Model Trained with 10000 images

```
#1000 images
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
import os
import cv2
import matplotlib.image as mp
```

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

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

```
s=open('/content/drive/My Drive/Main/train.mn.txt')
```

```
s=open("/content/drive/My Drive/Multi/train.mn.txt")
```

```
with open('/content/drive/My Drive/Main/train.mn.txt') as f:
    train_ml = f.read().split('\n')
with open('/content/drive/My Drive/Main/train.en.txt') as f:
    train_l = f.read().split('\n')
with open('/content/drive/My Drive/Main/train_images.txt') as f:
    train_img_name = f.read().split('\n')
train_ml.pop()
train_ml.pop()
train_en.pop()
train_en.pop()
train_img_name.pop()
print(len(train_ml))
print(len(train_en))
print(len(train_img_name))
img_path=[]
for s in train_img_name:
    img_path.append("/content/drive/My Drive/Main/trainimages/train/"+s)
```

```
28930
28931
28931
```

```
train_img_name[0]
```

```
'10.jpg'
```

```
train_en[1]
```

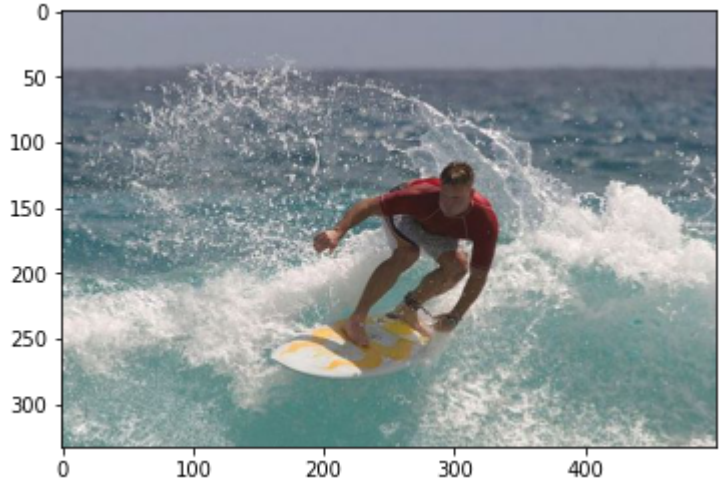
```
'it is an indoor scene\t\t\t\t\t\t'
```

```
im=mp.imread(img_path[1])
plt.imshow(im)
print(img_path[1])
print("ml:"+train_ml[1])
print("en:"+train_en[1])
```

```
/content/drive/My Drive/Main/trainimages/train/11.jpg
de:ഇത് ഒരു ഇൻഡോർ രംഗമാണ്
en:it is an indoor scene
```


```
im=mp.imread(img_path[0])
plt.imshow(im)
print(img_path[0])
print("ml:"+train_ml[0])
print("en:"+train_en[0])
```

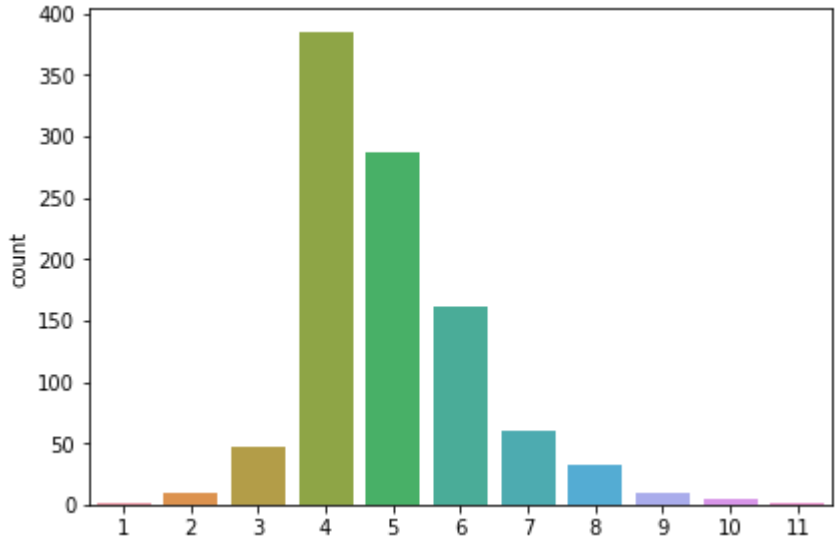
```
/content/drive/My Drive/Main/trainimages/train/10.jpg
de:ശാന്തമായ  കടലിൽ സർഫിങ് നടത്തുന്ന പുരുഷ സർഫർ
en:Male surfer surfing in still in the ocean
```



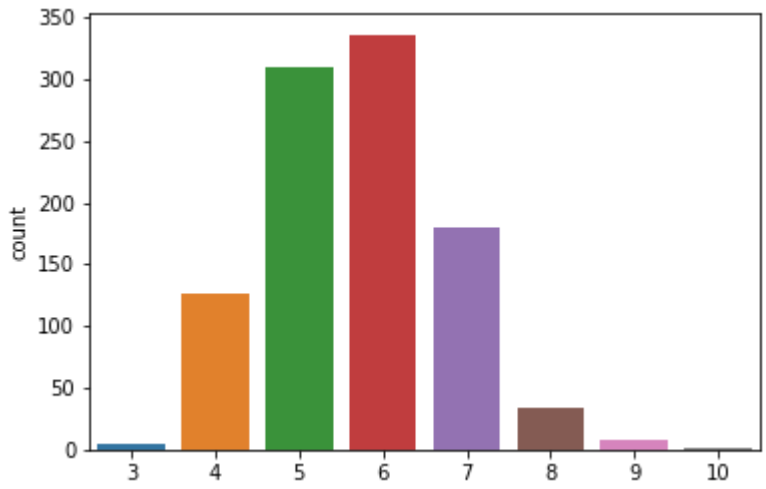
```
choicenum=1000
train_de=train_de[:choicenum]
train_en=train_en[:choicenum]


de_df = pd.DataFrame(train_ml, columns=['ml'])
en_df = pd.DataFrame(train_en, columns=['en'])
import re
def clean_text(text):
    '''Clean text by removing unnecessary characters and altering the format of words.'''
    text = text.lower()
    text = re.sub(r" ‘", "", text)
    text = re.sub(r" ‘", "", text)
    text = re.sub(r"-", " ", text)
    text = re.sub(r"<5>", "5", text)
    text = re.sub(r"“ ", "", text)
    text = re.sub(r" ”", "", text)
    text = re.sub(r"[+\.\!\/_,$%^*(+\"\']+|[+——！ ，  〈〉 《》 。 ｜？ ？、 . %~@#￥%……&* () ’]", "", t
    text=text.rstrip()
    #text=' '.join(text.split())
    return text

text1 = en_df["en"].apply(clean_text)
text2 = ml_df["ml"].apply(clean_text)
text1 = list(text1.values)
text2 = list(text2.values)


text1[1]

     'it is an indoor scene'


texttemp=[]
for s in text2:
    temp="cls "+s+" eos"
    texttemp.append(temp)
text2=[]
text2=texttemp
from sklearn.model_selection import train_test_split
english_words = []
malayalam_words = []

for i in text1:
    english_words.append(len(i.split()))

for j in text2:
    malayalam_words.append(len(j.split()))
import seaborn as sn
import matplotlib.pyplot as plt

sn.countplot(english_words)
```

```
#et_xlabel( "GFG X")
plt.tight_layout()
plt.show()

sn.countplot(malayalam_words)
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass th
  FutureWarning
```




```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass th
  FutureWarning
```




```
text2[1]
```

```
'cls ഇത് ഒരു ഇൻഡോർ രംഗമാണ് eos'
```

```
max_len_english = max(english_words)
max_len_malayalam = max(malayalam_words)

#from sklearn.model_selection import train_test_split
#x_tr,x_val,y_tr,y_val=train_test_split(text1,text2,test_size=0.3,random_state=12,shuffle=Tru
#print(len(x_tr))
```

```
#print(len(x_val))
x_tr=text1[:choicenum-500]
y_tr=text2[:choicenum-500]
x_val=text1[choicenum-500:]
y_val=text2[choicenum-500:]
```

```
len(x_tr)
```

```
2000
```

```
x_tr[1]
```

```
'it is an indoor scene'
```

```
len(text2)
```

```
1013
```

```
print(choicenum)
```

```
2000
```

```
a=text1[choicenum-500:]
a
```

```
[]
```

```
from keras.preprocessing.text import Tokenizer
x_tokens = Tokenizer()
x_tokens.fit_on_texts(x_tr)

x_tr = x_tokens.texts_to_sequences(x_tr)
x_val = x_tokens.texts_to_sequences(x_val)

from keras.preprocessing.sequence import pad_sequences
x_tr = pad_sequences(x_tr,maxlen = max_len_english,padding = 'post')
x_val = pad_sequences(x_val,maxlen = max_len_english,padding = 'post')

# +1 for padding
x_voc_size   =  len(x_tokens.word_index) +1

# y data
from keras.preprocessing.text import Tokenizer
y_tokens = Tokenizer()
y_tokens.fit_on_texts(y_tr)

y_tr = y_tokens.texts_to_sequences(y_tr)
y_val = y_tokens.texts_to_sequences(y_val)
```

```
from keras.preprocessing.sequence import pad_sequences
y_tr = pad_sequences(y_tr,maxlen = max_len_malayalam,padding = 'post')
y_val = pad_sequences(y_val,maxlen = max_len_malayalam,padding = 'post')

# +1 for padding
y_voc_size   =  len(y_tokens.word_index) +1


print("The document count",x_tokens.word_counts)
```

```
The document count OrderedDict([('male', 1), ('surfer', 1), ('surfing', 1), ('in', 75),
```

```
print("The document count",x_tokens.word_docs)
```

```
The document count defaultdict(<class 'int'>, {'the': 174, 'ocean': 2, 'in': 74, 'surfer
```

```
print("The document count",x_tokens.document_count)
```

```
The document count 500
```

```
print("The document count",x_tokens.word_index)
```

```
The document count {'the': 1, 'a': 2, 'on': 3, 'in': 4, 'of': 5, 'is': 6, 'white': 7, 'b
```

```
y_voc_size
```

```
3530
```

```
print("The sequences generated from text are : ",x_tr[1])
```

```
The sequences generated from text are :  [157   6  48 231 232   0   0   0   0   0   0]
```

```
len(x_tr)
```

```
500
```

```
pip install keras-applications
```

```
Collecting keras-applications
  Downloading Keras_Applications-1.0.8-py3-none-any.whl (50 kB)
     |████████████████████████████████| 50 kB 2.6 MB/s
Requirement already satisfied: numpy>=1.9.1 in /usr/local/lib/python3.7/dist-packages (f
Requirement already satisfied: h5py in /usr/local/lib/python3.7/dist-packages (from kera
Requirement already satisfied: cached-property in /usr/local/lib/python3.7/dist-packages
```

```
Installing collected packages: keras-applications
Successfully installed keras-applications-1.0.8
```

```
import pandas as pd
import pickle
import numpy as np
import os
import keras
import tensorflow
from keras_applications.resnet import ResNet50
from tensorflow.keras.optimizers import Adam
from keras.layers import Dense, GlobalAveragePooling2D,BatchNormalization,Flatten,Input, Conv
from keras.models import Sequential, Model
from keras.utils import np_utils
import random
from keras.preprocessing import image, sequence
import matplotlib.pyplot as plt
import keras
from keras import backend as K
import gensim
from numpy import *
import numpy as np
import pandas as pd
import re
from tensorflow.keras.applications.vgg16 import VGG16
from keras.preprocessing.text import Tokenizer
from keras.preprocessing.sequence import pad_sequences
from nltk.corpus import stopwords
from tensorflow.keras.layers import Input, LSTM, Embedding, Dense, Concatenate, TimeDistribut
from tensorflow.keras.models import Model
from tensorflow.keras.callbacks import EarlyStopping
import warnings
modelvgg = VGG16(include_top=True,weights="imagenet")
## load the locally saved weights
modelvgg.layers.pop()
modelvgg = Model(inputs=modelvgg.inputs, outputs=modelvgg.layers[-2].output)
modelvgg.summary()
```

```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/vgg16
553467904/553467096 [==============================] - 6s 0us/step
553476096/553467096 [==============================] - 6s 0us/step
Model: "model"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
input_1 (InputLayer)         [(None, 224, 224, 3)]     0
_________________________________________________________________
block1_conv1 (Conv2D)        (None, 224, 224, 64)      1792
_________________________________________________________________
block1_conv2 (Conv2D)        (None, 224, 224, 64)      36928
_________________________________________________________________
```

```
block1_pool (MaxPooling2D)   (None, 112, 112, 64)      0
_________________________________________________________________
block2_conv1 (Conv2D)        (None, 112, 112, 128)     73856
_________________________________________________________________
block2_conv2 (Conv2D)        (None, 112, 112, 128)     147584
_________________________________________________________________
block2_pool (MaxPooling2D)   (None, 56, 56, 128)       0
_________________________________________________________________
block3_conv1 (Conv2D)        (None, 56, 56, 256)       295168
_________________________________________________________________
block3_conv2 (Conv2D)        (None, 56, 56, 256)       590080
_________________________________________________________________
block3_conv3 (Conv2D)        (None, 56, 56, 256)       590080
_________________________________________________________________
block3_pool (MaxPooling2D)   (None, 28, 28, 256)       0
_________________________________________________________________
block4_conv1 (Conv2D)        (None, 28, 28, 512)       1180160
_________________________________________________________________
block4_conv2 (Conv2D)        (None, 28, 28, 512)       2359808
_________________________________________________________________
block4_conv3 (Conv2D)        (None, 28, 28, 512)       2359808
_________________________________________________________________
block4_pool (MaxPooling2D)   (None, 14, 14, 512)       0
_________________________________________________________________
block5_conv1 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_conv2 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_conv3 (Conv2D)        (None, 14, 14, 512)       2359808
_________________________________________________________________
block5_pool (MaxPooling2D)   (None, 7, 7, 512)         0
_________________________________________________________________
flatten (Flatten)            (None, 25088)             0
_________________________________________________________________
fc1 (Dense)                  (None, 4096)              102764544
_________________________________________________________________
fc2 (Dense)                  (None, 4096)              16781312
=================================================================
Total params: 134,260,544
Trainable params: 134,260,544
Non-trainable params: 0
_________________________________________________________________
```

```
import cv2
import cv
```

```
ERROR:root:Error disabling cv.imshow().
Traceback (most recent call last):
  File "/usr/local/lib/python3.7/dist-packages/google/colab/_import_hooks/_cv2.py", line
    cv_module.imshow,
AttributeError: module 'cv' has no attribute 'imshow'
```

```
pip install cv
```

```
     Collecting cv
       Downloading cv-1.0.0-py3-none-any.whl (7.3 kB)
     Installing collected packages: cv
     Successfully installed cv-1.0.0
```

```
imagedata=np.zeros(shape=(choicenum,224,224,3))
for i in range(choicenum):
    temp=mp.imread(img_path[i])
    if (len(temp.shape)==3):
       temp=cv2.resize(temp,(224,224))
       imagedata[i]=temp
    elif (len(temp.shape)<3):
       temp=cv2.cvtColor(temp, cv2.COLOR_BGR2RGB)
       temp=cv2.resize(temp,(224,224))
       imagedata[i]=temp
    #print(temp)
```

```
imagedata=imagedata/255
imagedata=imagedata.astype(np.float16)
```

```
from keras.preprocessing.image import load_img, img_to_array
from keras.applications.vgg16 import preprocess_input
from collections import OrderedDict
jpgs=img_path[:choicenum]

images = OrderedDict()
npix = 224
target_size = (npix,npix,3)
for i,name in enumerate(jpgs):
    filename = name
    image = load_img(filename, target_size=target_size)
    # convert the image pixels to a numpy array
    image = img_to_array(image)
    nimage = preprocess_input(image)
    y_pred = modelvgg.predict(nimage.reshape( (1,) + nimage.shape[:3]))
    images[name] = y_pred.flatten()
    if i%200==0:
        print(i,filename)
```

```
 0 /content/drive/My Drive/Main/trainimages/train/10.jpg
 200 /content/drive/My Drive/Main/trainimages/train/739.jpg
 400 /content/drive/My Drive/Main/trainimages/train/1529.jpg
 600 /content/drive/My Drive/Main/trainimages/train/2238.jpg
 800 /content/drive/My Drive/Main/trainimages/train/2970.jpg
```

```
vgg_imfea=np.zeros(shape=(len(jpgs),4096))
for i in range(len(jpgs)):
    vgg_imfea[i]=images[jpgs[i]]
```

```
train_vggf=vgg_imfea[:choicenum-500]
val_vggf=vgg_imfea[choicenum-500:]


#g_1=GlobalAveragePooling2D()(conv_3)
img_inputs=Input(shape=(4096,))
d_1=Dense(512, activation='relu')(img_inputs)
r_1=RepeatVector(max_len_english)(d_1)
vf_model = Model(img_inputs, r_1)
vf_model.summary()
```

```
Model: "model_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #   
=================================================================
input_2 (InputLayer)         [(None, 4096)]            0         
_________________________________________________________________
dense (Dense)                (None, 512)               2097664   
_________________________________________________________________
repeat_vector (RepeatVector) (None, 11, 512)           0         
=================================================================
Total params: 2,097,664
Trainable params: 2,097,664
Non-trainable params: 0
_________________________________________________________________
```

```
x_voc=x_voc_size
y_voc=y_voc_size

# img_inputs=Input(shape=(224,224,3))
# conv_1=Conv2D(filters=64, kernel_size=(3,3), strides=(1, 1), padding='valid')(img_inputs)
# m_pool=MaxPooling2D(pool_size=(2, 2), strides=None, padding='valid')(conv_1)
# bn_1=BatchNormalization()(m_pool)
# conv_2=Conv2D(filters=128, kernel_size=(3,3), strides=(1, 1), padding='valid')(bn_1)
# conv_2=Conv2D(filters=128, kernel_size=(3,3), strides=(1, 1), padding='valid')(conv_2)
# m_pool1=MaxPooling2D(pool_size=(2, 2), strides=None, padding='valid')(conv_2)
# conv_3=Conv2D(filters=256, kernel_size=(3,3), strides=(1, 1), padding='valid')(m_pool1)
# conv_3=Conv2D(filters=256, kernel_size=(3,3), strides=(1, 1), padding='valid')(conv_3)
# m_pool2=MaxPooling2D(pool_size=(2, 2), strides=None, padding='valid')(conv_3)
# bn_2=BatchNormalization()(m_pool2)
# conv_3=Conv2D(filters=512, kernel_size=(3,3), strides=(1, 1), padding='valid')(bn_2)
# conv_3=Conv2D(filters=512, kernel_size=(3,3), strides=(1, 1), padding='valid')(conv_3)
# g_1=GlobalAveragePooling2D()(conv_3)
# d_1=Dense(512, activation='relu')(g_1)
# r_1=RepeatVector(max_len_english)(d_1)
# vf_model = Model(img_inputs, r_1)
#vf_model.summary()


latent_dim = 512
embedding_dim=512
```

```
# Encoder
encoder_inputs = Input(shape=(max_len_english,))

#embedding layer
enc_emb =  Embedding(x_voc, embedding_dim,trainable=True)(encoder_inputs)

#encoder lstm 1
encoder_lstm1 = LSTM(latent_dim,return_sequences=True,return_state=True,dropout=0.4,recurrent
encoder_output1, state_h1, state_c1 = encoder_lstm1(enc_emb)

#encoder lstm 2
encoder_lstm2 = LSTM(latent_dim,return_sequences=True,return_state=True,dropout=0.4,recurrent
encoder_output2, state_h2, state_c2 = encoder_lstm2(encoder_output1)

encoder_output2=Concatenate(axis=-1)([encoder_output2,r_1])

#encoder lstm 3
encoder_lstm3=LSTM(latent_dim, return_state=True, return_sequences=True,dropout=0.4,recurrent
encoder_outputs, state_h, state_c= encoder_lstm3(encoder_output2)

# Set up the decoder, using `encoder_states` as initial state.
decoder_inputs = Input(shape=(None,))

#embedding layer
dec_emb_layer = Embedding(y_voc, embedding_dim,trainable=True)
dec_emb = dec_emb_layer(decoder_inputs)

decoder_lstm = LSTM(latent_dim, return_sequences=True, return_state=True,dropout=0.4,recurren
decoder_outputs,decoder_fwd_state, decoder_back_state = decoder_lstm(dec_emb,initial_state=[s

#dense layer
decoder_dense =  TimeDistributed(Dense(y_voc, activation='softmax'))
decoder_outputs = decoder_dense(decoder_outputs)

# Define the model
#model = Model([encoder_inputs, decoder_inputs], decoder_outputs)
model = Model([encoder_inputs,decoder_inputs,img_inputs], decoder_outputs)
model.summary()
```

```
WARNING:tensorflow:Layer lstm will not use cuDNN kernels since it doesn't meet the crite
WARNING:tensorflow:Layer lstm will not use cuDNN kernels since it doesn't meet the crite
WARNING:tensorflow:Layer lstm_1 will not use cuDNN kernels since it doesn't meet the cri
WARNING:tensorflow:Layer lstm_1 will not use cuDNN kernels since it doesn't meet the cri
WARNING:tensorflow:Layer lstm_2 will not use cuDNN kernels since it doesn't meet the cri
WARNING:tensorflow:Layer lstm_2 will not use cuDNN kernels since it doesn't meet the cri
WARNING:tensorflow:Layer lstm_3 will not use cuDNN kernels since it doesn't meet the cri
WARNING:tensorflow:Layer lstm_3 will not use cuDNN kernels since it doesn't meet the cri
Model: "model_2"
__________________________________________________________________________________________
Layer (type)                 Output Shape              Param #     Connected to
==========================================================================================
input_3 (InputLayer)         [(None, 11)]              0
```

```
embedding (Embedding)           (None, 11, 512)      294400      input_3[0][0]
__________________________________________________________________________________________
input_2 (InputLayer)            [(None, 4096)]       0
__________________________________________________________________________________________
lstm (LSTM)                     [(None, 11, 512), (N 2099200     embedding[0][0]
__________________________________________________________________________________________
dense (Dense)                   (None, 512)          2097664     input_2[0][0]
__________________________________________________________________________________________
lstm_1 (LSTM)                   [(None, 11, 512), (N 2099200     lstm[0][0]
__________________________________________________________________________________________
repeat_vector (RepeatVector)    (None, 11, 512)      0           dense[0][0]
__________________________________________________________________________________________
input_4 (InputLayer)            [(None, None)]       0
__________________________________________________________________________________________
concatenate (Concatenate)       (None, 11, 1024)     0           lstm_1[0][0]
                                                                 repeat_vector[0][0]
__________________________________________________________________________________________
embedding_1 (Embedding)         (None, None, 512)    396800      input_4[0][0]
__________________________________________________________________________________________
lstm_2 (LSTM)                   [(None, 11, 512), (N 3147776     concatenate[0][0]
__________________________________________________________________________________________
lstm_3 (LSTM)                   [(None, None, 512),  2099200     embedding_1[0][0]
                                                                 lstm_2[0][1]
                                                                 lstm_2[0][2]
__________________________________________________________________________________________
time_distributed (TimeDistribut (None, None, 775)    397575      lstm_3[0][0]
==========================================================================================
Total params: 12,631,815
Trainable params: 12,631,815
Non-trainable params: 0
__________________________________________________________________________________________
```

```
model.compile(optimizer='adam', loss='sparse_categorical_crossentropy')
history=model.fit([x_tr,y_tr[:,:-1],train_vggf], y_tr.reshape(y_tr.shape[0],y_tr.shape[1], 1)
```

```
Epoch 1/100
19/19 [==============================] - 14s 314ms/step - loss: 4.0959 - val_loss: 2.
Epoch 2/100
19/19 [==============================] - 5s 254ms/step - loss: 2.5005 - val_loss: 2.1
Epoch 3/100
19/19 [==============================] - 5s 256ms/step - loss: 2.3060 - val_loss: 2.0
Epoch 4/100
19/19 [==============================] - 5s 262ms/step - loss: 2.1863 - val_loss: 1.9
Epoch 5/100
19/19 [==============================] - 5s 255ms/step - loss: 2.1131 - val_loss: 1.8
Epoch 6/100
19/19 [==============================] - 5s 264ms/step - loss: 2.0635 - val_loss: 1.8
Epoch 7/100
19/19 [==============================] - 5s 254ms/step - loss: 2.0152 - val_loss: 1.8
Epoch 8/100
19/19 [==============================] - 5s 258ms/step - loss: 1.9631 - val_loss: 1.8
Epoch 9/100
19/19 [==============================] - 5s 256ms/step - loss: 1.9116 - val_loss: 1.7
Epoch 10/100
```

```
19/19 [==============================] - 5s 256ms/step - loss: 1.8635 - val_loss: 1.7
Epoch 11/100
19/19 [==============================] - 5s 255ms/step - loss: 1.8183 - val_loss: 1.7
Epoch 12/100
19/19 [==============================] - 5s 256ms/step - loss: 1.7786 - val_loss: 1.7
Epoch 13/100
19/19 [==============================] - 5s 255ms/step - loss: 1.7454 - val_loss: 1.6
Epoch 14/100
19/19 [==============================] - 5s 258ms/step - loss: 1.7166 - val_loss: 1.6
Epoch 15/100
19/19 [==============================] - 5s 251ms/step - loss: 1.6910 - val_loss: 1.6
Epoch 16/100
19/19 [==============================] - 5s 256ms/step - loss: 1.6670 - val_loss: 1.6
Epoch 17/100
19/19 [==============================] - 5s 256ms/step - loss: 1.6443 - val_loss: 1.6
Epoch 18/100
19/19 [==============================] - 5s 260ms/step - loss: 1.6228 - val_loss: 1.6
Epoch 19/100
19/19 [==============================] - 5s 257ms/step - loss: 1.6018 - val_loss: 1.6
Epoch 20/100
19/19 [==============================] - 5s 258ms/step - loss: 1.5818 - val_loss: 1.6
Epoch 21/100
19/19 [==============================] - 5s 252ms/step - loss: 1.5615 - val_loss: 1.6
Epoch 22/100
19/19 [==============================] - 5s 251ms/step - loss: 1.5420 - val_loss: 1.6
Epoch 23/100
19/19 [==============================] - 5s 252ms/step - loss: 1.5228 - val_loss: 1.6
Epoch 24/100
19/19 [==============================] - 5s 256ms/step - loss: 1.5044 - val_loss: 1.6
Epoch 25/100
19/19 [==============================] - 5s 254ms/step - loss: 1.4860 - val_loss: 1.6
Epoch 26/100
19/19 [==============================] - 5s 248ms/step - loss: 1.4675 - val_loss: 1.6
Epoch 27/100
19/19 [==============================] - 5s 255ms/step - loss: 1.4503 - val_loss: 1.6
Epoch 28/100
19/19 [==============================] - 5s 255ms/step - loss: 1.4330 - val_loss: 1.6
Epoch 29/100
19/19 [==============================] - 5s 250ms/step - loss: 1.4160 - val_loss: 1.6
```

```
reverse_target_word_index=y_tokens.index_word
reverse_source_word_index=x_tokens.index_word
target_word_index=y_tokens.word_index

# Encode the input sequence to get the feature vector
encoder_model = Model(inputs=[encoder_inputs,img_inputs],outputs=[encoder_outputs, state_h, s
encoder_model.summary()
```

```
Model: "model_3"
__________________________________________________________________________________________
Layer (type)                 Output Shape              Param #     Connected to
==========================================================================================
input_3 (InputLayer)         [(None, 14)]              0
__________________________________________________________________________________________
embedding (Embedding)        (None, 14, 512)           1551872     input_3[0][0]
```

```
input_2 (InputLayer)            [(None, 4096)]       0
lstm (LSTM)                     [(None, 14, 512), (N 2099200     embedding[0][0]
dense (Dense)                   (None, 512)          2097664     input_2[0][0]
lstm_1 (LSTM)                   [(None, 14, 512), (N 2099200     lstm[0][0]
repeat_vector (RepeatVector)    (None, 14, 512)      0           dense[0][0]
concatenate (Concatenate)       (None, 14, 1024)     0           lstm_1[0][0]
                                                                 repeat_vector[0][0]
lstm_2 (LSTM)                   [(None, 14, 512), (N 3147776     concatenate[0][0]
==================================================================================
Total params: 10,995,712
Trainable params: 10,995,712
Non-trainable params: 0
```

```
# Decoder setup
# Below tensors will hold the states of the previous time step
decoder_state_input_h = Input(shape=(latent_dim,))
decoder_state_input_c = Input(shape=(latent_dim,))
decoder_hidden_state_input = Input(shape=(max_len_english,latent_dim))

# Get the embeddings of the decoder sequence
dec_emb2= dec_emb_layer(decoder_inputs)
# To predict the next word in the sequence, set the initial states to the states from the pre
decoder_outputs2, state_h2, state_c2 = decoder_lstm(dec_emb2, initial_state=[decoder_state_in

# A dense softmax layer to generate prob dist. over the target vocabulary
decoder_outputs2 = decoder_dense(decoder_outputs2)

# Final decoder model
decoder_model = Model(
    [decoder_inputs] + [decoder_hidden_state_input,decoder_state_input_h, decoder_state_input
    [decoder_outputs2] + [state_h2, state_c2])
decoder_model.summary()
```

```
Model: "model_4"
__________________________________________________________________________________________
Layer (type)                    Output Shape         Param #     Connected to
==========================================================================================
input_4 (InputLayer)            [(None, None)]       0
__________________________________________________________________________________________
embedding_1 (Embedding)         (None, None, 512)    2905088     input_4[0][0]
__________________________________________________________________________________________
input_5 (InputLayer)            [(None, 512)]        0
__________________________________________________________________________________________
input_6 (InputLayer)            [(None, 512)]        0
```

```
lstm_3 (LSTM)                   [(None, None, 512),  2099200     embedding_1[1][0]
                                                                 input_5[0][0]
                                                                 input_6[0][0]
__________________________________________________________________________________________
input_7 (InputLayer)            [(None, 14, 512)]    0
__________________________________________________________________________________________
time_distributed (TimeDistribut (None, None, 5674)   2910762     lstm_3[1][0]
==========================================================================================
Total params: 7,915,050
Trainable params: 7,915,050
Non-trainable params: 0
__________________________________________________________________________________________
```

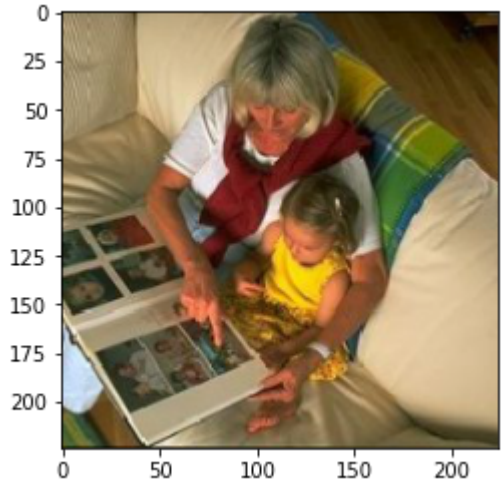
```
def decode_sequence(input_seq,img):
    img=img[np.newaxis,:]
    # Encode the input as state vectors.
    e_out, e_h, e_c = encoder_model.predict([input_seq,img])

    # Generate empty target sequence of length 1.
    target_seq = np.zeros((1,1))

    # Populate the first word of target sequence with the start word.
    target_seq[0, 0] = target_word_index['cls']

    stop_condition = False
    decoded_sentence = ''
    while not stop_condition:

        output_tokens, h, c = decoder_model.predict([target_seq] + [e_out, e_h, e_c])

        # Sample a token
        sampled_token_index = np.argmax(output_tokens[0, -1, :])
        sampled_token = reverse_target_word_index[sampled_token_index]

        if(sampled_token!='eos'):
            decoded_sentence += ' '+sampled_token

        # Exit condition: either hit max length or find stop word.
        if (sampled_token == 'eos'  or len(decoded_sentence.split()) >= (max_len_malayalam -1
            stop_condition = True

        # Update the target sequence (of length 1).
        target_seq = np.zeros((1,1))
        target_seq[0, 0] = sampled_token_index

        # Update internal states
        e_h, e_c = h, c

    return decoded_sentence
```

```
def seq2summary(input_seq):
    newString=''
    for i in input_seq:
        if((i!=0 and i!=target_word_index['cls']) and i!=target_word_index['eos']):
            newString=newString+reverse_target_word_index[i]+' '
    return newString

def seq2text(input_seq):
    newString=''
    for i in input_seq:
        if(i!=0):
            newString=newString+reverse_source_word_index[i]+' '
    return newString

for i in range(5):
    print("Review:",seq2text(x_tr[i]))
    print("Original summary:",seq2summary(y_tr[i]))
    print("Predicted summary:",decode_sequence(x_tr[i].reshape(1,max_len_english),train_vggf[
    print("\n")
```

```
Review: male surfer surfing in still in the ocean
Original summary: ശാന്തമായ കടലിൽ സർഫിങ് നടത്തുന്ന പുരുഷ സർഫർ
Predicted summary:  സമുദ്രത്തിലെ നല്ല തിരകൾ


Review: it is an indoor scene
Original summary: ഇത് ഒരു ഇൻഡോർ രംഗമാണ്
Predicted summary:  ഇതൊരു കുളിമുറിയാണ്


Review: computer screens turned on
Original summary: കമ്പ്യൂട്ടർ സ്ക്രീനുകൾ ഓണാക്കി
Predicted summary:  ചാരനിറത്തിലുള്ള റോഡിന്റെ വശങ്ങളിൽ പച്ച പുല്ലിന്റെ സ്ട്രിപ്പ


Review: man has short hair
Original summary: മനുഷ്യന് ചെറിയ മുടിയുണ്ട്
Predicted summary:  മനുഷ്യന് ചെറിയ മുടിയുണ്ട്


Review: photo album open on an adults lap
Original summary: ഫോട്ടോ ആൽബം മുതിർന്നവരുടെ മടിയിൽ തുറക്കുന്നു
Predicted summary:  ഫോട്ടോ ആൽബം മുതിർന്നവരുടെ മടിയിൽ തുറക്കുന്നു
```

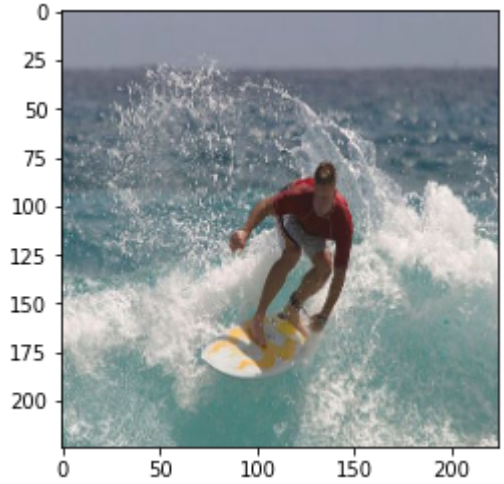
```
i=4
print("Review:",seq2text(x_tr[i]))
#print("Original summary:",seq2summary(y_tr[i]))
print("Predicted summary:",decode_sequence(x_tr[i].reshape(1,max_len_english),vgg_imfea[i]))
plt.imshow(imagedata[i].astype(np.float32))
```

```
Review: photo album open on an adults lap
Predicted summary:  ഫോട്ടോ ആൽബം മുതിർന്നവരുടെ മടിയിൽ തുറക്കുന്നു
<matplotlib.image.AxesImage at 0x7ff356884110>
```



```
i=0
print("Review:",seq2text(x_tr[i]))
print("Original summary:",seq2summary(y_tr[i]))
print("Predicted summary:",decode_sequence(x_tr[i].reshape(1,max_len_english),vgg_imfea[i]))
plt.imshow(imagedata[i].astype(np.float32))
```

```
Review: male surfer surfing in still in the ocean
Original summary: ശാന്തമായ കടലിൽ സർഫിങ് നടത്തുന്ന പുരുഷ സർഫർ
Predicted summary:  സമുദ്രത്തിലെ നല്ല തിരകൾ
<matplotlib.image.AxesImage at 0x7ff35686af90>
```



```
!pip install sacrebleu
import sacrebleu
import random
```

```
Requirement already satisfied: sacrebleu in /usr/local/lib/python3.7/dist-packages (2.0
Requirement already satisfied: numpy>=1.17 in /usr/local/lib/python3.7/dist-packages (fr
Requirement already satisfied: colorama in /usr/local/lib/python3.7/dist-packages (from
Requirement already satisfied: portalocker in /usr/local/lib/python3.7/dist-packages (fr
Requirement already satisfied: regex in /usr/local/lib/python3.7/dist-packages (from sac
Requirement already satisfied: tabulate>=0.8.9 in /usr/local/lib/python3.7/dist-packages
```

```
temp_o=[]
temp_p=[]
for i in range(50):
    s=random.randint(0,len(y_tr)-1)
    temp_o.append(seq2summary(y_tr[s]))
    temp_p.append(decode_sequence(x_tr[s].reshape(1,max_len_english),train_vggf[s]))

bleu = sacrebleu.corpus_bleu(temp_o, [temp_p],lowercase=True, tokenize='intl')
print(bleu.score)
```

```
44.835907663936744
```

```
temp_o=[]
temp_p=[]
for i in range(10000):
    s=random.randint(0,len(y_tr)-1)
    temp_o.append(seq2summary(y_tr[s]))
    temp_p.append(decode_sequence(x_tr[s].reshape(1,max_len_english),train_vggf[s]))

bleu = sacrebleu.corpus_bleu(temp_o, [temp_p],lowercase=True, tokenize='intl')
print(bleu.score)
```

```
44.08897167055731
```

```
temp_o=[]
temp_p=[]
for i in range(100):
    s=random.randint(0,len(y_tr)-1)
    temp_o.append(seq2summary(y_tr[s]))
    temp_p.append(decode_sequence(x_tr[s].reshape(1,max_len_english),vgg_imfea[s]))

bleu = sacrebleu.corpus_bleu(temp_o, [temp_p],lowercase=True, tokenize='intl')
print(bleu.score)
```

```
34.843988395192
```