

Text Mercato Assignment Submission

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Note

- We need to design two models where the first one will take any fashion image URL and generate an AI based description.
- We are free to take your assumptions and solve the problem.
- We are assuming that the input images in the model will be downloaded already.
- The model gives a decent overall accuracy (~97%) and the performance on unseen images is also decent.

Requirements

```
In [67]:

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import nltk
import re
import string
import pickle
import cv2
from nltk.corpus import stopwords
from nltk.stem import WordNetLemmatizer
lemmatizer = WordNetLemmatizer()
import tensorflow as tf
from keras.utils import plot_model
from tensorflow.keras.applications import ResNet50, imagenet_utils
from tensorflow.keras.preprocessing.sequence import pad_sequences
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.optimizers import Adam
from sklearn.model_selection import train_test_split
from tensorflow.keras.utils import to_categorical
from tensorflow.keras.models import Sequential, Model
from tensorflow.keras.layers import Conv2D, Dropout, MaxPooling2D, Flatten, Dense, BatchNormalization, Input, \
                                LSTM, Embedding, Input, TimeDistributed, Bidirectional, Activation, RepeatVector, Concatenate
```

```
In [2]:

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

Mounted at /content/drive

```
In [3]:

cd /content/drive/MyDrive/TM Assignment

/content/drive/MyDrive/TM Assignment
```

```
In [4]:

df = pd.read_excel('dataset 1.xlsx')
df.head()
```

Out[4]:

	Title	Description	Material	Pattern	Neckline	Image_Path
0	Peach Poly Crepe jumpsuit	This stylish foil print kurta from janasya is ...	Crepe	Printed	Round Neck	/images/pic_0.jpg
1	Light Brown Bias Yoke Checks Top	This check pattern top by Work Label is crafte...	Cotton	Checks	Round Neck	/images/pic_1.jpg
2	Off White Geometric Straight Cotton Dobby Top ...	Featuring elegant printed details, this off wh...	Viscose	Checks	Round Neck	/images/pic_2.jpg
3	Blue Me Away Cape Top	Add an extra dose of style to your casual ward...	Polyester	Solid/Plain	V-Neck	/images/pic_3.jpg
4	Yellow On A High Gown	Yellow polyester georgette maxi dress. Polyest...	Polyester	Solid/Plain	V-Neck	/images/pic_4.jpg

```
In [5]:

#Adding a '.' before the image path to access it
df['Image_Path'] = '.'+df['Image_Path']
imgpath = df['Image_Path']
description = df['Description']
```

```
In [6]:

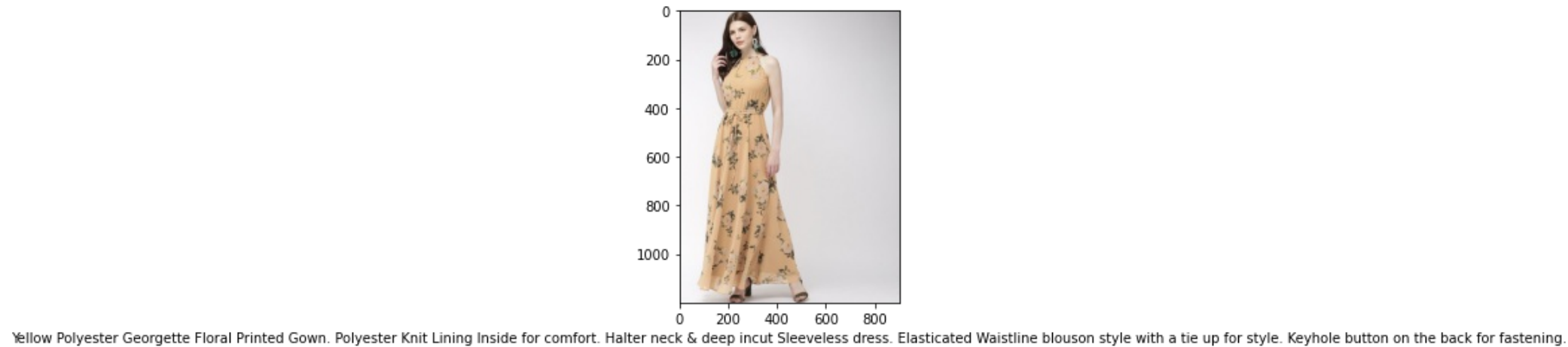
df.head()
```

Out[6]:

	Title	Description	Material	Pattern	Neckline	Image_Path
0	Peach Poly Crepe jumpsuit	This stylish foil print kurta from janasya is ...	Crepe	Printed	Round Neck	/images/pic_0.jpg
1	Light Brown Bias Yoke Checks Top	This check pattern top by Work Label is crafte...	Cotton	Checks	Round Neck	/images/pic_1.jpg
2	Off White Geometric Straight Cotton Dobby Top ...	Featuring elegant printed details, this off wh...	Viscose	Checks	Round Neck	/images/pic_2.jpg
3	Blue Me Away Cape Top	Add an extra dose of style to your casual ward...	Polyester	Solid/Plain	V-Neck	/images/pic_3.jpg

In [76]:

```
k = 30 #random number from 0-499
img = cv2.imread(imgpath[k])
img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
plt.imshow(img)
plt.xlabel(description[k]);
```



Yellow Polyester Georgette Floral Printed Gown. Polyester Knit Lining Inside for comfort. Halter neck & deep incut Sleeveless dress. Elasticated Waistline blouson style with a tie up for style. Keyhole button on the back for fastening.

Image Feature extraction using ResNet50 Model

In [77]:

```
#Downloadign ResNet50 Model
ResNet = ResNet50(include_top=True)
```

In [78]:

```
#Model layout
ResNet_model = ResNet50(weights='imagenet')
ResNet_model = Model(inputs=ResNet_model.inputs, outputs=ResNet_model.layers[-2].output)
ResNet_model.summary()
```

Model: "model_5"

Layer (type)	Output Shape	Param #	Connected to
=====			
input_4 (InputLayer)	[(None, 224, 224, 3)]	0	
conv1_pad (ZeroPadding2D)	(None, 230, 230, 3)	0	input_4[0][0]
conv1_conv (Conv2D)	(None, 112, 112, 64)	9472	conv1_pad[0][0]
conv1_bn (BatchNormalization)	(None, 112, 112, 64)	256	conv1_conv[0][0]
conv1_relu (Activation)	(None, 112, 112, 64)	0	conv1_bn[0][0]
pool1_pad (ZeroPadding2D)	(None, 114, 114, 64)	0	conv1_relu[0][0]
pool1_pool (MaxPooling2D)	(None, 56, 56, 64)	0	pool1_pad[0][0]
conv2_block1_1_conv (Conv2D)	(None, 56, 56, 64)	4160	pool1_pool[0][0]
conv2_block1_1_bn (BatchNormali	(None, 56, 56, 64)	256	conv2_block1_1_conv[0][0]
conv2_block1_1_relu (Activation	(None, 56, 56, 64)	0	conv2_block1_1_bn[0][0]
conv2_block1_2_conv (Conv2D)	(None, 56, 56, 64)	36928	conv2_block1_1_relu[0][0]
conv2_block1_2_bn (BatchNormali	(None, 56, 56, 64)	256	conv2_block1_2_conv[0][0]
conv2_block1_2_relu (Activation	(None, 56, 56, 64)	0	conv2_block1_2_bn[0][0]
conv2_block1_0_conv (Conv2D)	(None, 56, 56, 256)	16640	pool1_pool[0][0]
conv2_block1_3_conv (Conv2D)	(None, 56, 56, 256)	16640	conv2_block1_2_relu[0][0]
conv2_block1_0_bn (BatchNormali	(None, 56, 56, 256)	1024	conv2_block1_0_conv[0][0]
conv2_block1_3_bn (BatchNormali	(None, 56, 56, 256)	1024	conv2_block1_3_conv[0][0]
conv2_block1_add (Add)	(None, 56, 56, 256)	0	conv2_block1_0_bn[0][0] conv2_block1_3_bn[0][0]
conv2_block1_out (Activation)	(None, 56, 56, 256)	0	conv2_block1_add[0][0]
conv2_block2_1_conv (Conv2D)	(None, 56, 56, 64)	16448	conv2_block1_out[0][0]
conv2_block2_1_bn (BatchNormali	(None, 56, 56, 64)	256	conv2_block2_1_conv[0][0]
conv2_block2_1_relu (Activation	(None, 56, 56, 64)	0	conv2_block2_1_bn[0][0]
conv2_block2_2_conv (Conv2D)	(None, 56, 56, 64)	36928	conv2_block2_1_relu[0][0]
conv2_block2_2_bn (BatchNormali	(None, 56, 56, 64)	256	conv2_block2_2_conv[0][0]
conv2_block2_2_relu (Activation	(None, 56, 56, 64)	0	conv2_block2_2_bn[0][0]
conv2_block2_3_conv (Conv2D)	(None, 56, 56, 256)	16640	conv2_block2_2_relu[0][0]
conv2_block2_3_bn (BatchNormali	(None, 56, 56, 256)	1024	conv2_block2_3_conv[0][0]
conv2_block2_add (Add)	(None, 56, 56, 256)	0	conv2_block1_out[0][0] conv2_block2_3_bn[0][0]

conv2_block2_out (Activation)					conv2_block2_add[0][0]
conv2_block3_1_conv (Conv2D)					conv2_block2_out[0][0]
conv2_block3_1_bn (BatchNormali					conv2_block3_1_conv[0][0]
conv2_block3_1_relu (Activation					conv2_block3_1_bn[0][0]
conv2_block3_2_conv (Conv2D)					conv2_block3_1_relu[0][0]
conv2_block3_2_bn (BatchNormali					conv2_block3_2_conv[0][0]
conv2_block3_2_relu (Activation					conv2_block3_2_bn[0][0]
conv2_block3_3_conv (Conv2D)					conv2_block3_2_relu[0][0]
conv2_block3_3_bn (BatchNormali					conv2_block3_3_conv[0][0]
conv2_block3_add (Add)					conv2_block2_out[0][0] conv2_block3_3_bn[0][0]
conv2_block3_out (Activation)					conv2_block3_add[0][0]
conv3_block1_1_conv (Conv2D)					conv2_block3_out[0][0]
conv3_block1_1_bn (BatchNormali					conv3_block1_1_conv[0][0]
conv3_block1_1_relu (Activation					conv3_block1_1_bn[0][0]
conv3_block1_2_conv (Conv2D)					conv3_block1_1_relu[0][0]
conv3_block1_2_bn (BatchNormali					conv3_block1_2_conv[0][0]
conv3_block1_2_relu (Activation					conv3_block1_2_bn[0][0]
conv3_block1_0_conv (Conv2D)					conv2_block3_out[0][0]
conv3_block1_3_conv (Conv2D)					conv3_block1_2_relu[0][0]
conv3_block1_0_bn (BatchNormali					conv3_block1_0_conv[0][0]
conv3_block1_3_bn (BatchNormali					conv3_block1_3_conv[0][0]
conv3_block1_add (Add)					conv3_block1_0_bn[0][0] conv3_block1_3_bn[0][0]
conv3_block1_out (Activation)					conv3_block1_add[0][0]
conv3_block2_1_conv (Conv2D)					conv3_block1_out[0][0]
conv3_block2_1_bn (BatchNormali					conv3_block2_1_conv[0][0]
conv3_block2_1_relu (Activation					conv3_block2_1_bn[0][0]
conv3_block2_2_conv (Conv2D)					conv3_block2_1_relu[0][0]
conv3_block2_2_bn (BatchNormali					conv3_block2_2_conv[0][0]
conv3_block2_2_relu (Activation					conv3_block2_2_bn[0][0]
conv3_block2_3_conv (Conv2D)					conv3_block2_2_relu[0][0]
conv3_block2_3_bn (BatchNormali					conv3_block2_3_conv[0][0]
conv3_block2_add (Add)					conv3_block1_out[0][0] conv3_block2_3_bn[0][0]
conv3_block2_out (Activation)					conv3_block2_add[0][0]
conv3_block3_1_conv (Conv2D)					conv3_block2_out[0][0]
conv3_block3_1_bn (BatchNormali					conv3_block3_1_conv[0][0]
conv3_block3_1_relu (Activation					conv3_block3_1_bn[0][0]
conv3_block3_2_conv (Conv2D)					conv3_block3_1_relu[0][0]
conv3_block3_2_bn (BatchNormali					conv3_block3_2_conv[0][0]
conv3_block3_2_relu (Activation					conv3_block3_2_bn[0][0]
conv3_block3_3_conv (Conv2D)					conv3_block3_2_relu[0][0]
conv3_block3_3_bn (BatchNormali					conv3_block3_3_conv[0][0]
conv3_block3_add (Add)					conv3_block2_out[0][0] conv3_block3_3_bn[0][0]
conv3_block3_out (Activation)					conv3_block3_add[0][0]
conv3_block4_1_conv (Conv2D)					conv3_block3_out[0][0]
conv3_block4_1_bn (BatchNormali					conv3_block4_1_conv[0][0]
conv3_block4_1_relu (Activation					conv3_block4_1_bn[0][0]
conv3_block4_2_conv (Conv2D)					conv3_block4_1_relu[0][0]
conv3_block4_2_bn (BatchNormali					conv3_block4_2_conv[0][0]
conv3_block4_2_relu (Activation					conv3_block4_2_bn[0][0]

conv3_block4_3_conv (Conv2D)	(None, 28, 28, 512)	66048	conv3_block4_2_relu[0][0]
conv3_block4_3_bn (BatchNormali	(None, 28, 28, 512)	2048	conv3_block4_3_conv[0][0]
conv3_block4_add (Add)	(None, 28, 28, 512)	0	conv3_block3_out[0][0] conv3_block4_3_bn[0][0]
conv3_block4_out (Activation)	(None, 28, 28, 512)	0	conv3_block4_add[0][0]
conv4_block1_1_conv (Conv2D)	(None, 14, 14, 256)	131328	conv3_block4_out[0][0]
conv4_block1_1_bn (BatchNormali	(None, 14, 14, 256)	1024	conv4_block1_1_conv[0][0]
conv4_block1_1_relu (Activation	(None, 14, 14, 256)	0	conv4_block1_1_bn[0][0]
conv4_block1_2_conv (Conv2D)	(None, 14, 14, 256)	590080	conv4_block1_1_relu[0][0]
conv4_block1_2_bn (BatchNormali	(None, 14, 14, 256)	1024	conv4_block1_2_conv[0][0]
conv4_block1_2_relu (Activation	(None, 14, 14, 256)	0	conv4_block1_2_bn[0][0]
conv4_block1_0_conv (Conv2D)	(None, 14, 14, 1024)	525312	conv3_block4_out[0][0]
conv4_block1_3_conv (Conv2D)	(None, 14, 14, 1024)	263168	conv4_block1_2_relu[0][0]
conv4_block1_0_bn (BatchNormali	(None, 14, 14, 1024)	4096	conv4_block1_0_conv[0][0]
conv4_block1_3_bn (BatchNormali	(None, 14, 14, 1024)	4096	conv4_block1_3_conv[0][0]
conv4_block1_add (Add)	(None, 14, 14, 1024)	0	conv4_block1_0_bn[0][0] conv4_block1_3_bn[0][0]
conv4_block1_out (Activation)	(None, 14, 14, 1024)	0	conv4_block1_add[0][0]
conv4_block2_1_conv (Conv2D)	(None, 14, 14, 256)	262400	conv4_block1_out[0][0]
conv4_block2_1_bn (BatchNormali	(None, 14, 14, 256)	1024	conv4_block2_1_conv[0][0]
conv4_block2_1_relu (Activation	(None, 14, 14, 256)	0	conv4_block2_1_bn[0][0]
conv4_block2_2_conv (Conv2D)	(None, 14, 14, 256)	590080	conv4_block2_1_relu[0][0]
conv4_block2_2_bn (BatchNormali	(None, 14, 14, 256)	1024	conv4_block2_2_conv[0][0]
conv4_block2_2_relu (Activation	(None, 14, 14, 256)	0	conv4_block2_2_bn[0][0]
conv4_block2_3_conv (Conv2D)	(None, 14, 14, 1024)	263168	conv4_block2_2_relu[0][0]
conv4_block2_3_bn (BatchNormali	(None, 14, 14, 1024)	4096	conv4_block2_3_conv[0][0]
conv4_block2_add (Add)	(None, 14, 14, 1024)	0	conv4_block1_out[0][0] conv4_block2_3_bn[0][0]
conv4_block2_out (Activation)	(None, 14, 14, 1024)	0	conv4_block2_add[0][0]
conv4_block3_1_conv (Conv2D)	(None, 14, 14, 256)	262400	conv4_block2_out[0][0]
conv4_block3_1_bn (BatchNormali	(None, 14, 14, 256)	1024	conv4_block3_1_conv[0][0]
conv4_block3_1_relu (Activation	(None, 14, 14, 256)	0	conv4_block3_1_bn[0][0]
conv4_block3_2_conv (Conv2D)	(None, 14, 14, 256)	590080	conv4_block3_1_relu[0][0]
conv4_block3_2_bn (BatchNormali	(None, 14, 14, 256)	1024	conv4_block3_2_conv[0][0]
conv4_block3_2_relu (Activation	(None, 14, 14, 256)	0	conv4_block3_2_bn[0][0]
conv4_block3_3_conv (Conv2D)	(None, 14, 14, 1024)	263168	conv4_block3_2_relu[0][0]
conv4_block3_3_bn (BatchNormali	(None, 14, 14, 1024)	4096	conv4_block3_3_conv[0][0]
conv4_block3_add (Add)	(None, 14, 14, 1024)	0	conv4_block2_out[0][0] conv4_block3_3_bn[0][0]
conv4_block3_out (Activation)	(None, 14, 14, 1024)	0	conv4_block3_add[0][0]
conv4_block4_1_conv (Conv2D)	(None, 14, 14, 256)	262400	conv4_block3_out[0][0]
conv4_block4_1_bn (BatchNormali	(None, 14, 14, 256)	1024	conv4_block4_1_conv[0][0]
conv4_block4_1_relu (Activation	(None, 14, 14, 256)	0	conv4_block4_1_bn[0][0]
conv4_block4_2_conv (Conv2D)	(None, 14, 14, 256)	590080	conv4_block4_1_relu[0][0]
conv4_block4_2_bn (BatchNormali	(None, 14, 14, 256)	1024	conv4_block4_2_conv[0][0]
conv4_block4_2_relu (Activation	(None, 14, 14, 256)	0	conv4_block4_2_bn[0][0]
conv4_block4_3_conv (Conv2D)	(None, 14, 14, 1024)	263168	conv4_block4_2_relu[0][0]
conv4_block4_3_bn (BatchNormali	(None, 14, 14, 1024)	4096	conv4_block4_3_conv[0][0]
conv4_block4_add (Add)	(None, 14, 14, 1024)	0	conv4_block3_out[0][0] conv4_block4_3_bn[0][0]
conv4_block4_out (Activation)	(None, 14, 14, 1024)	0	conv4_block4_add[0][0]
conv4_block5_1_conv (Conv2D)	(None, 14, 14, 256)	262400	conv4_block4_out[0][0]
conv4_block5_1_bn (BatchNormali	(None, 14, 14, 256)	1024	conv4_block5_1_conv[0][0]

conv4_block5_1_relu	(Activation	(None, 14, 14, 256)	0	conv4_block5_1_bn[0][0]
conv4_block5_2_conv	(Conv2D)	(None, 14, 14, 256)	590080	conv4_block5_1_relu[0][0]
conv4_block5_2_bn	(BatchNormali	(None, 14, 14, 256)	1024	conv4_block5_2_conv[0][0]
conv4_block5_2_relu	(Activation	(None, 14, 14, 256)	0	conv4_block5_2_bn[0][0]
conv4_block5_3_conv	(Conv2D)	(None, 14, 14, 1024)	263168	conv4_block5_2_relu[0][0]
conv4_block5_3_bn	(BatchNormali	(None, 14, 14, 1024)	4096	conv4_block5_3_conv[0][0]
conv4_block5_add	(Add)	(None, 14, 14, 1024)	0	conv4_block4_out[0][0] conv4_block5_3_bn[0][0]
conv4_block5_out	(Activation)	(None, 14, 14, 1024)	0	conv4_block5_add[0][0]
conv4_block6_1_conv	(Conv2D)	(None, 14, 14, 256)	262400	conv4_block5_out[0][0]
conv4_block6_1_bn	(BatchNormali	(None, 14, 14, 256)	1024	conv4_block6_1_conv[0][0]
conv4_block6_1_relu	(Activation	(None, 14, 14, 256)	0	conv4_block6_1_bn[0][0]
conv4_block6_2_conv	(Conv2D)	(None, 14, 14, 256)	590080	conv4_block6_1_relu[0][0]
conv4_block6_2_bn	(BatchNormali	(None, 14, 14, 256)	1024	conv4_block6_2_conv[0][0]
conv4_block6_2_relu	(Activation	(None, 14, 14, 256)	0	conv4_block6_2_bn[0][0]
conv4_block6_3_conv	(Conv2D)	(None, 14, 14, 1024)	263168	conv4_block6_2_relu[0][0]
conv4_block6_3_bn	(BatchNormali	(None, 14, 14, 1024)	4096	conv4_block6_3_conv[0][0]
conv4_block6_add	(Add)	(None, 14, 14, 1024)	0	conv4_block5_out[0][0] conv4_block6_3_bn[0][0]
conv4_block6_out	(Activation)	(None, 14, 14, 1024)	0	conv4_block6_add[0][0]
conv5_block1_1_conv	(Conv2D)	(None, 7, 7, 512)	524800	conv4_block6_out[0][0]
conv5_block1_1_bn	(BatchNormali	(None, 7, 7, 512)	2048	conv5_block1_1_conv[0][0]
conv5_block1_1_relu	(Activation	(None, 7, 7, 512)	0	conv5_block1_1_bn[0][0]
conv5_block1_2_conv	(Conv2D)	(None, 7, 7, 512)	2359808	conv5_block1_1_relu[0][0]
conv5_block1_2_bn	(BatchNormali	(None, 7, 7, 512)	2048	conv5_block1_2_conv[0][0]
conv5_block1_2_relu	(Activation	(None, 7, 7, 512)	0	conv5_block1_2_bn[0][0]
conv5_block1_0_conv	(Conv2D)	(None, 7, 7, 2048)	2099200	conv4_block6_out[0][0]
conv5_block1_3_conv	(Conv2D)	(None, 7, 7, 2048)	1050624	conv5_block1_2_relu[0][0]
conv5_block1_0_bn	(BatchNormali	(None, 7, 7, 2048)	8192	conv5_block1_0_conv[0][0]
conv5_block1_3_bn	(BatchNormali	(None, 7, 7, 2048)	8192	conv5_block1_3_conv[0][0]
conv5_block1_add	(Add)	(None, 7, 7, 2048)	0	conv5_block1_0_bn[0][0] conv5_block1_3_bn[0][0]
conv5_block1_out	(Activation)	(None, 7, 7, 2048)	0	conv5_block1_add[0][0]
conv5_block2_1_conv	(Conv2D)	(None, 7, 7, 512)	1049088	conv5_block1_out[0][0]
conv5_block2_1_bn	(BatchNormali	(None, 7, 7, 512)	2048	conv5_block2_1_conv[0][0]
conv5_block2_1_relu	(Activation	(None, 7, 7, 512)	0	conv5_block2_1_bn[0][0]
conv5_block2_2_conv	(Conv2D)	(None, 7, 7, 512)	2359808	conv5_block2_1_relu[0][0]
conv5_block2_2_bn	(BatchNormali	(None, 7, 7, 512)	2048	conv5_block2_2_conv[0][0]
conv5_block2_2_relu	(Activation	(None, 7, 7, 512)	0	conv5_block2_2_bn[0][0]
conv5_block2_3_conv	(Conv2D)	(None, 7, 7, 2048)	1050624	conv5_block2_2_relu[0][0]
conv5_block2_3_bn	(BatchNormali	(None, 7, 7, 2048)	8192	conv5_block2_3_conv[0][0]
conv5_block2_add	(Add)	(None, 7, 7, 2048)	0	conv5_block1_out[0][0] conv5_block2_3_bn[0][0]
conv5_block2_out	(Activation)	(None, 7, 7, 2048)	0	conv5_block2_add[0][0]
conv5_block3_1_conv	(Conv2D)	(None, 7, 7, 512)	1049088	conv5_block2_out[0][0]
conv5_block3_1_bn	(BatchNormali	(None, 7, 7, 512)	2048	conv5_block3_1_conv[0][0]
conv5_block3_1_relu	(Activation	(None, 7, 7, 512)	0	conv5_block3_1_bn[0][0]
conv5_block3_2_conv	(Conv2D)	(None, 7, 7, 512)	2359808	conv5_block3_1_relu[0][0]
conv5_block3_2_bn	(BatchNormali	(None, 7, 7, 512)	2048	conv5_block3_2_conv[0][0]
conv5_block3_2_relu	(Activation	(None, 7, 7, 512)	0	conv5_block3_2_bn[0][0]
conv5_block3_3_conv	(Conv2D)	(None, 7, 7, 2048)	1050624	conv5_block3_2_relu[0][0]
conv5_block3_3_bn	(BatchNormali	(None, 7, 7, 2048)	8192	conv5_block3_3_conv[0][0]
conv5_block3_add	(Add)	(None, 7, 7, 2048)	0	conv5_block2_out[0][0] conv5_block3_3_bn[0][0]

conv5_block3_out (Activation)	(None, 7, 7, 2048)	0	conv5_block3_add[0][0]
avg_pool (GlobalAveragePooling2)	(None, 2048)	0	conv5_block3_out[0][0]
=====			
Total params: 23,587,712			
Trainable params: 23,534,592			
Non-trainable params: 53,120			

In [79]:

```
#Creating a dictionary of image path and predicted image feaure using ResNet50 Model
imgfeatures = {}
count = 0
for i in range(len(imgpath)):
    img = cv2.imread(imgpath[i])
    img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
    img = cv2.resize(img, (224,224))
    img = img.reshape(1,224,224,3)
    imgfeatures[imgpath[i]] = ResNet_model.predict(img)[0]
    count+=1
    if count%50 == 0:
        print(count,'image features predicted')
```

50 image features predicted
100 image features predicted
150 image features predicted
200 image features predicted
250 image features predicted
300 image features predicted
350 image features predicted
400 image features predicted
450 image features predicted
500 image features predicted

In [80]:

```
#storing the image features
with open('imgfeatures.txt','wb') as f1:
    pickle.dump(imgfeatures,f1)
```

In [81]:

```
#loading the stored image feature dictionary
imgfeatures = pickle.load(open('imgfeatures.txt','rb'))
```

In [82]:

```
#Creating dictionary of image path and image description
catalouge = {}
for i in range(len(imgpath)):
    catalouge[imgpath[i]] = str('seqstart ')+description[i]+str(' seqend')
```

NLP Model

In [116]:

```
#Model Tokenizer for descriptions
tokenizer = Tokenizer() #split=" ",filters='!"#${}%()*+,-.:;<=>?[\\]^_`{|}~\t\n'
data = []
for i in range(len(description)):
    data.append(catalouge[imgpath[i]].lower())

tokenizer.fit_on_texts(data)

total_words = int(len(tokenizer.word_index))+1
print(total_words)
print(tokenizer.word_index)
print(tokenizer.word_counts)
```

1526
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('detachable', 2), ('master', 1), ('art', 1), ('orange', 2), ('lurex', 1), ('opening', 2), ('updated', 1), ('lbd', 3), ('dainty', 1), ('periwinkle', 1), ('designed', 4), ('stay', 2), ('absolutely', 1), ('cluster', 1), ('shell', 1), ('bodice', 6), ('whereas', 1), ('part', 1), ('multitiered', 1), ('metre', 1), ('accented', 3), ('hoop', 3), ('edge', 2), ('knee', 1), ('antique', 2), ('pointed', 2), ('holiday', 3), ('a\x00baby', 1), ('material', 2), ('and\x00adjustable', 1), ('obsessed', 1), ('crowd', 1), ('surplice', 1), ('anti', 2), ('pill', 1), ('intended', 1), ('fall', 1), ('according', 2), ('image', 1), ('5'3"', 1), ('5'5"', 1), ('vary', 1), ('slightly', 1), ('screen', 1), ('settings', 1), ('resolution', 1), ('baby', 1), ('strapless', 1), ('fabulous', 1), ('attires', 1), ('ove', 1), ('rit', 1), ('border', 1), ('1', 1), ('fixed', 1), ('extended', 1), ('accessorise', 1), ('gaped', 1), ('mesh', 2), ('cups', 1), ('cami', 1), ('neutral', 1), ('hue', 1), ('separates', 3), ('floaty', 1), ('decorated', 2), ('florals', 2), ('complement', 4), ('tone', 3), ('event', 5), ('prom', 1), ('date', 2), ('nights', 1), ('brunches', 1), ('cocktails', 1), ('found', 1), ('suede', 1), ('epaulets', 1), ('leading', 1), ('dramatic', 1), ('creation', 1), ('reach', 1), ('again', 1), ('version', 1), ('rotation', 2), ('crinkled', 1), ('notched', 1), ('slides', 1), ('cigarette', 1), ('empire', 1), ('tapered', 1), ('ankles', 1), ('pinstripe', 1), ('sweater', 4), ('wool', 1), ('platform', 5), ('multicolored', 1), ('camisole', 3), ('sequined', 2), ('serves', 1), ('blank', 1), ('slate', 1), ('diamond', 1), ('studs', 3), ('queen', 1), ('anne', 1), ('spotty', 1), ('pointy', 1), ('true', 1), ('name', 1), ('spunk', 1), ('carries', 1), ('fortitude', 1), ('girl', 1), ('door', 1), ('tint', 1), ('grit', 1), ('one's', 1), ('personality', 1), ('site', 1), ('charming', 2), ('orion', 1), ('right', 1), ('aries', 1), ('striking', 1), ('phases', 1), ('moon', 1), ('flaps', 1), ('dual', 1), ('stitches', 1), ('chirpy', 1), ('sport', 1), ('patterned', 3), ('folded', 1), ('royal', 1), ('tote', 1), ('dangling', 1), ('enhance', 1), ('multicolour', 1), ('way', 3), ('robin', 1), ('minimalist', 1), ('lightest', 1), ('cold', 4), ('false', 2), ('life', 1), ('chores', 1), ('bird', 1), ('flairy', 1), ('bird', 1), ('spirit', 1), ('filled', 1), ('vine', 1), ('plants', 1), ('b ranches', 1), ('2', 2), ('carefree', 1), ('really', 1), ('small', 4), ('big', 1), ('prominent', 1), ('abstract', 1), ('paisley', 1), ('jacquard', 1), ('sakhi', 1), ('pocket', 1), ('curated', 1), ('morden', 1), ('carry', 1), ('individually', 1), ('always', 1), ('come', 1), ('handy', 1), ('rushed', 1), ('monday', 1), ('mornings', 1), ('checked', 1), ('bardot', 1), ('sees', 1), ('coming', 1), ('together', 1), ('silhouette', 1), ('onverlapping', 1), ('action', 1), ('sunglasses', 1), ('fun', 5), ('truebrowns', 1), ('effortlessly', 1), ('revive', 1), ('outfits', 1), ('beach', 1), ('schiffli', 1), ('passion', 1), ('continues', 1), ('woman', 2), ('slub', 1), ('bouquet', 1), ('rainbow', 1), ('gleam', 1), ('gathering', 1), ('collars', 1), ('equal', 2), ('parts', 2), ('quirky', 1), ('structured', 2), ('crossover', 1), ('confidence', 1), ('glam', 1), ('product', 2), ('li', 28), ('62', 1), ('5cm', 1), ('34', 1), ('2cm', 1), ('68', 1), ('7cm', 1), ('au', 1), ('8', 1), ('internal', 1), ('resin', 1), ('attend', 1), ('organza', 1), ('about', 1), ('tune', 1), ('building', 1), ('embrace', 1), ('modern', 1), ('tuxedo', 1), ('espresso', 1), ('martini', 1), ('glamour', 1), ('not

In [117]:

18853
111

In [118]:

Out [118] :

$$((18853, 2048), (18853, 110), (18853, 1526))$$

Combined Model Training

In [176]:

```
Model: "sequential_30"
```

Layer (type)	Output Shape	Param #
dense_48 (Dense)	(None, 100)	204900
repeat_vector_15 (RepeatVect	(None, 110, 100)	0
Total params: 204,900		
Trainable params: 204,900		
Non-trainable params: 0		

```
Model: "sequential_31"
```

Layer (type)	Output Shape	Param #
--------------	--------------	---------

embedding_15 (Embedding)	(None, 110, 100)	152600
bidirectional_27 (Bidirectio	(None, 110, 512)	731136
dense_49 (Dense)	(None, 110, 128)	65664
time_distributed_15 (TimeDis	(None, 110, 100)	12900
=====		
Total params: 962,300		
Trainable params: 962,300		
Non-trainable params: 0		

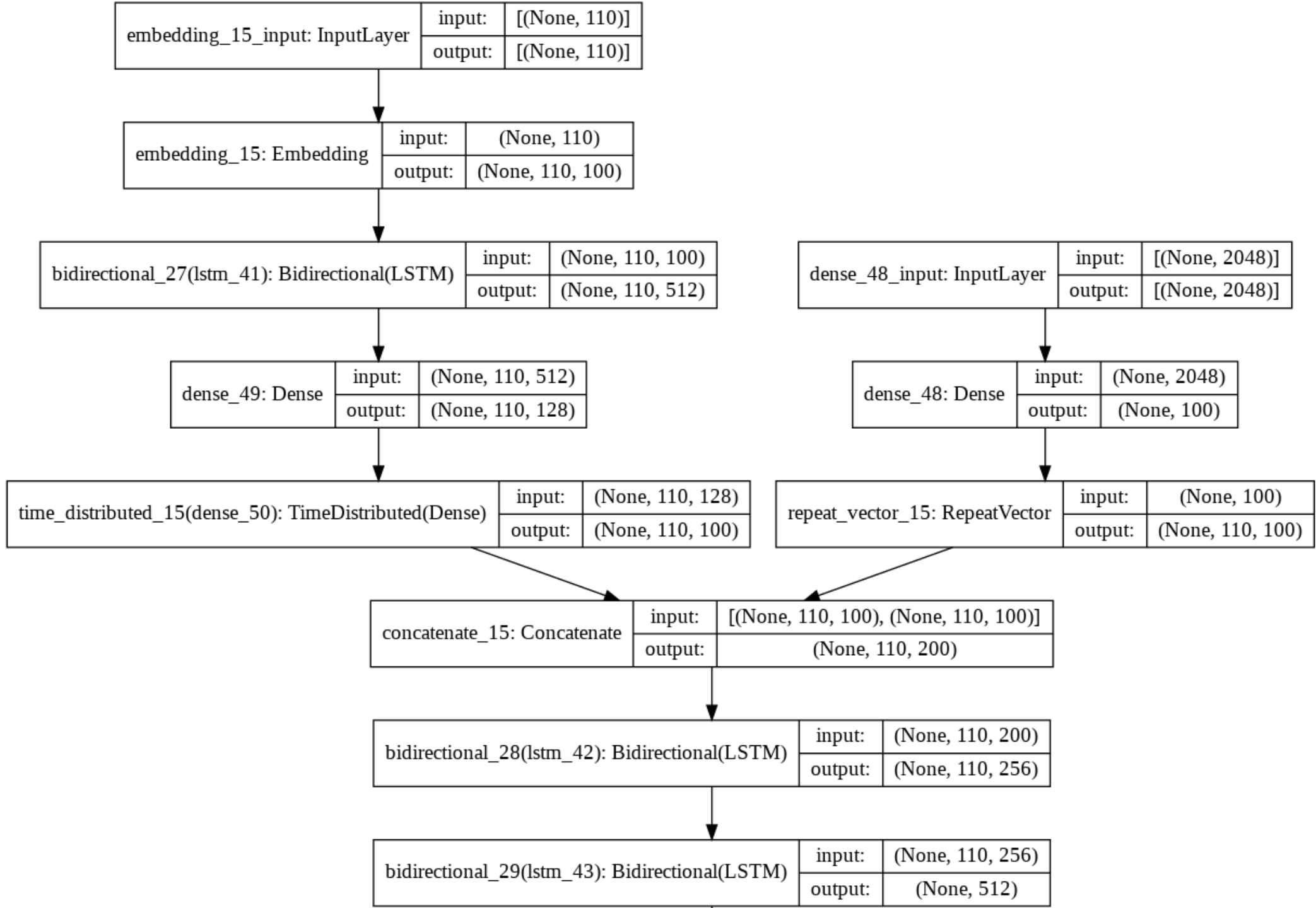
Model: "model_17"

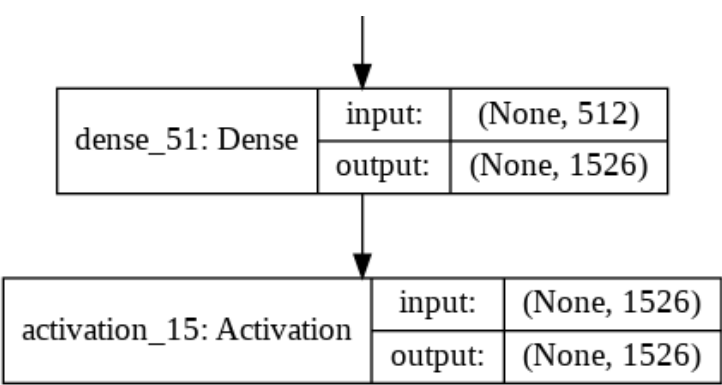
Layer (type)	Output Shape	Param #	Connected to
=====			
embedding_15_input (InputLayer)	[(None, 110)]	0	
embedding_15 (Embedding)	(None, 110, 100)	152600	embedding_15_input[0][0]
dense_48_input (InputLayer)	[(None, 2048)]	0	
bidirectional_27 (Bidirectional	(None, 110, 512)	731136	embedding_15[0][0]
dense_48 (Dense)	(None, 100)	204900	dense_48_input[0][0]
dense_49 (Dense)	(None, 110, 128)	65664	bidirectional_27[0][0]
repeat_vector_15 (RepeatVector)	(None, 110, 100)	0	dense_48[0][0]
time_distributed_15 (TimeDistri	(None, 110, 100)	12900	dense_49[0][0]
concatenate_15 (Concatenate)	(None, 110, 200)	0	repeat_vector_15[0][0] time_distributed_15[0][0]
bidirectional_28 (Bidirectional	(None, 110, 256)	336896	concatenate_15[0][0]
bidirectional_29 (Bidirectional	(None, 512)	1050624	bidirectional_28[0][0]
dense_51 (Dense)	(None, 1526)	782838	bidirectional_29[0][0]
activation_15 (Activation)	(None, 1526)	0	dense_51[0][0]
=====			
Total params: 3,337,558			
Trainable params: 3,337,558			
Non-trainable params: 0			

In [177]:

```
#Model visualisation
plot_model(model, show_shapes=True)
```

Out[177]:





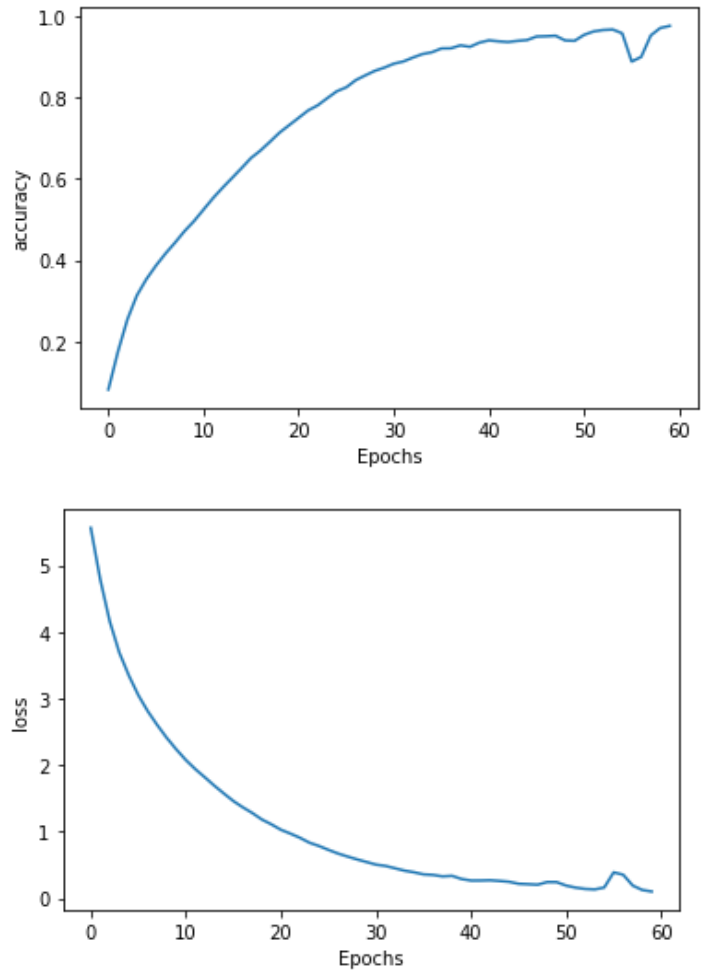
```
In [178]:  
  
# trained the model  
history = model.fit([image_input, x1], x2, batch_size=64, epochs=60)
```

Epoch 1/60
295/295 [=====] - 26s 64ms/step - loss: 5.8509 - accuracy: 0.0597
Epoch 2/60
295/295 [=====] - 19s 65ms/step - loss: 4.9263 - accuracy: 0.1522
Epoch 3/60
295/295 [=====] - 19s 65ms/step - loss: 4.2604 - accuracy: 0.2348
Epoch 4/60
295/295 [=====] - 19s 64ms/step - loss: 3.7234 - accuracy: 0.3037
Epoch 5/60
295/295 [=====] - 19s 64ms/step - loss: 3.3689 - accuracy: 0.3436
Epoch 6/60
295/295 [=====] - 19s 64ms/step - loss: 3.0509 - accuracy: 0.3809
Epoch 7/60
295/295 [=====] - 19s 65ms/step - loss: 2.7495 - accuracy: 0.4246
Epoch 8/60
295/295 [=====] - 19s 65ms/step - loss: 2.5648 - accuracy: 0.4454
Epoch 9/60
295/295 [=====] - 19s 64ms/step - loss: 2.3834 - accuracy: 0.4738
Epoch 10/60
295/295 [=====] - 19s 64ms/step - loss: 2.1617 - accuracy: 0.5104
Epoch 11/60
295/295 [=====] - 19s 64ms/step - loss: 2.0522 - accuracy: 0.5276
Epoch 12/60
295/295 [=====] - 19s 65ms/step - loss: 1.9024 - accuracy: 0.5636
Epoch 13/60
295/295 [=====] - 19s 65ms/step - loss: 1.7409 - accuracy: 0.5941
Epoch 14/60
295/295 [=====] - 19s 65ms/step - loss: 1.6527 - accuracy: 0.6073
Epoch 15/60
295/295 [=====] - 19s 65ms/step - loss: 1.5678 - accuracy: 0.6288
Epoch 16/60
295/295 [=====] - 19s 65ms/step - loss: 1.4217 - accuracy: 0.6650
Epoch 17/60
295/295 [=====] - 19s 64ms/step - loss: 1.3315 - accuracy: 0.6793
Epoch 18/60
295/295 [=====] - 19s 64ms/step - loss: 1.2275 - accuracy: 0.7065
Epoch 19/60
295/295 [=====] - 19s 64ms/step - loss: 1.1426 - accuracy: 0.7277
Epoch 20/60
295/295 [=====] - 19s 65ms/step - loss: 1.0862 - accuracy: 0.7421
Epoch 21/60
295/295 [=====] - 19s 65ms/step - loss: 0.9742 - accuracy: 0.7638
Epoch 22/60
295/295 [=====] - 19s 65ms/step - loss: 0.9462 - accuracy: 0.7730
Epoch 23/60
295/295 [=====] - 19s 65ms/step - loss: 0.9040 - accuracy: 0.7834
Epoch 24/60
295/295 [=====] - 19s 65ms/step - loss: 0.7999 - accuracy: 0.8083
Epoch 25/60
295/295 [=====] - 19s 65ms/step - loss: 0.7609 - accuracy: 0.8224
Epoch 26/60
295/295 [=====] - 19s 65ms/step - loss: 0.7079 - accuracy: 0.8279
Epoch 27/60
295/295 [=====] - 19s 65ms/step - loss: 0.6349 - accuracy: 0.8560
Epoch 28/60
295/295 [=====] - 19s 64ms/step - loss: 0.6019 - accuracy: 0.8601
Epoch 29/60
295/295 [=====] - 19s 64ms/step - loss: 0.5611 - accuracy: 0.8739
Epoch 30/60
295/295 [=====] - 19s 65ms/step - loss: 0.5174 - accuracy: 0.8850
Epoch 31/60
295/295 [=====] - 19s 65ms/step - loss: 0.4890 - accuracy: 0.8900
Epoch 32/60
295/295 [=====] - 19s 65ms/step - loss: 0.4580 - accuracy: 0.8967
Epoch 33/60
295/295 [=====] - 19s 65ms/step - loss: 0.4302 - accuracy: 0.9069
Epoch 34/60
295/295 [=====] - 19s 65ms/step - loss: 0.3940 - accuracy: 0.9118
Epoch 35/60
295/295 [=====] - 19s 64ms/step - loss: 0.3722 - accuracy: 0.9173
Epoch 36/60
295/295 [=====] - 19s 65ms/step - loss: 0.3354 - accuracy: 0.9272
Epoch 37/60
295/295 [=====] - 19s 65ms/step - loss: 0.3323 - accuracy: 0.9256
Epoch 38/60
295/295 [=====] - 19s 65ms/step - loss: 0.3070 - accuracy: 0.9327
Epoch 39/60
295/295 [=====] - 19s 65ms/step - loss: 0.3263 - accuracy: 0.9270
Epoch 40/60
295/295 [=====] - 19s 65ms/step - loss: 0.2733 - accuracy: 0.9391
Epoch 41/60
295/295 [=====] - 19s 65ms/step - loss: 0.2472 - accuracy: 0.9466
Epoch 42/60
295/295 [=====] - 19s 65ms/step - loss: 0.2519 - accuracy: 0.9438

Epoch 43/60
295/295 [=====] - 19s 65ms/step - loss: 0.2434 - accuracy: 0.9430
Epoch 44/60
295/295 [=====] - 19s 65ms/step - loss: 0.2496 - accuracy: 0.9416
Epoch 45/60
295/295 [=====] - 19s 65ms/step - loss: 0.2415 - accuracy: 0.9423
Epoch 46/60
295/295 [=====] - 19s 65ms/step - loss: 0.2047 - accuracy: 0.9553
Epoch 47/60
295/295 [=====] - 19s 65ms/step - loss: 0.2031 - accuracy: 0.9523
Epoch 48/60
295/295 [=====] - 19s 65ms/step - loss: 0.1871 - accuracy: 0.9566
Epoch 49/60
295/295 [=====] - 19s 65ms/step - loss: 0.2215 - accuracy: 0.9482
Epoch 50/60
295/295 [=====] - 19s 65ms/step - loss: 0.2290 - accuracy: 0.9434
Epoch 51/60
295/295 [=====] - 19s 65ms/step - loss: 0.1832 - accuracy: 0.9561
Epoch 52/60
295/295 [=====] - 19s 65ms/step - loss: 0.1592 - accuracy: 0.9621
Epoch 53/60
295/295 [=====] - 19s 65ms/step - loss: 0.1347 - accuracy: 0.9681
Epoch 54/60
295/295 [=====] - 19s 65ms/step - loss: 0.1238 - accuracy: 0.9693
Epoch 55/60
295/295 [=====] - 19s 65ms/step - loss: 0.1294 - accuracy: 0.9683
Epoch 56/60
295/295 [=====] - 19s 65ms/step - loss: 0.3069 - accuracy: 0.9142
Epoch 57/60
295/295 [=====] - 19s 65ms/step - loss: 0.3562 - accuracy: 0.8979
Epoch 58/60
295/295 [=====] - 19s 65ms/step - loss: 0.2144 - accuracy: 0.9443
Epoch 59/60
295/295 [=====] - 19s 65ms/step - loss: 0.1223 - accuracy: 0.9714
Epoch 60/60
295/295 [=====] - 19s 65ms/step - loss: 0.0985 - accuracy: 0.9766

In [179]:

```
def plot_graphs(history, string):  
    plt.plot(history.history[string])  
    plt.xlabel("Epochs")  
    plt.ylabel(string)  
    plt.show()  
plot_graphs(history, 'accuracy')  
plot_graphs(history, 'loss')
```



In [180]:

```
#saving the trained model  
model.save('tm_assignment1 model 1.h5')
```

In [189]:

```
#loading the saved model  
model = tf.keras.models.load_model('tm_assignment1 model 1.h5')
```

Trying this model on unseen images

In [190]:

```
def predict_description(path):  
    img = cv2.imread(path)  
    img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)  
    img1 = cv2.resize(img, (224,224))  
    img2 = img1.reshape(1,224,224,3)  
    img_inp = np.array(ResNet_model.predict(img2)[0]).reshape(1,2048)
```



```
seed_text = ["seqstart"]
while (seed_text[-1]) != 'seqend':
    token_list = tokenizer.texts_to_sequences([seed_text])[0]
    token_list = pad_sequences([token_list], maxlen=max_len-1, padding='pre')
    predicted = np.argmax(model.predict([img_inp, token_list], verbose=0))
    output_word = ""
    for word, index in tokenizer.word_index.items():
        if index == predicted:
            output_word = word
            break
    seed_text.append(output_word)
    if len(seed_text)>26:
        break
seed_text = ' '.join(seed_text[1:-1])
plt.imshow(img)
plt.xlabel(seed_text);
```

In [191]:

```
predict_description(path = imgpath[2])
```



featuring elegant printed details this off white top and skirt set from jaipur kurti makes a statement addition to your casual wardrobe style this set

In [192]:

```
predict_description(path = './imgnew1.jpg')
```



round neck dress having three quarter designer sleeves with button detailing and the dress is of is is this with is georgette for the maxi

In [193]:

```
predict_description(path = './imgnew2.jpg')
```



this pink solid top from and will be a great addition to your western wear collection featuring a collar neck and half sleeves pair this

In [194]:

```
predict_description(path = './imgnew4.jpg')
```



this red dress by label ritu kumar is crafted in cotton viscose and georgette and features a v neck a sleeveless sleeves a flared detail

In [195]:


```
predict_description(path = './imgnew5.jpg')
```



make a stunning style statement with this elegant light top from gap crafted in linen style this top with a pair of girlfriend denims and

In [200]:

```
predict_description(path = './imgnew9.jpg')
```



black one shoulder lace detailing with a curved neckline neckline jeggings the front and a sleeveless t it is mandarin for work or shorts for

In [205]:

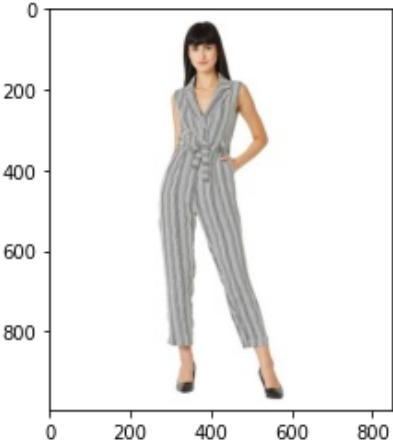
```
predict_description(path = './imgnew11.jpg')
```



gap is known for creating basics that can be worn on a regular basis and as a loungewear staple as well this logo tee is

In [206]:

```
predict_description(path = './imgnew13.jpg')
```



this off white dhoti jumpsuit by idalia is crafted in cotton sleeveless and features a boat neck striped patterns all over a back zip closure