In [1]:
```
import pandas as pd
```

In [2]:
```
import numpy as np
```

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

```
---------------------------------------------------------------------------
ModuleNotFoundError                       Traceback (most recent call last)
<ipython-input-3-64156d691fe5> in <module>
----> 1 import tensorflow as tf

~\anaconda3\lib\site-packages\tensorflow\__init__.py in <module>
     39 import sys as _sys
     40
---> 41 from tensorflow.python.tools import module_util as _module_util
     42 from tensorflow.python.util.lazy_loader import LazyLoader as _LazyLoader
     43

~\anaconda3\lib\site-packages\tensorflow\python\__init__.py in <module>
     38 # pylint: disable=wildcard-import,g-bad-import-order,g-import-not-at-top
     39
---> 40 from tensorflow.python.eager import context
     41 from tensorflow.python import pywrap_tensorflow as _pywrap_tensorflow
     42

~\anaconda3\lib\site-packages\tensorflow\python\eager\context.py in <module>
     33 from tensorflow.core.protobuf import config_pb2
     34 from tensorflow.core.protobuf import rewriter_config_pb2
---> 35 from tensorflow.python import pywrap_tfe
     36 from tensorflow.python import tf2
     37 from tensorflow.python.client import pywrap_tf_session

~\anaconda3\lib\site-packages\tensorflow\python\pywrap_tfe.py in <module>
     26
     27 # pylint: disable=invalid-import-order,g-bad-import-order, wildcard-import, unused
-import
---> 28 from tensorflow.python import pywrap_tensorflow
     29 from tensorflow.python._pywrap_tfe import *

~\anaconda3\lib\site-packages\tensorflow\python\pywrap_tensorflow.py in <module>
     23 import traceback
     24
---> 25 from tensorflow.python.platform import self_check
     26
     27 # Perform pre-load sanity checks in order to produce a more actionable error.

ModuleNotFoundError: No module named 'tensorflow.python.platform'
```

In [ ]:
```
import cv2
```

In [5]:
```
from tensorflow import keras
```

In [6]:
```
from tensorflow.keras.models import Model
```

In [83]:
```
from tensorflow.keras import Sequential,layers,Input
```

In [8]:
```
import matplotlib.pyplot as plt
```

In [9]:
```
import os
```

In [10]:
```
from PIL import Image
```

In [19]:
```
image_directory="D:/malaria_data/"
```

In [20]:
```
image_directory
```

Out[20]:
```
'D:/malaria_data/'
```

In [21]:
```
parasitized=os.listdir(image_directory+"parasitized/")
```

In [22]:
```
parasitized
```

Out[22]:
```
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'C39P4thinF_original_IMG_20150622_113632_cell_5.png']
```

In [68]:
```
datasets=[]
labels=[]
size=64
```

In [72]:
```
for x,image in enumerate(parasitized):
    if image.split(".")[1]=="png":
        img=cv2.imread(image_directory+"parasitized/"+image)
        img1=Image.fromarray(img,"RGB")
        img2=img1.resize((size,size))
        datasets.append(np.array(img2))
        labels.append(0)
```

In [74]:
```
datasets[87]
```

Out[74]:
```
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],
        [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]]], dtype=uint8)
```

In [75]:
```
uninfected=os.listdir(image_directory+"uninfected/")
```

In [76]:
```
uninfected
```

Out[76]:
```
['C12NThinF_IMG_20150614_124212_cell_111.png',
 'C12NThinF_IMG_20150614_124212_cell_120.png',
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'C5NThinF_IMG_20150609_122108_cell_117.png',
'C5NThinF_IMG_20150609_122108_cell_141.png',
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```
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'C7NthinF_IMG_20150611_105444_cell_179.png',
'C7NthinF_IMG_20150611_105444_cell_195.png',
'C7NthinF_IMG_20150611_105444_cell_31.png',
'C7NthinF_IMG_20150611_105444_cell_5.png',
'C7NthinF_IMG_20150611_105444_cell_56.png',
'C7NthinF_IMG_20150611_105444_cell_77.png']
```

In [78]:

```
for y,image_name in enumerate(uninfected):
    if image_name.split(".")[1]=="png":
        image=cv2.imread(image_directory+"uninfected/"+image_name)
        image=Image.fromarray(image,"RGB")
        image=image.resize((size,size))
        datasets.append(np.array(image))
        labels.append(1)
```

In [86]:

```
datasets.pop(1000)
```

Out[86]:

```
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],
        [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]]], dtype=uint8)
```

In [87]:
```
len(datasets)
```

Out[87]:
```
1000
```

In [88]:
```
len(labels)
```

Out[88]:
```
1000
```

In [89]:
```
from tensorflow.keras.models import Model
```

In [103…
```
#CONVOLUTIONAL LAYER1
input_shape=(size,size,3)
inp=Input(shape=input_shape)
con1=layers.Conv2D(32,kernel_size=(3,3),activation="relu",padding="same")(inp)
maxp=layers.MaxPooling2D(pool_size=(2,2))(con1)
norm=layers.BatchNormalization(axis=-1)(maxp)
drop=layers.Dropout(0.20)(norm)
```

In [109…
```
#CONVOLUTIONAL LAYER2
con2=layers.Conv2D(32,kernel_size=(3,3),activation="relu",padding="same")(drop)
maxp2=layers.MaxPooling2D(pool_size=(2,2))(con2)
norm2=layers.BatchNormalization(axis=-1)(maxp2)
drop2=layers.Dropout(0.20)(norm2)
```

In [110…
```
#FLATTEN
flat=layers.Flatten()(drop2)
```

In [113…
```
#DENSE LAYERS(HIDDEN LAYERS)
hidden1=layers.Dense(512,activation="relu")(flat)
norm3=layers.BatchNormalization(axis=-1)(hidden1)
drop3=layers.Dropout(0.20)(norm3)
```

In [115…
```
#SECOND HIDDDEN LAYER
hidden2=layers.Dense(256,activation="relu")(drop3)
norm4=layers.BatchNormalization(axis=-1)(hidden2)
drop4=layers.Dropout(0.20)(norm4)
```

In [116…
```
#OUTPUT
out=layers.Dense(2,activation="sigmoid")(drop4)
```

In [117…
```
model=Model(inputs=inp,outputs=out)
```

In [118…
```
model.summary()
```

```
Model: "functional_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
input_10 (InputLayer)        [(None, 64, 64, 3)]       0
_________________________________________________________________
conv2d_7 (Conv2D)            (None, 64, 64, 32)        896
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 32, 32, 32)        0
_________________________________________________________________
batch_normalization_3 (Batch (None, 32, 32, 32)        128
_________________________________________________________________
dropout (Dropout)            (None, 32, 32, 32)        0
_________________________________________________________________
conv2d_11 (Conv2D)           (None, 32, 32, 32)        9248
_________________________________________________________________
max_pooling2d_6 (MaxPooling2 (None, 16, 16, 32)        0
_________________________________________________________________
batch_normalization_5 (Batch (None, 16, 16, 32)        128
_________________________________________________________________
dropout_1 (Dropout)          (None, 16, 16, 32)        0
_________________________________________________________________
flatten (Flatten)            (None, 8192)              0
_________________________________________________________________
dense_2 (Dense)              (None, 512)               4194816
_________________________________________________________________
batch_normalization_7 (Batch (None, 512)               2048
_________________________________________________________________
dropout_2 (Dropout)          (None, 512)               0
_________________________________________________________________
dense_4 (Dense)              (None, 256)               131328
_________________________________________________________________
batch_normalization_8 (Batch (None, 256)               1024
_________________________________________________________________
dropout_3 (Dropout)          (None, 256)               0
_________________________________________________________________
dense_5 (Dense)              (None, 2)                 514
=================================================================
Total params: 4,340,130
Trainable params: 4,338,466
Non-trainable params: 1,664
_________________________________________________________________
```

In [121…
```
from tensorflow.keras.utils import to_categorical
```

In [122…
```
cat=to_categorical(np.array(labels))
```

In [123…
```
cat
```

Out[123…
```
array([[1., 0.],
       [1., 0.],
       [1., 0.],
       ...,
       [0., 1.],
       [0., 1.],
       [0., 1.]], dtype=float32)
```

In [124…
```
from sklearn. model_selection import train_test_split
```

In [126…
```
xtrain,xtest,ytrain,ytest=train_test_split(datasets,cat,test_size=0.20,random_state=0)
```

In [128…
```
len(xtrain)
```

Out[128…
```
800
```

In [141…
```
model.compile(optimizer="adam",loss="categorical_crossentropy",metrics=["accuracy"])
```

In [142…
```
model.fit(np.array(xtrain),ytrain,epochs=25,batch_size=250,verbose=1,shuffle=False,valida
```

```
Epoch 1/25
3/3 [==============================] - 2s 654ms/step - loss: 0.0159 - accuracy: 0.9972 - v
al_loss: 0.6148 - val_accuracy: 0.9000
Epoch 2/25
3/3 [==============================] - 2s 654ms/step - loss: 0.0043 - accuracy: 0.9986 - v
al_loss: 0.7478 - val_accuracy: 0.8250
Epoch 3/25
3/3 [==============================] - 2s 808ms/step - loss: 0.0054 - accuracy: 0.9986 - v
al_loss: 0.7872 - val_accuracy: 0.8625
Epoch 4/25
3/3 [==============================] - 2s 592ms/step - loss: 0.0075 - accuracy: 0.9944 - v
al_loss: 0.8338 - val_accuracy: 0.8125
Epoch 5/25
3/3 [==============================] - 2s 630ms/step - loss: 0.0040 - accuracy: 0.9986 - v
al_loss: 2.0876 - val_accuracy: 0.7000
Epoch 6/25
3/3 [==============================] - 3s 1s/step - loss: 0.0078 - accuracy: 0.9958 - val_
loss: 2.9718 - val_accuracy: 0.6125
Epoch 7/25
3/3 [==============================] - 2s 610ms/step - loss: 0.0036 - accuracy: 0.9986 - v
al_loss: 2.8927 - val_accuracy: 0.6125
Epoch 8/25
3/3 [==============================] - 2s 632ms/step - loss: 0.0043 - accuracy: 0.9986 - v
al_loss: 2.0374 - val_accuracy: 0.6750
Epoch 9/25
3/3 [==============================] - 3s 1s/step - loss: 0.0107 - accuracy: 0.9972 - val_
loss: 1.8657 - val_accuracy: 0.6875
Epoch 10/25
3/3 [==============================] - 2s 584ms/step - loss: 0.0068 - accuracy: 0.9972 - v
al_loss: 2.1253 - val_accuracy: 0.6750
Epoch 11/25
3/3 [==============================] - 3s 1s/step - loss: 0.0030 - accuracy: 0.9986 - val_
loss: 2.4639 - val_accuracy: 0.6750
Epoch 12/25
3/3 [==============================] - 2s 657ms/step - loss: 0.0027 - accuracy: 0.9986 - v
al_loss: 2.5096 - val_accuracy: 0.6875
Epoch 13/25
3/3 [==============================] - 2s 653ms/step - loss: 0.0033 - accuracy: 0.9986 - v
al_loss: 2.3177 - val_accuracy: 0.6875
Epoch 14/25
3/3 [==============================] - 2s 753ms/step - loss: 0.0020 - accuracy: 1.0000 - v
al_loss: 1.9933 - val_accuracy: 0.7000
Epoch 15/25
3/3 [==============================] - 2s 665ms/step - loss: 0.0030 - accuracy: 0.9986 - v
al_loss: 1.6075 - val_accuracy: 0.7125
Epoch 16/25
3/3 [==============================] - 2s 696ms/step - loss: 0.0031 - accuracy: 0.9986 - v
al_loss: 2.3293 - val_accuracy: 0.6375
Epoch 17/25
3/3 [==============================] - 3s 902ms/step - loss: 0.0051 - accuracy: 0.9958 - v
al_loss: 3.6539 - val_accuracy: 0.5875
Epoch 18/25
3/3 [==============================] - 2s 659ms/step - loss: 0.0036 - accuracy: 0.9986 - v
al_loss: 2.9181 - val_accuracy: 0.5875
Epoch 19/25
3/3 [==============================] - 2s 649ms/step - loss: 0.0025 - accuracy: 0.9986 - v
al_loss: 1.3411 - val_accuracy: 0.7500
Epoch 20/25
```

```
3/3 [==============================] - 3s 1s/step - loss: 0.0034 - accuracy: 0.9986 - val_
loss: 1.4074 - val_accuracy: 0.7875
Epoch 21/25
3/3 [==============================] - 2s 722ms/step - loss: 0.0035 - accuracy: 0.9986 - v
al_loss: 2.0898 - val_accuracy: 0.6875
Epoch 22/25
3/3 [==============================] - 2s 801ms/step - loss: 0.0066 - accuracy: 0.9972 - v
al_loss: 2.3202 - val_accuracy: 0.6875
Epoch 23/25
3/3 [==============================] - 2s 627ms/step - loss: 0.0081 - accuracy: 0.9958 - v
al_loss: 2.3666 - val_accuracy: 0.7125
Epoch 24/25
3/3 [==============================] - 2s 668ms/step - loss: 0.0197 - accuracy: 0.9917 - v
al_loss: 2.5312 - val_accuracy: 0.6125
Epoch 25/25
3/3 [==============================] - 3s 1s/step - loss: 0.0085 - accuracy: 0.9972 - val_
loss: 2.0162 - val_accuracy: 0.6375
```

Out[142…

```
<tensorflow.python.keras.callbacks.History at 0x19a180cfc70>
```

In [145…

```
model.evaluate(np.array(xtest),ytest)
```

```
7/7 [==============================] - 0s 16ms/step - loss: 1.7901 - accuracy: 0.7150
```

Out[145…

```
[1.7900656461715698, 0.7149999737739563]
```

In [ ]: