IMPORTING ALL NECESSARY LIBRARIES AND FUNCTIONS

```
import pandas as pd
import numpy as np
import os
import matplotlib.pyplot as plt
import cv2
import sklearn
from sklearn import model_selection
from sklearn.model_selection import train_test_split, learning_curve, KFold, cross_val_
from sklearn.utils import class_weight
from sklearn.metrics import confusion_matrix

import keras
from keras.models import Sequential
from keras.layers import Dense, Activation, Dropout, Flatten, Conv2D, MaxPool2D, MaxPoo
from keras.preprocessing.image import ImageDataGenerator
from keras.utils.np_utils import to_categorical
from keras.callbacks import ReduceLROnPlateau, ModelCheckpoint
from keras.models import model_from_json
from keras import backend as K
from google.colab import files
from glob import glob
import random
import matplotlib.gridspec as gridspec
import seaborn as sns
import zlib
import itertools
from keras.utils.vis_utils import plot_model
from keras.preprocessing import image
from keras.applications.mobilenet import preprocess_input
from keras.models import Model
from mlxtend.plotting import plot_confusion_matrix
from sklearn.metrics import classification_report

from keras import optimizers
from google.colab import files
```

CHECKING IF THE GPU IS WORKING

```
import tensorflow as tf
tf.test.gpu_device_name()
```

```
'/device:GPU:0'
```

IMPORTING THE DATASET FROM GOOGLE DRIVE

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

train_path='/content/drive/MyDrive/train_dataset'
test_path='/content/drive/MyDrive/test_dataset'

train_datagen=ImageDataGenerator(rescale=1./255,shear_range=.2, zoom_range=.2,horizonta
test_datagen=ImageDataGenerator(rescale=1./255)

training_set=train_datagen.flow_from_directory(train_path,target_size=(224,224),batch_s
testing_set=test_datagen.flow_from_directory(test_path,target_size=(224,224),batch_size
```

```
Mounted at /content/drive/
Found 4591 images belonging to 2 classes.
Found 2159 images belonging to 2 classes.
```

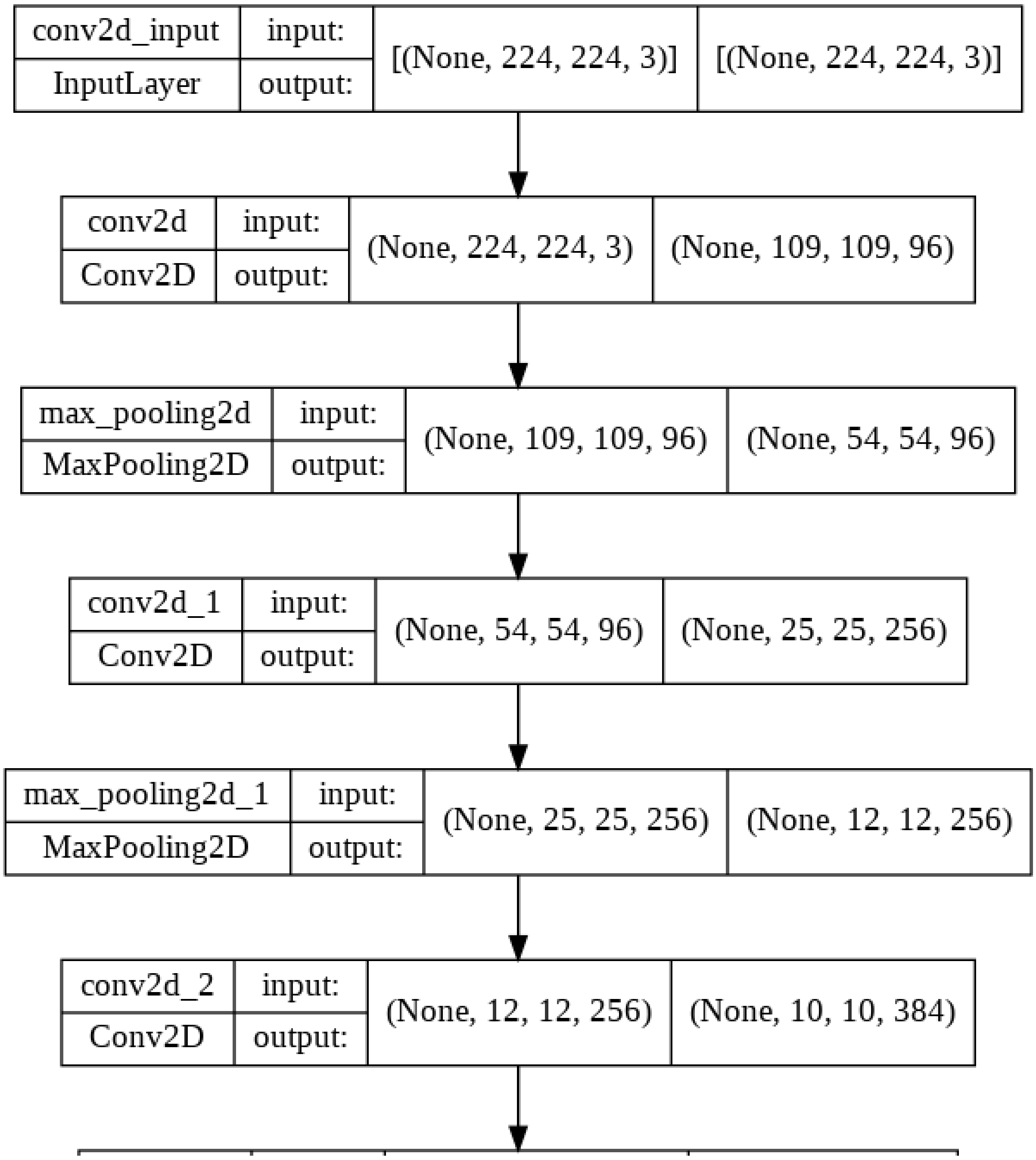
ZFnet MODEL

MAKING, COMPILATION, STRUCTURE, FITTING, PROGRESS VISUALIZATION AND HEATMAP

```
model5=Sequential()

# Layer 1: Convolutional
model5.add(Conv2D(filters=96,kernel_size=7,strides=2,activation='relu',input_shape=(224

# Max Pool 1
model5.add(MaxPool2D(pool_size=3,strides=2))

# Layer 2: Convolutional
model5.add(Conv2D(filters=256,kernel_size=5,strides=2,activation='relu'))

# Max Pool 2
model5.add(MaxPool2D(pool_size=3,strides=2))

# Layer 3: Convolutional
model5.add(Conv2D(filters=384,kernel_size=3,strides=1,activation='relu'))

# Layer 4: Convolutional
model5.add(Conv2D(filters=384,kernel_size=3,strides=1,activation='relu'))

# Layer 5: Convolutional
model5.add(Conv2D(filters=256,kernel_size=3,strides=1,activation='relu'))

# Max Pool 3
model5.add(MaxPool2D(pool_size=3,strides=2))

# Flattening the input layer
model5.add(Flatten())
```

```

# Layer 6: Fully Connected
model5.add(Dense(units=4096,activation='relu'))

# Layer 7: Fully Connected
model5.add(Dense(units=4096,activation='relu'))

# Layer 8: Fully Connected
model5.add(Dense(units=2,activation='softmax'))

# compiling the model
model5.compile(loss='categorical_crossentropy',optimizer=tf.optimizers.SGD(lr=.01),metr

# printing the blueprint of the model
plot_model(model5, to_file='model_plot.png', show_shapes=True, show_layer_names=True)
```

```
/usr/local/lib/python3.7/dist-packages/keras/optimizer_v2/gradient_descent.py:102: Us
  super(SGD, self).__init__(name, **kwargs)
```

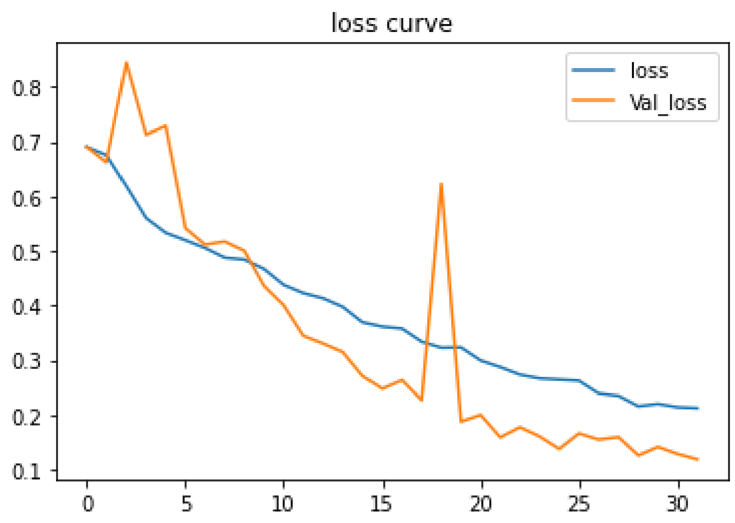


```
# fitting the alexnet model
r5=model5.fit_generator(training_set,validation_data=testing_set,epochs=32,steps_per_ep

# keys present in the history
print(r5.history.keys())
```

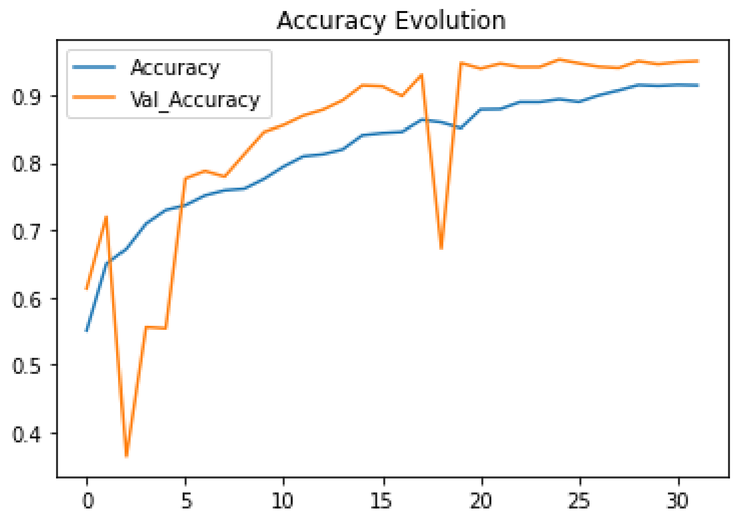
```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: UserWarning: `Mode

Epoch 1/32
144/144 [==============================] - 882s 6s/step - loss: 0.6899 - accuracy:
Epoch 2/32
144/144 [==============================] - 180s 1s/step - loss: 0.6754 - accuracy:
Epoch 3/32
144/144 [==============================] - 176s 1s/step - loss: 0.6186 - accuracy:
Epoch 4/32
144/144 [==============================] - 171s 1s/step - loss: 0.5603 - accuracy:
Epoch 5/32
```

```
144/144 [==============================] - 169s 1s/step - loss: 0.5332 - accuracy:
Epoch 6/32
144/144 [==============================] - 169s 1s/step - loss: 0.5196 - accuracy:
Epoch 7/32
144/144 [==============================] - 172s 1s/step - loss: 0.5054 - accuracy:
Epoch 8/32
144/144 [==============================] - 172s 1s/step - loss: 0.4877 - accuracy:
Epoch 9/32
144/144 [==============================] - 173s 1s/step - loss: 0.4842 - accuracy:
Epoch 10/32
144/144 [==============================] - 173s 1s/step - loss: 0.4670 - accuracy:
Epoch 11/32
144/144 [==============================] - 173s 1s/step - loss: 0.4379 - accuracy:
Epoch 12/32
144/144 [==============================] - 173s 1s/step - loss: 0.4228 - accuracy:
Epoch 13/32
144/144 [==============================] - 173s 1s/step - loss: 0.4134 - accuracy:
Epoch 14/32
144/144 [==============================] - 173s 1s/step - loss: 0.3978 - accuracy:
Epoch 15/32
144/144 [==============================] - 173s 1s/step - loss: 0.3695 - accuracy:
Epoch 16/32
144/144 [==============================] - 172s 1s/step - loss: 0.3613 - accuracy:
Epoch 17/32
144/144 [==============================] - 171s 1s/step - loss: 0.3579 - accuracy:
Epoch 18/32
144/144 [==============================] - 171s 1s/step - loss: 0.3337 - accuracy:
Epoch 19/32
144/144 [==============================] - 171s 1s/step - loss: 0.3229 - accuracy:
Epoch 20/32
144/144 [==============================] - 171s 1s/step - loss: 0.3234 - accuracy:
Epoch 21/32
144/144 [==============================] - 171s 1s/step - loss: 0.2995 - accuracy:
Epoch 22/32
144/144 [==============================] - 170s 1s/step - loss: 0.2874 - accuracy:
Epoch 23/32
144/144 [==============================] - 172s 1s/step - loss: 0.2737 - accuracy:
Epoch 24/32
144/144 [==============================] - 170s 1s/step - loss: 0.2668 - accuracy:
Epoch 25/32
144/144 [==============================] - 169s 1s/step - loss: 0.2648 - accuracy:
Epoch 26/32
144/144 [==============================] - 171s 1s/step - loss: 0.2628 - accuracy:
Epoch 27/32
144/144 [==============================] - 170s 1s/step - loss: 0.2397 - accuracy:
```

```python
import matplotlib.pyplot as plt

plt.plot(r5.history['loss'],label='loss')
plt.plot(r5.history['val_loss'],label='Val_loss')
plt.title('loss curve')
plt.legend()
plt.show()

plt.plot(r5.history['accuracy'], label='Accuracy')
plt.plot(r5.history['val_accuracy'], label='Val_Accuracy')
plt.title('accuracy curve')
plt.legend()
plt.title('Accuracy Evolution')
```



```
Text(0.5, 1.0, 'Accuracy Evolution')
```



```
evaluation=model5.evaluate(testing_set)
print(f"Test Accuracy: {evaluation[1] * 100:.2f}%")

evaluation=model5.evaluate(training_set)
print(f"Train Accuracy: {evaluation[1] * 100:.2f}%")
```

```
68/68 [==============================] - 54s 795ms/step - loss: 0.1194 - accuracy: 0
Test Accuracy: 95.09%
144/144 [==============================] - 118s 815ms/step - loss: 0.1951 - accuracy
Train Accuracy: 92.96%
```