```
#load data set from the kaggle
! pip install -q kaggle
#Make a directory named ".kaggle"
! mkdir ~/.kaggle
from google.colab import files
! cp /content/kaggle.json ~/.kaggle/
! cp /content/kaggle.json ~/.kaggle/
```

```
mkdir: cannot create directory '/root/.kaggle': File exists
```

```
! kaggle datasets download -d lakshmi25npathi/imdb-dataset-of-50k-movie-reviews
```

```
Warning: Your Kaggle API key is readable by other users on this system! To fix this, you can run 'chmod 600 /root/.kaggle/kaggl
Downloading imdb-dataset-of-50k-movie-reviews.zip to /content
 35% 9.00M/25.7M [00:00<00:00, 59.4MB/s]
100% 25.7M/25.7M [00:00<00:00, 102MB/s]
```

```
! mkdir movie_data
```

```
mkdir: cannot create directory 'movie_data': File exists
```

```
! unzip /content/imdb-dataset-of-50k-movie-reviews.zip -d movie_data
```

```
Archive:  /content/imdb-dataset-of-50k-movie-reviews.zip
  inflating: movie_data/IMDB Dataset.csv
```

```
import numpy as np
import pandas as pd
import seaborn as sns
from wordcloud import WordCloud,STOPWORDS
import re
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
```

```
data=pd.read_csv('movie_data/IMDB Dataset.csv')
```

```
data.head(10)
```

	review	sentiment
0	One of the other reviewers has mentioned that ...	positive
1	A wonderful little production. The...	positive
2	I thought this was a wonderful way to spend ti...	positive
3	Basically there's a family where a little boy ...	negative
4	Petter Mattei's "Love in the Time of Money" is...	positive
5	Probably my all-time favorite movie, a story o...	positive
6	I sure would like to see a resurrection of a u...	positive
7	This show was an amazing, fresh & innovative i...	negative
8	Encouraged by the positive comments about this...	negative
9	If you like original gut wrenching laughter yo...	positive

```
data.isnull().sum()
```

```
review       0
sentiment    0
dtype: int64
```

```
sns.countplot(x=data['sentiment'])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4e4afd7210>
```


```
stop = set(STOPWORDS)
```

```
#clean the text data
def remove_between_square_brackets(text):
    return re.sub('\[[^]]*\]', '', text)
def remove_between_square_brackets(text):
    return re.sub(r'http\S+', '', text)
#Removing the stopwords from text
def remove_stopwords(text):
    final_text = []
    for i in text.split():
        if i.strip().lower() not in stop and i.strip().lower().isalpha():
            final_text.append(i.strip().lower())
    return " ".join(final_text)
#Removing the noisy text
def denoise_text(text):
    text = remove_between_square_brackets(text)
    text = remove_stopwords(text)
    return text

#Lemmatize the corpus
def lemma_traincorpus(text):
    lemmatizer=WordNetLemmatizer()
    out_data=""
    for words in text:
```

```
        for words in text:
            out_data+= lemmatizer.lemmatize(words)
        return out_data

    def tfidf(text):
        tfidfv = TfidfVectorizer(stop_words='english', ngram_range=(1, 2), lowercase=True, max_features=150000)
        fit_data_tfidf=tfidfv.fit_transform(data)
        return fit_data_tfidf
    #Apply function on review column
    data['review']=data['review'].apply(denoise_text)
```

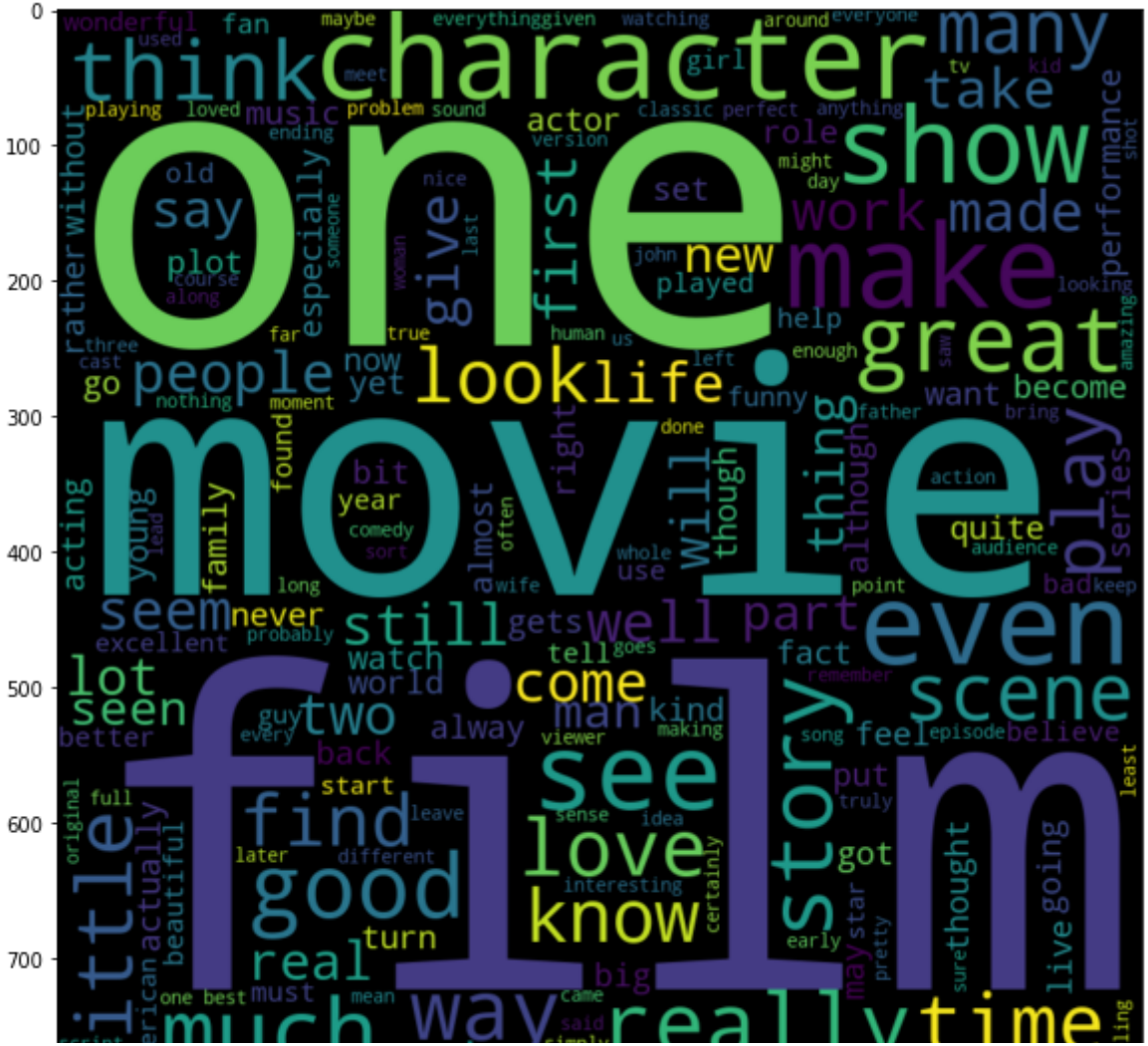
```
data.sentiment.replace("positive" , 1 , inplace = True)
data.sentiment.replace("negative" , 0 , inplace = True)
data.head()
```

	review	sentiment
0	one reviewers mentioned watching oz episode ex...	1
1	wonderful little filming technique fashion giv...	1
2	thought wonderful way spend time hot summer si...	1
3	basically family little boy thinks zombie clos...	0
4	petter time visually stunning film mattei offe...	1

Positive Review

```
 plt.figure(figsize = (10,10))
 word_cloud= WordCloud(width = 800 , height = 800).generate(" ".join(data[data.sentiment == 1].review))
plt.imshow(word_cloud , interpolation = 'bilinear')
```

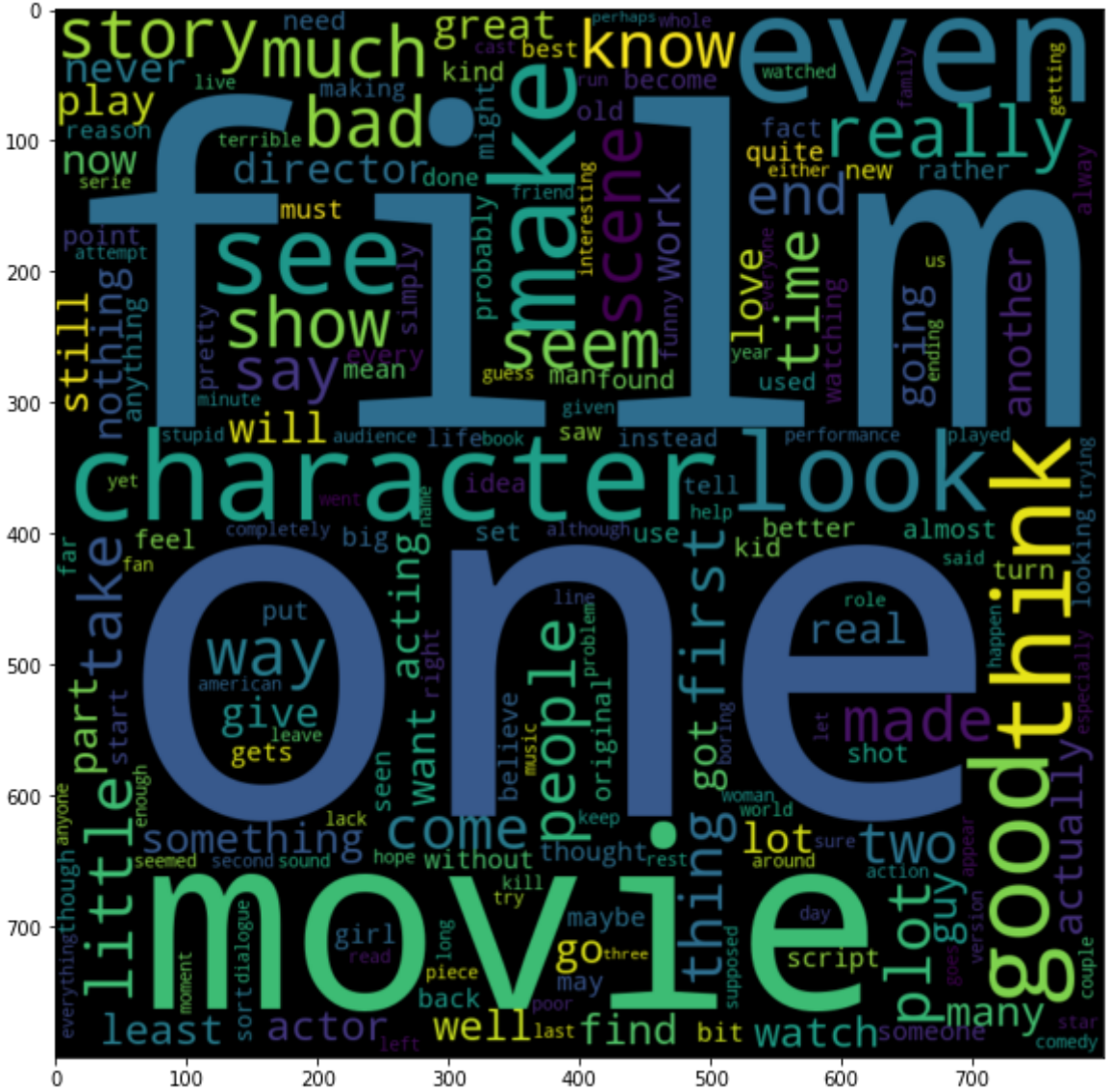
```
<matplotlib.image.AxesImage at 0x7f4e2765a790>
```



Negative Review

```
plt.figure(figsize = (10,10))
word_cloud = WordCloud(width = 800 , height = 800).generate(" ".join(data[data.sentiment == 0].review))
plt.imshow(word_cloud , interpolation = 'bilinear')
```

```
<matplotlib.image.AxesImage at 0x7f4e49744fd0>
```




```
from sklearn import preprocessing,metrics,manifold
from sklearn.manifold import TSNE
from sklearn.model_selection import train_test_split,cross_val_score,GridSearchCV,cross_val_predict
from imblearn.over_sampling import ADASYN,SMOTE
from imblearn.under_sampling import NearMiss
from sklearn.linear_model import LogisticRegression
```

```
from sklearn.svm import SVC
from sklearn.neighbors import KNeighborsClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis
from sklearn.svm import SVC
import collections
import matplotlib.patches as mpatches
from sklearn.metrics import accuracy_score
%matplotlib inline
from sklearn.preprocessing import RobustScaler
import xgboost
from imblearn.metrics import classification_report_imbalanced
from sklearn.metrics import classification_report,roc_auc_score,roc_curve,r2_score,recall_score,confusion_matrix,precision_recall_
from collections import Counter
from sklearn.model_selection import StratifiedKFold,KFold,StratifiedShuffleSplit
from nltk import word_tokenize
from nltk.corpus import stopwords
import matplotlib.pyplot as plt
import matplotlib.patches as mpatches
from sklearn.feature_extraction.text import CountVectorizer, TfidfVectorizer
from sklearn.model_selection import train_test_split
from sklearn.decomposition import PCA, TruncatedSVD,SparsePCA
from sklearn.metrics import classification_report,confusion_matrix
from nltk.tokenize import word_tokenize
from collections import defaultdict
from collections import Counter
import seaborn as sns
from wordcloud import WordCloud,STOPWORDS
import nltk
from nltk.corpus import stopwords
import string
from nltk.stem import WordNetLemmatizer
from sklearn.decomposition import TruncatedSVD
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split
from sklearn.naive_bayes import MultinomialNB
from sklearn.neighbors import KNeighborsClassifier
```

```
from sklearn.neighbors import KNeighborsClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis
from sklearn.svm import SVC
import xgboost
from imblearn.metrics import classification_report_imbalanced
from sklearn.metrics import classification_report,roc_auc_score,roc_curve,r2_score,recall_score,confusion_matrix,precision_recall_
from collections import Counter
from sklearn.model_selection import StratifiedKFold,KFold,StratifiedShuffleSplit


import tensorflow as tf
from tensorflow import keras
from keras.preprocessing.text import Tokenizer
from tensorflow.keras.layers import LSTM, Dense,Flatten,Conv2D,Conv1D,GlobalMaxPooling1D,GlobalMaxPool1D
from tensorflow.keras.optimizers import Adam
import numpy as np
import pandas as pd
import keras.backend as k
from tensorflow.keras.preprocessing.sequence import pad_sequences
from tensorflow.keras.layers import Input, LSTM, Embedding, Dense, Concatenate, TimeDistributed, Bidirectional,GRU
from tensorflow.keras.models import Model,Sequential
from tensorflow.keras.callbacks import EarlyStopping
from sklearn.preprocessing import OneHotEncoder
from tensorflow.keras.utils import to_categorical
from keras.utils.vis_utils import plot_model
```

Here we used 2 method lstm and encoding and decoding Approch check there Acuracy

**Creating a Basic LSTM Neural Network In this case, we will not be using an y pretrained static/dynamic embeddings but will be using a simple Neural Network model of LSTM to create our network.The steps are as follows:

Tokenize the input data Creating the limits of Maxlen, Max Features and Embedding Size for our Embedding Matrix Pad the tokenized data to maintain uniformity in length of the input features**

```
maxlen=1000
max_features=5000
embed_size=300

train_y=data['sentiment']
train_x,test_x,train_y,test_y=train_test_split(data['review'],train_y,test_size=0.2,random_state=42)

val_x=test_x

val_x=test_x
#Tokenizing steps- must be remembered
tokenizer=Tokenizer(num_words=max_features)
tokenizer.fit_on_texts(list(train_x))
train_x=tokenizer.texts_to_sequences(train_x)
val_x=tokenizer.texts_to_sequences(val_x)

#Pad the sequence- To allow same length for all vectorized words
train_x=pad_sequences(train_x,maxlen=maxlen)
val_x=pad_sequences(val_x,maxlen=maxlen)
val_y=test_y
print("Padded and Tokenized Training Sequence".format(),train_x.shape)
print("Target Values Shape".format(),train_y.shape)
print("Padded and Tokenized Training Sequence".format(),val_x.shape)
print("Target Values Shape".format(),val_y.shape)
```

```
Padded and Tokenized Training Sequence (40000, 1000)
Target Values Shape (40000,)
Padded and Tokenized Training Sequence (10000, 1000)
Target Values Shape (10000,)
```

```
model=Sequential()
model.add(Embedding(max_features,embed_size,input_length=maxlen))
model.add(LSTM(60))
model.add(Dense(16,activation='relu'))
model.add(Dense(1,activation='sigmoid'))
model.compile(loss='binary_crossentropy',optimizer='adam',metrics=['accuracy'])
```

```
model.summary()
plot_model(
    model,
    to_file="simple_model.png",
    show_shapes=True,
    show_layer_names=True,
    rankdir="TB",
    expand_nested=False,
    dpi=96,
)
train_data=model.fit(train_x,train_y,batch_size=512,epochs=3,verbose=2)
print(train_data)

def plot_graph(history,string):

    plt.plot(history.history[string],label='training '+string)
    plt.plot(history.history['val_'+string],label='validation '+string)
    plt.legend()
    plt.xlabel('epochs')
    plt.ylabel(string)
    plt.title(string+' vs epochs')
    plt.show()
```

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
embedding_1 (Embedding)      (None, 1000, 300)         1500000
_________________________________________________________________
lstm_1 (LSTM)                (None, 60)                86640
_________________________________________________________________
dense_2 (Dense)              (None, 16)                976
_________________________________________________________________
dense_3 (Dense)              (None, 1)                 17
=================================================================
Total params: 1,587,633
Trainable params: 1,587,633
Non-trainable params: 0
_________________________________________________________________
```

```
Epoch 1/3
79/79 - 30s - loss: 0.4723 - accuracy: 0.7878
Epoch 2/3
79/79 - 28s - loss: 0.2848 - accuracy: 0.8852
Epoch 3/3
79/79 - 28s - loss: 0.2487 - accuracy: 0.9032
```

For Validation data

```
#Fit and validate
model.fit(train_x,train_y,batch_size=128,epochs=3,verbose=2,validation_data=(val_x,val_y))
```

```
Epoch 1/3
313/313 - 51s - loss: 0.2714 - accuracy: 0.8880 - val_loss: 0.3361 - val_accuracy: 0.8572
Epoch 2/3
313/313 - 51s - loss: 0.2156 - accuracy: 0.9143 - val_loss: 0.3571 - val_accuracy: 0.8608
Epoch 3/3
313/313 - 51s - loss: 0.1887 - accuracy: 0.9248 - val_loss: 0.3727 - val_accuracy: 0.8494
<keras.callbacks.History at 0x7f4e26f4d1d0>
```

***The key benefits of the approach are the ability to train a single end-to-end model directly on source and target sentences and the ability to handle variable length input and output sequences of text.*

More detail :-https://blog.keras.io/a-ten-minute-introduction-to-sequence-to-sequence-learning-in-keras.html***

```
maxlen=1000
max_features=5000
embed_size=300

#clean some null words or use the previously cleaned & lemmatized corpus

train_y=data['sentiment']
train_x,test_x,train_y,test_y=train_test_split(data['review'],train_y,test_size=0.2,random_state=0)

val_x=test_x
```

```
#Tokenizing steps- must be remembered
tokenizer=Tokenizer(num_words=max_features)
tokenizer.fit_on_texts(list(train_x))
train_x=tokenizer.texts_to_sequences(train_x)
val_x=tokenizer.texts_to_sequences(val_x)

#Pad the sequence- To allow same length for all vectorized words
train_x=pad_sequences(train_x,maxlen=maxlen)
val_x=pad_sequences(val_x,maxlen=maxlen)
val_y=test_y
print("Padded and Tokenized Training Sequence".format(),train_x.shape)
print("Target Values Shape".format(),train_y.shape)
print("Padded and Tokenized Training Sequence".format(),val_x.shape)
print("Target Values Shape".format(),val_y.shape)

#sequence to sequence basic lstm encoder gru decoders
def seq2seq_encoder_decoder(maxlen,max_features,embed_size):
    #Creating LSTM  encoder neural model with no pretrained embeddings
    encoder_inp=Input(shape=(maxlen,))
    encoder_embed=Embedding(max_features,embed_size,input_length=maxlen,trainable=True)(encoder_inp)
    encoder_lstm_cell=LSTM(60,return_state='True')
    encoder_outputs,encoder_state_lstm_h,encoder_state_lstm_c=encoder_lstm_cell(encoder_embed)
    print(f'Encoder Ouputs Shape{encoder_outputs.shape}')
    #Creating LSTM decoder model and feeding the output states (h,c) of lstm of encoders
    decoder_inp=Input(shape=(maxlen,))
    decoder_embed=Embedding(max_features,embed_size,input_length=maxlen,trainable=True)(decoder_inp)
    decoder_lstm_cell=LSTM(60,return_sequences='True',return_state=True)
    decoder_outputs,decoder_state_lstm_h,decoder_state_lstm_c=decoder_lstm_cell(decoder_embed,initial_state=[encoder_state_lstm_h,
    decoder_dense_cell=Dense(16,activation='relu')
    decoder_d_output=decoder_dense_cell(decoder_outputs)
    decoder_dense_cell2=Dense(1,activation='sigmoid')
    decoder_output=decoder_dense_cell2(decoder_d_output)
    model=Model([encoder_inp,decoder_inp],decoder_output)
    model.summary()
    return model


model=seq2seq_encoder_decoder(maxlen,max_features,embed_size)
```

```
model=seq2seq_encoder_decoder(maxlen,max_features,embed_size)
model.compile(loss='binary_crossentropy',optimizer='adam',metrics=['accuracy'])
plot_model(
    model,to_file="seq2seq_encoder_decoder_model.png",
    show_shapes=True,
    show_layer_names=True,
    rankdir="TB",
    expand_nested=False,
    dpi=96)

model.fit([train_x,train_x],train_y,batch_size=512,epochs=3,verbose=2)
```

```
Padded and Tokenized Training Sequence (40000, 1000)
Target Values Shape (40000,)
Padded and Tokenized Training Sequence (10000, 1000)
Target Values Shape (10000,)
Encoder Ouputs Shape(None, 60)
Model: "model"
__________________________________________________________________________________________________
Layer (type)                    Output Shape         Param #     Connected to
==================================================================================================
input_1 (InputLayer)            [(None, 1000)]       0
__________________________________________________________________________________________________
input_2 (InputLayer)            [(None, 1000)]       0
__________________________________________________________________________________________________
embedding_2 (Embedding)         (None, 1000, 300)    1500000     input_1[0][0]
__________________________________________________________________________________________________
embedding_3 (Embedding)         (None, 1000, 300)    1500000     input_2[0][0]
__________________________________________________________________________________________________
lstm_2 (LSTM)                   [(None, 60), (None,  86640       embedding_2[0][0]
__________________________________________________________________________________________________
lstm_3 (LSTM)                   [(None, 1000, 60), ( 86640       embedding_3[0][0]
                                                                 lstm_2[0][1]
                                                                 lstm_2[0][2]
__________________________________________________________________________________________________
dense_4 (Dense)                 (None, 1000, 16)     976         lstm_3[0][0]
__________________________________________________________________________________________________
dense_5 (Dense)                 (None, 1000, 1)      17          dense_4[0][0]
==================================================================================================
Total params: 3,174,273
```

```
Trainable params: 3,174,273
Non-trainable params: 0
_________________________________________________________________
Epoch 1/3
79/79 - 61s - loss: 0.6898 - accuracy: 0.5072
Epoch 2/3
79/79 - 57s - loss: 0.6785 - accuracy: 0.5264
Epoch 3/3
79/79 - 57s - loss: 0.6716 - accuracy: 0.5258
<keras.callbacks.History at 0x7f4e2648f690>
```

#here we get 52 percent accuracy if we incrase the epoch and increase the layer defently get good accuracy

colab for link:-https://colab.research.google.com/drive/14OA5CuD1NAT3cwmp_NLRTAkHEVKVVjoP?usp=sharing

Thank you

Gtihub:-(https://github.com/RAGHAVJHA01)

Kaggle:-https://www.kaggle.com/raghavjha858