```
In [ ]:  ##supervised learning
```

```
In [1]:  import pandas as pd
         import numpy as np
         import matplotlib.pyplot as plt
         from keras.layers import Conv2D,MaxPooling2D
```

```
In [8]:  !nvidia-smi
```

```
Thu Apr  6 10:45:14 2023
+-----------------------------------------------------------------------------+
| NVIDIA-SMI 528.33       Driver Version: 528.33       CUDA Version: 12.0      |
|-------------------------------+----------------------+----------------------+
| GPU  Name            TCC/WDDM | Bus-Id        Disp.A | Volatile Uncorr. ECC |
| Fan  Temp  Perf  Pwr:Usage/Cap|         Memory-Usage | GPU-Util  Compute M. |
|                               |                      |               MIG M. |
|===============================+======================+======================|
|   0  NVIDIA GeForce ... WDDM | 00000000:01:00.0 Off |                  N/A |
| N/A   53C    P0    16W /  50W |      0MiB /  4096MiB |      0%      Default |
|                               |                      |                  N/A |
+-------------------------------+----------------------+----------------------+

+-----------------------------------------------------------------------------+
| Processes:                                                                  |
|  GPU   GI   CI        PID   Type   Process name                  GPU Memory |
|        ID   ID                                                   Usage      |
|=============================================================================|
|  No running processes found                                                 |
+-----------------------------------------------------------------------------+
```

```
In [2]:  import tensorflow as tf
         print(tf.__version__)
```

```
2.12.0
```

```
In [3]:  import os
         import tensorflow as tf
```

```
In [12]: ##pip install tensorflow==2.12.*
```

```
In [9]:  df = pd.read_csv('train.csv')
```

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

Out[10]:

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

```
In [15]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 159571 entries, 0 to 159570
Data columns (total 8 columns):
 #   Column         Non-Null Count   Dtype
---  ------         --------------   -----
 0   id             159571 non-null  object
 1   comment_text   159571 non-null  object
 2   toxic          159571 non-null  int64
 3   severe_toxic   159571 non-null  int64
 4   obscene        159571 non-null  int64
 5   threat         159571 non-null  int64
 6   insult         159571 non-null  int64
 7   identity_hate  159571 non-null  int64
dtypes: int64(6), object(2)
memory usage: 9.7+ MB
```

In [16]: `df.describe()`

Out[16]:

	toxic	severe_toxic	obscene	threat	insult	identity_hate
count	159571.000000	159571.000000	159571.000000	159571.000000	159571.000000	159571.000000
mean	0.095844	0.009996	0.052948	0.002996	0.049364	0.008805
std	0.294379	0.099477	0.223931	0.054650	0.216627	0.093420
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
25%	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
50%	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
75%	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
max	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

In [17]: `df.tail()`

Out[17]:

	id	comment_text	toxic	severe_toxic	obscene	threat	insult	identity_hate
159566	ffe987279560d7ff	":::::And for the second time of asking, when ...	0	0	0	0	0	0
159567	ffea4adeee384e90	You should be ashamed of yourself \n\nThat is ...	0	0	0	0	0	0
159568	ffee36eab5c267c9	Spitzer \n\nUmm, theres no actual article for ...	0	0	0	0	0	0
159569	fff125370e4aaaf3	And it looks like it was actually you who put ...	0	0	0	0	0	0
159570	fff46fc426af1f9a	"\nAnd ... I really don't think you understand...	0	0	0	0	0	0

In [18]: `df.iloc[1]['comment_text']`

Out[18]: "D'aww! He matches this background colour I'm seemingly stuck with. Thanks. (talk) 21:51, January 11, 2016 (UTC)"

In [19]: `##Preprocess`

In [20]: `!pip list`

```
Package                          Version
-------------------------------- --------------------
```

```
absl-py                         1.4.0
aiofiles                        23.1.0
aiohttp                         3.8.4
aiosignal                       1.3.1
alabaster                       0.7.12
altair                          4.2.2
altair-data-server              0.4.1
altair-viewer                   0.4.0
anaconda-client                 1.11.0
anaconda-navigator              2.3.1
anaconda-project                0.11.1
anyio                           3.5.0
appdirs                         1.4.4
apyori                          1.1.2
argon2-cffi                     21.3.0
argon2-cffi-bindings            21.2.0
arrow                           1.2.2
astroid                         2.11.7
astropy                         5.1
astunparse                      1.6.3
async-timeout                   4.0.2
atomicwrites                    1.4.0
attrs                           21.4.0
Automat                         20.2.0
autopep8                        1.6.0
Babel                           2.9.1
backcall                        0.2.0
backports.functools-lru-cache   1.6.4
backports.tempfile              1.0
backports.weakref               1.0.post1
bar-chart-race                  0.1.0
bcrypt                          3.2.0
beautifulsoup4                  4.11.1
binaryornot                     0.4.4
bitarray                        2.5.1
bkcharts                        0.2
black                           22.6.0
bleach                          4.1.0
blinker                         1.5
bokeh                           2.4.3
boto3                           1.24.28
botocore                        1.27.28
Bottleneck                      1.3.5
brotlipy                        0.7.0
cachetools                      5.3.0
certifi                         2022.9.14
cffi                            1.15.1
chardet                         4.0.0
charset-normalizer              2.0.4
chart-studio                    1.1.0
click                           8.0.4
cloudpickle                     2.0.0
clyent                          1.2.2
colorama                        0.4.5
colorcet                        3.0.0
colorlover                      0.3.0
comtypes                        1.1.10
conda                           22.9.0
conda-build                     3.22.0
conda-content-trust             0.1.3
conda-pack                      0.6.0
conda-package-handling          1.9.0
conda-repo-cli                  1.0.20
conda-token                     0.4.0
conda-verify                    3.4.2
constantly                      15.1.0
```

```
cookiecutter              1.7.3
coverage                  7.2.2
cryptography              37.0.1
csscompressor             0.9.5
cssselect                 1.1.0
cufflinks                 0.17.3
cutecharts                1.2.0
cycler                    0.11.0
Cython                    0.29.32
cytoolz                   0.11.0
daal4py                   2021.6.0
daiquiri                  3.2.1
dask                      2022.7.0
datashader                0.14.1
datashape                 0.5.4
debugpy                   1.5.1
decorator                 5.1.1
defusedxml                0.7.1
diff-match-patch          20200713
dill                      0.3.4
distributed               2022.7.0
docutils                  0.18.1
entrypoints               0.4
et-xmlfile                1.1.0
fastapi                   0.95.0
fastjsonschema            2.16.2
ffmpy                     0.3.0
filelock                  3.6.0
flake8                    4.0.1
Flask                     1.1.2
flatbuffers               23.3.3
fonttools                 4.25.0
fpgrowth-py               1.0.0
freetype-py               2.3.0
frozenlist                1.3.3
fsspec                    2022.7.1
future                    0.18.2
gast                      0.4.0
gensim                    4.1.2
gitdb                     4.0.10
GitPython                 3.1.31
glob2                     0.7
google-auth               2.17.1
google-auth-oauthlib      1.0.0
google-pasta              0.2.0
gradio                    3.24.1
gradio_client             0.0.5
greenlet                  1.1.1
grpcio                    1.53.0
h11                       0.14.0
h5py                      3.7.0
HeapDict                  1.0.1
holoviews                 1.15.0
hsluv                     5.0.3
httpcore                  0.16.3
httpx                     0.23.3
huggingface-hub           0.13.3
hvplot                    0.8.0
hyperlink                 21.0.0
idna                      3.3
imagecodecs               2021.8.26
imageio                   2.19.3
imagesize                 1.4.1
importlib-metadata        4.11.3
incremental               21.3.0
inflection                0.5.1
```

```
iniconfig                               1.1.1
intake                                  0.6.5
intervaltree                            3.1.0
ipykernel                               6.15.2
ipython                                 7.31.1
ipython-genutils                        0.2.0
ipywidgets                              7.6.5
isort                                   5.9.3
itemadapter                             0.3.0
itemloaders                             1.0.4
itsdangerous                            2.0.1
jax                                     0.4.8
jdcal                                   1.4.1
jedi                                    0.18.1
jellyfish                               0.9.0
Jinja2                                  2.11.3
jinja2-time                             0.2.0
jmespath                                0.10.0
joblib                                  1.1.0
json5                                   0.9.6
jsonschema                              4.16.0
jupyter                                 1.0.0
jupyter_client                          7.3.4
jupyter-console                         6.4.3
jupyter-contrib-core                    0.4.2
jupyter-contrib-nbextensions            0.7.0
jupyter_core                            4.11.1
jupyter-datatables                      0.3.9
jupyter-highlight-selected-word         0.2.0
jupyter-nbextensions-configurator       0.6.1
jupyter-nbutils                         0.1.3
jupyter-require                         0.6.1
jupyter-rfb                             0.3.3
jupyter-server                          1.18.1
jupyterlab                              3.4.4
jupyterlab-pygments                     0.1.2
jupyterlab-server                       2.10.3
jupyterlab-widgets                      1.0.0
keras                                   2.12.0
keyring                                 23.4.0
kiwisolver                              1.4.2
lazy-object-proxy                       1.6.0
libarchive-c                            2.9
libclang                                16.0.0
linkify-it-py                           2.0.0
llvmlite                                0.38.0
locket                                  1.0.0
lxml                                    4.9.1
lz4                                     3.1.3
Markdown                                3.3.4
markdown-it-py                          2.2.0
MarkupSafe                              2.0.1
matplotlib                              3.5.2
matplotlib-inline                       0.1.6
mccabe                                  0.6.1
mdit-py-plugins                         0.3.3
mdurl                                   0.1.2
menuinst                                1.4.19
mistune                                 0.8.4
mkl-fft                                 1.3.1
mkl-random                              1.2.2
mkl-service                             2.4.0
ml-dtypes                               0.0.4
mlxtend                                 0.21.0
mock                                    4.0.3
mpmath                                  1.2.1
```

```
msgpack                         1.0.3
multidict                       6.0.4
multipledispatch                0.6.0
munkres                         1.1.4
mypy-extensions                 0.4.3
navigator-updater               0.3.0
nbclassic                       0.5.3
nbclient                        0.5.13
nbconvert                       6.4.4
nbformat                        5.5.0
nest-asyncio                    1.5.5
networkx                        2.8.4
nltk                            3.7
nose                            1.3.7
notebook                        6.5.3
notebook-as-pdf                 0.5.0
notebook_shim                   0.2.2
numba                           0.55.1
numexpr                         2.8.3
numpy                           1.23.5
numpydoc                        1.4.0
oauthlib                        3.2.2
olefile                         0.46
openpyxl                        3.0.10
opt-einsum                      3.3.0
orjson                          3.8.9
packaging                       21.3
pandas                          1.4.4
pandas-datareader               0.10.0
pandocfilters                   1.5.0
panel                           0.13.1
param                           1.12.0
paramiko                        2.8.1
parsel                          1.6.0
parso                           0.8.3
partd                           1.2.0
pathlib                         1.0.1
pathspec                        0.9.0
patsy                           0.5.2
pdfrw                           0.4
pep8                            1.7.1
pexpect                         4.8.0
pickleshare                     0.7.5
Pillow                          9.2.0
pip                             22.2.2
pivottablejs                    0.9.0
pkginfo                         1.8.2
platformdirs                    2.5.2
plotly                          5.9.0
pluggy                          1.0.0
portpicker                      1.5.2
poyo                            0.5.0
prometheus-client               0.14.1
prompt-toolkit                  3.0.20
Protego                         0.1.16
protobuf                        3.20.3
psutil                          5.9.0
ptyprocess                      0.7.0
py                              1.11.0
py4j                            0.10.9.5
pyarrow                         11.0.0
pyasn1                          0.4.8
pyasn1-modules                  0.2.8
pycodestyle                     2.8.0
pycosat                         0.6.3
pycparser                       2.21
```

```
pyct                      0.4.8
pycurl                    7.45.1
pydantic                  1.10.7
pydeck                    0.8.0
PyDispatcher              2.0.5
pydocstyle                6.1.1
pydub                     0.25.1
pyee                      8.2.2
pyerfa                    2.0.0
pyflakes                  2.4.0
Pygments                  2.14.0
pygwalker                 0.1.4.7
PyHamcrest                2.0.2
PyJWT                     2.4.0
pylint                    2.14.5
pyls-spyder               0.4.0
Pympler                   1.0.1
PyNaCl                    1.5.0
pyodbc                    4.0.34
pyOpenSSL                 22.0.0
pyparsing                 3.0.9
PyPDF2                    3.0.1
pyppeteer                 1.0.2
pyrsistent                0.18.0
PySocks                   1.7.1
pyspark                   3.3.2
pytest                    7.1.2
pytest-cov                4.0.0
pytest-dependency         0.5.1
python-dateutil           2.8.2
python-json-logger        2.0.7
python-lsp-black          1.0.0
python-lsp-jsonrpc        1.0.0
python-lsp-server         1.3.3
python-multipart          0.0.6
python-slugify            5.0.2
python-snappy             0.6.0
pytz                      2022.1
pytz-deprecation-shim     0.1.0.post0
pyviz-comms               2.0.2
PyWavelets                1.3.0
pywin32                   302
pywin32-ctypes            0.2.0
pywinpty                  2.0.2
PyYAML                    6.0
pyzmq                     23.2.0
QDarkStyle                3.0.2
qstylizer                 0.1.10
QtAwesome                 1.0.3
qtconsole                 5.2.2
QtPy                      2.2.0
queuelib                  1.5.0
raceplotly                0.1.7
regex                     2022.7.9
requests                  2.28.1
requests-file             1.5.1
requests-oauthlib         1.3.1
retrying                  1.3.4
rfc3986                   1.5.0
rich                      13.3.2
rope                      0.22.0
rsa                       4.9
Rtree                     0.9.7
ruamel-yaml-conda         0.15.100
s3transfer                0.6.0
scikit-image              0.19.2
```

```
scikit-learn                     1.0.2
scikit-learn-intelex             2021.20221004.171935
scipy                            1.9.1
Scrapy                           2.6.2
seaborn                          0.11.2
semantic-version                 2.10.0
semver                           2.13.0
Send2Trash                       1.8.0
service-identity                 18.1.0
setuptools                       63.4.1
sip                              4.19.13
six                              1.16.0
smart-open                       5.2.1
smmap                            5.0.0
sniffio                          1.2.0
snowballstemmer                  2.2.0
sortedcollections                2.1.0
sortedcontainers                 2.4.0
soupsieve                        2.3.1
Sphinx                           5.0.2
sphinxcontrib-applehelp          1.0.2
sphinxcontrib-devhelp            1.0.2
sphinxcontrib-htmlhelp           2.0.0
sphinxcontrib-jsmath             1.0.1
sphinxcontrib-qthelp             1.0.3
sphinxcontrib-serializinghtml    1.1.5
spyder                           5.2.2
spyder-kernels                   2.2.1
SQLAlchemy                       1.4.39
starlette                        0.26.1
statsmodels                      0.13.2
streamlit                        1.19.0
sympy                            1.10.1
tables                           3.6.1
tabulate                         0.8.10
TBB                              0.2
tblib                            1.7.0
tenacity                         8.0.1
tensorboard                      2.12.1
tensorboard-data-server          0.7.0
tensorboard-plugin-wit           1.8.1
tensorflow-estimator             2.12.0
tensorflow-intel                 2.12.0
tensorflow-io-gcs-filesystem     0.31.0
termcolor                        2.2.0
terminado                        0.13.1
testpath                         0.6.0
text-unidecode                   1.3
textdistance                     4.2.1
threadpoolctl                    2.2.0
three-merge                      0.1.1
tifffile                         2021.7.2
tinycss                          0.4
tldextract                       3.2.0
toml                             0.10.2
tomli                            2.0.1
tomlkit                          0.11.1
toolz                            0.11.2
tornado                          6.1
tqdm                             4.64.1
traitlets                        5.1.1
Twisted                          22.2.0
twisted-iocpsupport              1.0.2
typing_extensions                4.3.0
tzdata                           2022.7
tzlocal                          4.2
```

```
uc-micro-py                              1.0.1
ujson                                    5.4.0
Unidecode                                1.2.0
urllib3                                  1.26.11
uvicorn                                  0.21.1
validators                               0.20.0
vega-datasets                            0.9.0
vispy                                    0.12.2
w3lib                                    1.21.0
watchdog                                 2.1.6
wcwidth                                  0.2.5
webencodings                             0.5.1
websocket-client                         0.58.0
websockets                               10.4
Werkzeug                                 2.0.3
wheel                                    0.37.1
widgetsnbextension                       3.5.2
win-inet-pton                            1.1.0
win-unicode-console                      0.5
wincertstore                             0.2
wordcloud                                1.8.2.2
wrapt                                    1.14.1
xarray                                   0.20.1
xlrd                                     2.0.1
XlsxWriter                               3.0.3
xlwings                                  0.27.15
yapf                                     0.31.0
yarl                                     1.8.2
zict                                     2.1.0
zipp                                     3.8.0
zope.interface                           5.4.0
```

In [21]:
```python
##tokenization(TextVectorization)
from tensorflow.keras.layers import TextVectorization
```

In [22]:
```python
# Spliting the data into comment and features
X = df['comment_text']
y = df[df.columns[2:]].values ##values will create numpy array
```

In [23]:
```python
X
```

Out[23]:
```
0         Explanation\nWhy the edits made under my usern...
1         D'aww! He matches this background colour I'm s...
2         Hey man, I'm really not trying to edit war. It...
3         "\nMore\nI can't make any real suggestions on ...
4         You, sir, are my hero. Any chance you remember...
                               ...
159566    ":::::And for the second time of asking, when ...
159567    You should be ashamed of yourself \n\nThat is ...
159568    Spitzer \n\nUmm, theres no actual article for ...
159569    And it looks like it was actually you who put ...
159570    "\nAnd ... I really don't think you understand...
Name: comment_text, Length: 159571, dtype: object
```

In [24]:
```python
y
```

Out[24]:
```
array([[0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0],
       ...,
       [0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0]], dtype=int64)
```

In [25]:
```python
MAX_FEATURES = 200000 # number of words in the vocab
```

```
In [26]:  ## Creating TextVectorization layer
          vectorizer = TextVectorization(max_tokens=MAX_FEATURES, ##passing Max_features
                                         output_sequence_length=1800, ##This is sentences length i
                                         output_mode='int') ##We want our output in integer...it g

In [27]:  vectorizer.adapt(X.values) ##adapt will learn all X.values

In [28]:  vectorizer("Nice to meet you")

Out[28]:  <tf.Tensor: shape=(1800,), dtype=int64, numpy=array([ 520,     3, 1007, ...,    0,    0,
             0], dtype=int64)>

In [29]:  vectorizer("Nice to meet you")[:4]

Out[29]:  <tf.Tensor: shape=(4,), dtype=int64, numpy=array([ 520,     3, 1007,     7], dtype=int64)>

In [30]:  vectorizer_text = vectorizer(X.values) ## tokenizing all the text in int formate

In [31]:  vectorizer_text

Out[31]:  <tf.Tensor: shape=(159571, 1800), dtype=int64, numpy=
          array([[  645,    76,     2, ...,     0,     0,     0],
                 [    1,    54,  2489, ...,     0,     0,     0],
                 [  425,   441,    70, ...,     0,     0,     0],
                 ...,
                 [32445,  7392,   383, ...,     0,     0,     0],
                 [    5,    12,   534, ...,     0,     0,     0],
                 [    5,     8,   130, ...,     0,     0,     0]], dtype=int64)>

In [32]:  #creating tensorflow pipeline
          #MCSHBAP - map, chache, shuffle, batch, prefetch  from_tensor_slices, list_file
          dataset = tf.data.Dataset.from_tensor_slices((vectorizer_text, y)) ##creating a dataset
          dataset = dataset.cache()
          dataset = dataset.shuffle(160000)
          dataset = dataset.batch(16)
          dataset = dataset.prefetch(8) # helps bottlenecks

In [33]:  batch_X , batch_y = dataset.as_numpy_iterator().next()

In [34]:  batch_X

Out[34]:  array([[   399,     3,  35142, ...,     0,     0,     0],
                 [    20,     7,   2947, ...,     0,     0,     0],
                 [    64,    20,      7, ...,     0,     0,     0],
                 ...,
                 [ 36594,     2, 171479, ...,     0,     0,     0],
                 [  8519,    34,      2, ...,     0,     0,     0],
                 [    14,    15,     91, ...,     0,     0,     0]], dtype=int64)

In [35]:  batch_y

Out[35]:  array([[0, 0, 0, 0, 0, 0],
                 [0, 0, 0, 0, 0, 0],
                 [0, 0, 0, 0, 0, 0],
                 [0, 0, 0, 0, 0, 0],
                 [0, 0, 0, 0, 0, 0],
                 [0, 0, 0, 0, 0, 0],
                 [0, 0, 0, 0, 0, 0],
                 [0, 0, 0, 0, 0, 0],
                 [0, 0, 0, 0, 0, 0],
                 [0, 0, 0, 0, 0, 0],
                 [1, 0, 0, 0, 1, 0],
                 [0, 0, 0, 0, 0, 0],
```

```
                    [0, 0, 0, 0, 0, 0],
                    [0, 0, 0, 0, 0, 0],
                    [0, 0, 0, 0, 0, 0],
                    [0, 0, 0, 0, 0, 0]], dtype=int64)
```

In [36]: `int(len(dataset)*.7)`

Out[36]:
```
6981
```

In [37]:
```python
train = dataset.take(int(len(dataset)*.7)) ##taking (assing)  70% to training
val = dataset.skip(int(len(dataset)*.7)).take(int(len(dataset)*.2)) ##skipping 70% and u
test = dataset.skip(int(len(dataset)*.9)).take(int(len(dataset)*.1))# skipping 90 % and
```

In [38]: `train_generator  = train.as_numpy_iterator()`

In [39]: `train_generator.next()`

Out[39]:
```
(array([[   22,    92,  2681, ...,     0,     0,     0],
        [ 3975,    23,    18, ...,     0,     0,     0],
        [   94,    94,    13, ...,     0,     0,     0],
        ...,
        [   21,  1800,    12, ...,     0,     0,     0],
        [41322,  1958,     4, ...,     0,     0,     0],
        [    8,    74,   531, ...,     0,     0,     0]], dtype=int64),
 array([[0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0],
        [1, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0]], dtype=int64))
```

In [40]: `###Creating the sequentail model`

In [41]:
```python
#LSTM
#Dropout : It is method of regularization
#Bidirectional layer : it is allow us to pass the features or values  of LSTM layers aco
#Dense : it is fully conneted layer
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import LSTM, Dropout, Bidirectional, Dense, Embedding
```

In [42]: `model = Sequential()`

In [43]:
```python
#Creating the embedding layers
model.add(Embedding(MAX_FEATURES+1,32)) ##+1 for unknown word  ##32 features
```

In [44]:
```python
#creating the Bidirectional LSTM layer
model.add(Bidirectional(LSTM(32,activation='tanh'))) ##LSTM having 32 differernt units
# we are using 'tanh' because for GPU acceleration we requrid ..and it define by tensorf
```

In [45]:
```python
#creating the Feature extractor Fully conncected Layer
model.add(Dense(128, activation='relu')) #128 units
```

```python
model.add(Dense(256, activation='relu'))
model.add(Dense(128, activation='relu'))
```

In [46]:
```python
#Final Layer
#it will take the pervious layer and convert into sigmoid fuction (btw 0 and 1 )
model.add(Dense(6, activation='sigmoid'))
```

In [47]:
```python
model.compile(loss='BinaryCrossentropy', optimizer='Adam')
```

In [48]:
```python
model.summary()
```

```
Model: "sequential"
_____
 Layer (type)                Output Shape              Param #
=================================================================
 embedding (Embedding)       (None, None, 32)          6400032

 bidirectional (Bidirectiona  (None, 64)               16640
 l)

 dense (Dense)               (None, 128)               8320

 dense_1 (Dense)             (None, 256)               33024

 dense_2 (Dense)             (None, 128)               32896

 dense_3 (Dense)             (None, 6)                 774

=================================================================
Total params: 6,491,686
Trainable params: 6,491,686
Non-trainable params: 0
_____
```

In [ ]:
```python
history = model.fit(train, epochs=10, validation_data=val)
```

```
Epoch 1/10
   11/6981 [..............................] - ETA: 1:05:14 - loss: 0.6253
```

In [ ]:
```python
plt.figure(figsize=(8,5))
pd.DataFrame(history.history).plot()
plt.show()
```

In [ ]:
```python
##Make Predictions
```

In [ ]:
```python
input_text = vectorizer('You freaking suck! I am going to hit you.')
```

In [ ]:
```python
df.columns[2:]
```

In [ ]:
```python
batch = test.as_numpy_iterator().next()
```

In [ ]:
```python
batch_X,batch_y = test.as_numpy_iterator().next()
```

In [80]:
```python
model.predict(batch_X)
```

```
1/1 [==============================] - 0s 85ms/step
```

Out[80]:
```
array([[1.45959971e-03, 1.16221294e-07, 1.53660090e-04, 1.51137319e-05,
        4.88020960e-05, 4.37866538e-06],
       [3.68381181e-04, 1.85834423e-08, 5.62152491e-05, 3.17833133e-06,
        1.06373354e-05, 6.80965968e-07],
       [8.83506262e-04, 4.42652706e-08, 9.22036124e-05, 7.43961255e-06,
        2.46741020e-05, 2.04146477e-06],
```

```
            [6.07268303e-04, 2.07262278e-08, 6.14786404e-05, 4.27952318e-06,
             1.45466829e-05, 1.12643772e-06],
            [1.25368242e-03, 8.56372324e-08, 1.31397159e-04, 1.20738659e-05,
             3.97111617e-05, 3.46846650e-06],
            [3.32964538e-03, 4.87271564e-07, 3.30046343e-04, 4.44668403e-05,
             1.48461593e-04, 1.40227949e-05],
            [5.70323085e-04, 1.76079791e-08, 5.62943751e-05, 3.84740770e-06,
             1.32758678e-05, 1.00538159e-06],
            [5.38308755e-04, 3.04481276e-08, 7.33757843e-05, 4.92075378e-06,
             1.58788225e-05, 1.13017154e-06],
            [9.82646924e-03, 3.61407456e-06, 9.58388671e-04, 1.96569890e-04,
             6.46945613e-04, 6.83324906e-05],
            [5.72627671e-02, 1.33285474e-04, 6.45585125e-03, 2.57775746e-03,
             8.04548152e-03, 9.89001943e-04],
            [9.98390496e-01, 3.66632462e-01, 9.82799351e-01, 4.11540084e-02,
             9.07198966e-01, 1.00313783e-01],
            [4.08587548e-05, 9.74116010e-10, 1.08363938e-05, 2.59552507e-07,
             1.07365781e-06, 3.69209516e-08],
            [1.64829695e-03, 1.59736800e-07, 1.83368873e-04, 1.88395607e-05,
             5.94377125e-05, 5.46842148e-06],
            [4.13875023e-05, 9.74205272e-10, 1.08012100e-05, 2.61946440e-07,
             1.06881646e-06, 3.67304622e-08],
            [1.30574848e-03, 1.09931641e-07, 1.49482061e-04, 1.38742389e-05,
             4.40577860e-05, 3.81429322e-06],
            [3.32873464e-01, 1.77174795e-03, 5.37349768e-02, 1.12674283e-02,
             1.05030537e-01, 9.37590562e-03]], dtype=float32)
```

In [81]: `(model.predict(batch_X) > 0.5).astype(int)`

```
1/1 [==============================] - 0s 96ms/step
```
Out[81]:
```
array([[0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0],
       [1, 0, 1, 0, 1, 0],
       [0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0]])
```

In [90]: `res = model.predict(batch_X)`

```
1/1 [==============================] - 0s 104ms/step
```

In [91]: `res`

Out[91]:
```
array([[1.45959971e-03, 1.16221294e-07, 1.53660090e-04, 1.51137319e-05,
        4.88020960e-05, 4.37866538e-06],
       [3.68381181e-04, 1.85834423e-08, 5.62152491e-05, 3.17833133e-06,
        1.06373354e-05, 6.80965968e-07],
       [8.83506262e-04, 4.42652706e-08, 9.22036124e-05, 7.43961255e-06,
        2.46741020e-05, 2.04146477e-06],
       [6.07268303e-04, 2.07262278e-08, 6.14786404e-05, 4.27952318e-06,
        1.45466829e-05, 1.12643772e-06],
       [1.25368242e-03, 8.56372324e-08, 1.31397159e-04, 1.20738659e-05,
        3.97111617e-05, 3.46846650e-06],
       [3.32964538e-03, 4.87271564e-07, 3.30046343e-04, 4.44668403e-05,
        1.48461593e-04, 1.40227949e-05],
       [5.70323085e-04, 1.76079791e-08, 5.62943751e-05, 3.84740770e-06,
```

```
        1.32758678e-05, 1.00538159e-06],
       [5.38308755e-04, 3.04481276e-08, 7.33757843e-05, 4.92075378e-06,
        1.58788225e-05, 1.13017154e-06],
       [9.82646924e-03, 3.61407456e-06, 9.58388671e-04, 1.96569890e-04,
        6.46945613e-04, 6.83324906e-05],
       [5.72627671e-02, 1.33285474e-04, 6.45585125e-03, 2.57775746e-03,
        8.04548152e-03, 9.89001943e-04],
       [9.98390496e-01, 3.66632462e-01, 9.82799351e-01, 4.11540084e-02,
        9.07198966e-01, 1.00313783e-01],
       [4.08587548e-05, 9.74116010e-10, 1.08363938e-05, 2.59552507e-07,
        1.07365781e-06, 3.69209516e-08],
       [1.64829695e-03, 1.59736800e-07, 1.83368873e-04, 1.88395607e-05,
        5.94377125e-05, 5.46842148e-06],
       [4.13875023e-05, 9.74205272e-10, 1.08012100e-05, 2.61946440e-07,
        1.06881646e-06, 3.67304622e-08],
       [1.30574848e-03, 1.09931641e-07, 1.49482061e-04, 1.38742389e-05,
        4.40577860e-05, 3.81429322e-06],
       [3.32873464e-01, 1.77174795e-03, 5.37349768e-02, 1.12674283e-02,
        1.05030537e-01, 9.37590562e-03]], dtype=float32)
```

In [94]: `##res.flatten()`

In [87]: `###Evaluate Model`

In [88]:
```python
from tensorflow.keras.metrics import Precision, Recall, CategoricalAccuracy
```

In [89]:
```python
pre = Precision()
re = Recall()
acc = CategoricalAccuracy()
```

In [95]:
```python
for batch in test.as_numpy_iterator(): ##looping each batch from our data pipeline
    # Unpack the batch
    X_true, y_true = batch
    # Make a prediction
    yhat = model.predict(X_true)

    # Flatten the predictions
    y_true = y_true.flatten()  ##flatten convert it into 1 bigg array fromate
    yhat = yhat.flatten()

    pre.update_state(y_true, yhat)
    re.update_state(y_true, yhat)
    acc.update_state(y_true, yhat)
```

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In [96]:
```python
print(f'Precision: {pre.result().numpy()}, Recall:{re.result().numpy()}, Accuracy:{acc.r
```

Precision: 0.8197124004364014, Recall:0.6702036261558533, Accuracy:0.47342026233673096

In [97]:
```python
###Test and Gradio
```

In [99]:
```python
##!pip install gradio jinja2
```

In [9]:
```python
import gradio as gr
```

```
In [101…   model.save('toxicity.h5')
```

```
In [4]:   model = tf.keras.models.load_model('toxicity.h5')
```

```
In [5]:   input_str = vectorizer('hey i freaken hate you!')
```

```
          ---------------------------------------------------------------------------
          NameError                                 Traceback (most recent call last)
          ~\AppData\Local\Temp\ipykernel_27952\4006532911.py in <module>
          ----> 1 input_str = vectorizer('hey i freaken hate you!')

          NameError: name 'vectorizer' is not defined
```

```
In [6]:   res = model.predict(np.expand_dims(input_str,0))
```

```
          ---------------------------------------------------------------------------
          NameError                                 Traceback (most recent call last)
          ~\AppData\Local\Temp\ipykernel_27952\1153749333.py in <module>
          ----> 1 res = model.predict(np.expand_dims(input_str,0))

          NameError: name 'input_str' is not defined
```

```
In [105…   df.columns[2:]
```

```
Out[105]:   Index(['toxic', 'severe_toxic', 'obscene', 'threat', 'insult',
                  'identity_hate'],
                dtype='object')
```

```
In [106…   res
```

```
Out[106]:   array([[0.41900614, 0.0036603 , 0.08816806, 0.0166436 , 0.1500733 ,
                  0.01621035]], dtype=float32)
```

```
In [7]:   def score_comment(comment):
              vectorized_comment = vectorizer([comment])
              results = model.predict(vectorized_comment)

              text = ''
              for idx, col in enumerate(df.columns[2:]):
                  text += '{}: {}\n'.format(col, results[0][idx]>0.5)

              return text
```

```
In [10]:   interface = gr.Interface(fn=score_comment,
                                    inputs=gr.inputs.Textbox(lines=2, placeholder='Comment to score
                                    outputs='text')
```

```
          2023-04-17 17:37:01,583 [27952] WARNING  py.warnings:109: [JupyterRequire] C:\Users\avis
          h\anaconda3\lib\site-packages\gradio\inputs.py:27: UserWarning: Usage of gradio.inputs i
          s deprecated, and will not be supported in the future, please import your component from
          gradio.components
            warnings.warn(

          2023-04-17 17:37:01,585 [27952] WARNING  py.warnings:109: [JupyterRequire] C:\Users\avis
          h\anaconda3\lib\site-packages\gradio\deprecation.py:40: UserWarning: `optional` paramete
          r is deprecated, and it has no effect
            warnings.warn(value)

          2023-04-17 17:37:01,586 [27952] WARNING  py.warnings:109: [JupyterRequire] C:\Users\avis
          h\anaconda3\lib\site-packages\gradio\deprecation.py:40: UserWarning: `numeric` parameter
          is deprecated, and it has no effect
            warnings.warn(value)
```

```
In [ ]:   interface.launch()
```

In [ ]:

In [ ]:

In [ ]:

In [ ]: