda x:len(str(x).split())).max()
print('max len of comment_text column',pad_len)
```

```
max len of comment_text column 2321
```

DATA PREPARATION

In [12]:
```
xtrain, xvalid, ytrain, yvalid = train_test_split(train.comment_text.values, tra
```

In [13]:
```
len(xtrain),len(xvalid)
```

Out[13]: (134129, 89420)

Tokenisation and Padding with max len of words in curpus

In [14]:
```
test.head()
```

Out[14]:

	id	content	lang
0	0	Doctor Who adlı viki başlığına 12. doctor olar...	tr
1	1	Вполне возможно, но я пока не вижу необходимо...	ru
2	2	Quindi tu sei uno di quelli conservativi , ...	it
3	3	Malesef gerçekleştirilmedi ancak şöyle bir şey...	tr
4	4	:Resim:Seldabagcan.jpg resminde kaynak sorunu ...	tr

In [15]:
```
#using keras tokenizer
token = text.Tokenizer(num_words = None)
max_len = 2400
xtest = test.content.values
token.fit_on_texts(list(xtrain) + list(xvalid) + list(xtest))

x_train_seq = token.texts_to_sequences(xtrain)
x_valid_seq = token.texts_to_sequences(xvalid)
x_test_seq = token.texts_to_sequences(xtest)

#zero pad the sequences
x_train_pad = pad_sequences(x_train_seq,maxlen = max_len)


x_valid_pad = pad_sequences(x_valid_seq,maxlen = max_len)
x_test_pad = pad_sequences(x_test_seq,maxlen = max_len)
word_index = token.word_index
```

Classification on basic RNN Network

In [16]:
```
len(word_index) + 1
```

Out[16]: 583777

In [17]:
```
%%time
with strategy.scope():

    model = Sequential()
    model.add(Embedding(len(word_index) + 1,
                        300,
                        input_length=max_len))
    model.add(SimpleRNN(100))
    model.add(Dense(1,activation = 'sigmoid'))
    model.compile(loss = 'binary_crossentropy',optimizer = 'adam',metrics = ['ac

model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding (Embedding)       (None, 2400, 300)         175133100

 simple_rnn (SimpleRNN)      (None, 100)               40100

 dense (Dense)               (None, 1)                 101

=================================================================
Total params: 175173301 (668.23 MB)
Trainable params: 175173301 (668.23 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
CPU times: total: 5.73 s
Wall time: 1.16 s
```

In [18]:
```
#using strategy to run the TPU
model.fit(x_train_pad,ytrain,epochs = 3,batch_size = 128*strategy.num_replicas_i
```

```
Epoch 1/3
1048/1048 [==============================] - 37556s 36s/step - loss: 0.2347 - acc
uracy: 0.9211
Epoch 2/3
1048/1048 [==============================] - 11573s 11s/step - loss: 0.1238 - acc
uracy: 0.9553
Epoch 3/3
1048/1048 [==============================] - 11545s 11s/step - loss: 0.0765 - acc
uracy: 0.9734
```

Out[18]:
```
<keras.src.callbacks.History at 0x1ece4681250>
```

In [19]:
```
from sklearn.metrics import roc_auc_score
from tqdm import tqdm
import numpy as np
```

In [20]:
```
pred_val = model.predict(x_valid_pad)
```

```
2795/2795 [==============================] - 3555s 1s/step
```

In [21]:
```
model_accuracy = roc_auc_score(yvalid,pred_val)
```

In [22]:
```
model_accuracy_ls = []
model_accuracy_ls.append({'model':'simpleRNN','AUC_SCORE':model_accuracy})
```

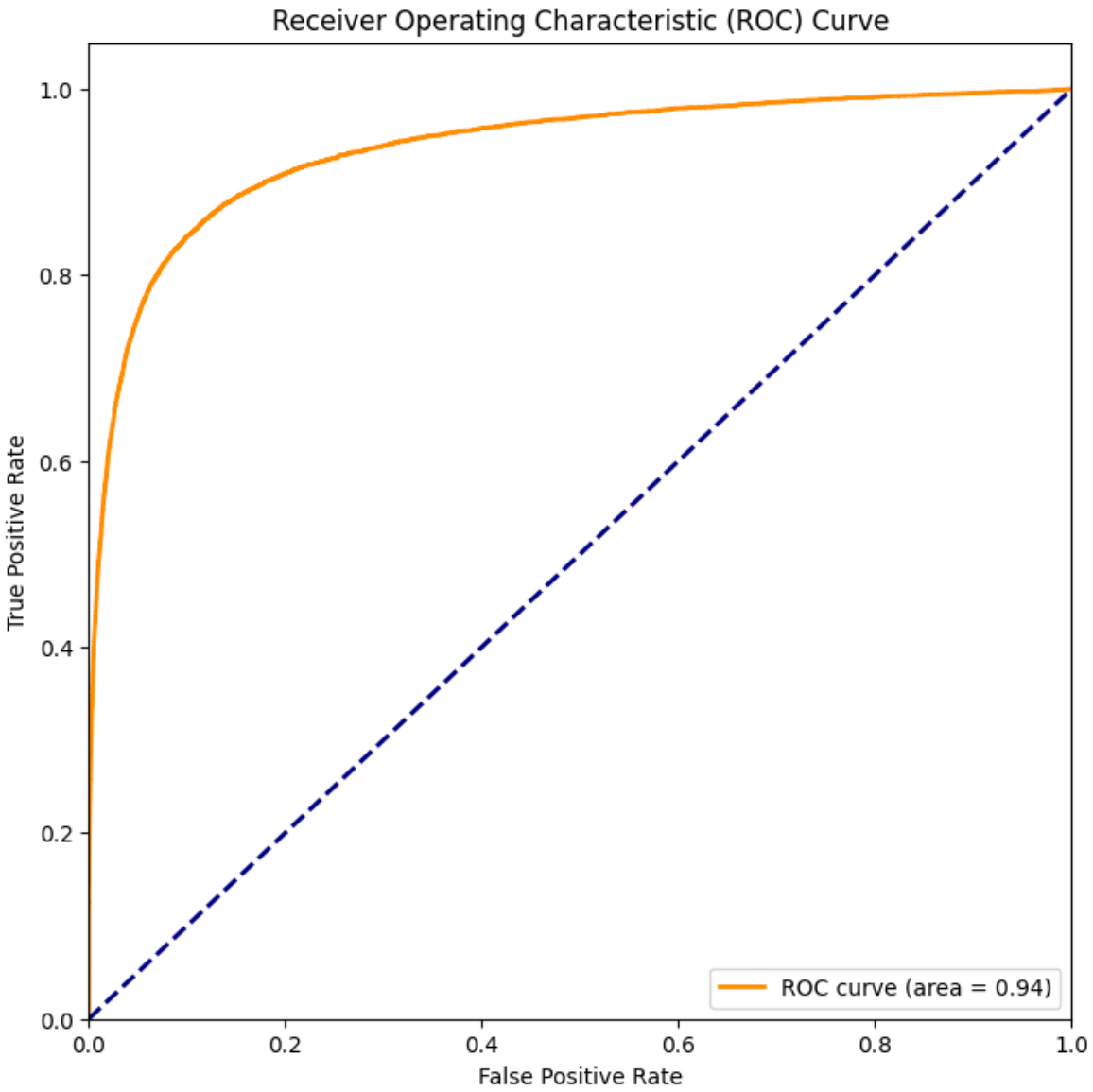
In [23]:
```
model_accuracy_ls
```

Out[23]:
```
[{'model': 'simpleRNN', 'AUC_SCORE': 0.936011072124611}]
```

In [24]:
```
# Calculate ROC curve and AUC score
fpr, tpr, thresholds = roc_curve(yvalid, pred_val)
roc_auc = auc(fpr, tpr)
```

In [25]:
```
# Plot ROC curve
plt.figure(figsize=(8, 8))
plt.plot(fpr, tpr, color='darkorange', lw=2, label=f'ROC curve (area = {roc_auc:
plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
```

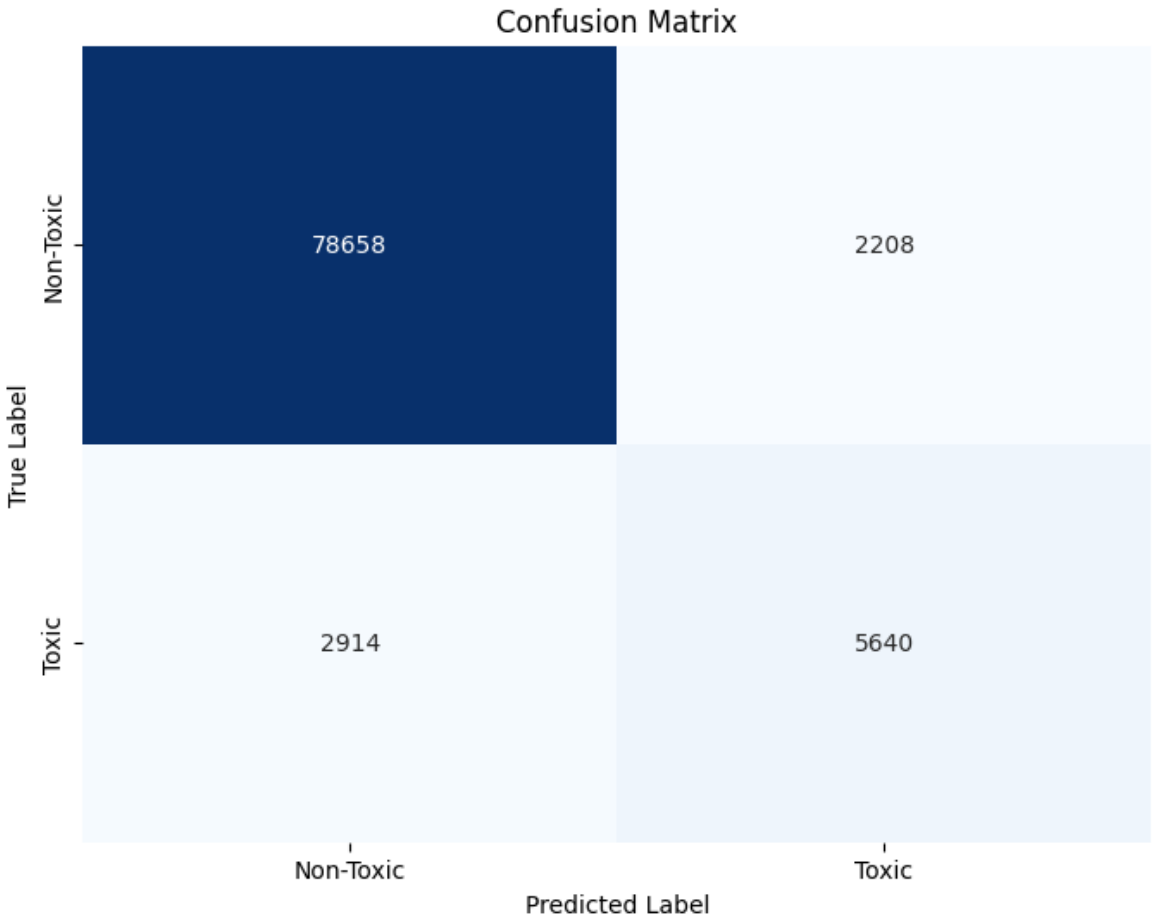
```
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver Operating Characteristic (ROC) Curve')
plt.legend(loc="lower right")
plt.show()
```



In [26]:
```
# Threshold predictions to convert probabilities to binary predictions
threshold = 0.5  # You can adjust this threshold as needed
binary_pred_val = (pred_val > threshold).astype(int)

# Create confusion matrix
conf_matrix = confusion_matrix(yvalid, binary_pred_val)

# Plot confusion matrix using seaborn
plt.figure(figsize=(8, 6))
sns.heatmap(conf_matrix, annot=True, fmt='d', cmap='Blues', cbar=False,
            xticklabels=['Non-Toxic', 'Toxic'], yticklabels=['Non-Toxic', 'Toxic
plt.title('Confusion Matrix')
plt.xlabel('Predicted Label')
plt.ylabel('True Label')
plt.show()
```


Confusion Matrix
78658
2208
2914
5640
Non-Toxic
Toxic
True Label
Non-Toxic
Toxic
Predicted Label