Imported Libraries

In [1]:
```python
import tensorflow as tf
import keras
from tensorflow.keras.models import Sequential, Model
from tensorflow.keras.layers import Dense, Conv2D , MaxPool2D , Flatten , Dropout, BatchNormalization, LSTM, Input, Reshape
from tensorflow.keras.applications import DenseNet169
from tensorflow.keras.losses import sparse_categorical_crossentropy
from tensorflow.keras.optimizers import RMSprop
from sklearn.metrics import classification_report,confusion_matrix
from sklearn.model_selection import train_test_split
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import random
import cv2
import os
```

Image Dataset Import

In [2]:
```python
labels = ['1_normal', '2_cataract','3_glaucoma','4_retina_disease']
img_size = 224
def get_data(data_dir):
    data = []

    for label in labels:
        path = os.path.join(data_dir, label)
        class_num = labels.index(label)
        for img in os.listdir(path):
            try:
                img_arr = cv2.imread(os.path.join(path, img))[...,::-1] #convert BGR to RGB format
                crop_image= img_arr[0:1728,430:2190]
                resized_arr = cv2.resize(crop_image, (img_size, img_size)) # Reshaping images to preferred size
                data.append([resized_arr, class_num])
            except Exception as e:
                print(e)
    return np.array(data)
```

In [3]:
```python
#function call to get_data function that takes file path of the dataset.
data= get_data('dataset/all_equal_300_images/')
```

```
<ipython-input-2-b08f5e223f84>:17: VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences (which
is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths or shapes) is deprecated. If you meant to do
this, you must specify 'dtype=object' when creating the ndarray
  return np.array(data)
```

In [4]:
```python
data.shape
```

Out[4]:
```
(1200, 2)
```

In [5]:
```python
type(data)
```

Out[5]:
```
numpy.ndarray
```

Dividing Data Ndarray into Normal, Cataract, Glaucoma and Retina diseases.

In [6]:
```python
normal= data[0:300]
normal.shape
```

Out[6]:
```
(300, 2)
```

In [7]:
```python
cataract=data[300:600]
cataract.shape
```

Out[7]:
```
(300, 2)
```

In [8]:
```python
glaucoma= data[600:900]
glaucoma.shape
```

Out[8]:
```
(300, 2)
```

In [9]:

```
retina_disease= data[900:1200]
retina_disease.shape
```

Out[9]:

```
(300, 2)
```

In [10]:

```
random.seed(20)
np.random.shuffle(normal)
np.random.shuffle(cataract)
np.random.shuffle(glaucoma)
np.random.shuffle(retina_disease)
```

Performing Normalization and Resize operation

In [11]:

```
def normalize(x_train,x_val,x_test):

    x_train = np.array(x_train) / 255
    x_train.reshape(-1, img_size, img_size, 1)

    x_test= np.array(x_test) / 255
    x_test.reshape(-1, img_size, img_size, 1)

    x_val= np.array(x_val) / 255
    x_val.reshape(-1, img_size, img_size, 1)


    return (x_train,x_val,x_test)
```

Separating the Images and Labels into Respective Variables

In [12]:

```
def image_label_split(train,validation,test):

    x_train = []
    y_train = []
    x_val = []
    y_val = []
    x_test = []
    y_test = []

    for feature, label in train:
      x_train.append(feature)
      y_train.append(label)

    for feature, label in validation:
      x_val.append(feature)
      y_val.append(label)


    for feature, label in test:
      x_test.append(feature)
      y_test.append(label)


    y_train = np.array(y_train)
    y_val = np.array(y_val)
    y_test= np.array(y_test)

    return (x_train,y_train,x_val,y_val,x_test,y_test)
```

DenseNet169-LSTM MODEL

In [13]:

```
def model_build_compile(k):
    baseModel = DenseNet169(weights="imagenet", include_top=False, input_tensor=Input(shape=(224, 224, 3)))
    for layer in baseModel.layers:
            layer.trainable = False

    x = baseModel.output

        # LSTM layer
    x = Reshape((49, 1664))(x)
    x = ((LSTM(1664, activation="relu", return_sequences=True, trainable=False)))(x)
    x = BatchNormalization()(x)


        # FC layer
    x = Flatten(name="flatten")(x)

        # fc1 layer
    x = Dense(units=4096, activation='relu')(x)
    x = BatchNormalization()(x)

        # fc2 layer
    x = Dense(units=4096, activation='relu')(x)
    x = BatchNormalization()(x)


        # Output layer
    output = Dense(units=4, activation='softmax')(x)

    model = Model(inputs=baseModel.input, outputs=output)
    opt = RMSprop(learning_rate=0.01, clipvalue=100)
    model.compile(loss='sparse_categorical_crossentropy', optimizer=opt, metrics=["accuracy"])
    k=k+1
    print("model building and compiling for fold",k)
    return model
```

Model prediction for Test Images and Computation of Sensitivity and Specificity

In [14]:

```
def test_pred(x_val,y_val,k):
    predictions = model.predict(x_val)
    predictions = np.argmax(predictions, axis = -1)

    print('----------------Test accuracy for',k+1,'fold----------------')
    #Confusion matrix, Accuracy, sensitivity and specificity
    cm1 = confusion_matrix(y_val,predictions)
    print('Confusion Matrix : \n', cm1)

    #####from confusion matrix calculate accuracy


    sensitivity_1_normal = (cm1[0,0])/(cm1[0,0]+cm1[0,1]+cm1[0,2]+cm1[0,3])
    #print('Sensitivity_1_normal          : ', sensitivity_1_normal )

    sensitivity_2_cataract = (cm1[1,1])/(cm1[1,0]+cm1[1,1]+cm1[1,2]+cm1[1,3])
    #print('Sensitivity_2_cataract        : ', sensitivity_2_cataract )

    sensitivity_3_glaucoma = (cm1[2,2])/(cm1[2,0]+cm1[2,1]+cm1[2,2]+cm1[2,3])
    #print('Sensitivity_3_glaucoma        : ', sensitivity_3_glaucoma )

    sensitivity_4_retina_disease = (cm1[3,3])/(cm1[3,0]+cm1[3,1]+cm1[3,2]+cm1[3,3])
    #print('Sensitivity_4_retina_disease  : ', sensitivity_4_retina_disease )

    specificity_1_normal = (cm1[1,1]+cm1[1,2]+cm1[1,3]+cm1[2,1]+cm1[2,2]+cm1[2,3]+cm1[3,1]+cm1[3,2]+cm1[3,3])/(cm1[1,0
]+cm1[2,0]+cm1[3,0]+cm1[1,1]+cm1[1,2]+cm1[1,3]+cm1[2,1]+cm1[2,2]+cm1[2,3]+cm1[3,1]+cm1[3,2]+cm1[3,3])
    #print('Specificity : ', specificity_1_normal)

    specificity_2_cataract = (cm1[0,0]+cm1[0,2]+cm1[0,3]+cm1[2,0]+cm1[2,2]+cm1[2,3]+cm1[3,0]+cm1[3,2]+cm1[3,3])/(cm1[0
,1]+cm1[2,1]+cm1[3,1]+cm1[0,0]+cm1[0,2]+cm1[0,3]+cm1[2,0]+cm1[2,2]+cm1[2,3]+cm1[3,0]+cm1[3,2]+cm1[3,3])
    #print('Specificity : ', specificity_2_cataract)

    specificity_3_glaucoma = (cm1[0,0]+cm1[0,1]+cm1[0,3]+cm1[1,0]+cm1[1,1]+cm1[1,3]+cm1[3,0]+cm1[3,1]+cm1[3,3])/(cm1[0
,2]+cm1[1,2]+cm1[3,2]+cm1[0,0]+cm1[0,1]+cm1[0,3]+cm1[1,0]+cm1[1,1]+cm1[1,3]+cm1[3,0]+cm1[3,1]+cm1[3,3])
    #print('Specificity : ', specificity_3_glaucoma)

    specificity_4_retina_disease= (cm1[0,0]+cm1[0,1]+cm1[0,2]+cm1[1,0]+cm1[1,1]+cm1[1,2]+cm1[2,0]+cm1[2,1]+cm1[2,2])/(
cm1[0,3]+cm1[1,3]+cm1[2,3]+cm1[0,0]+cm1[0,1]+cm1[0,2]+cm1[1,0]+cm1[1,1]+cm1[1,2]+cm1[2,0]+cm1[2,1]+cm1[2,2])
    #print('Specificity : ', specificity_4_retina_disease)

    Sensitivity= (sensitivity_1_normal + sensitivity_2_cataract + sensitivity_3_glaucoma + sensitivity_4_retina_diseas
e)/4
    #print(Sensitivity)

    Specificity= (specificity_1_normal + specificity_2_cataract + specificity_3_glaucoma + specificity_4_retina_diseas
e)/4
    #print(Specificity)

    total1=sum(sum(cm1))
    test_accuracy=(cm1[0,0]+cm1[1,1]+cm1[2,2]+cm1[3,3])/total1

    print ('Accuracy    : ', test_accuracy)
    print ('Specificity : ', Specificity)
    print ('Sensitivity : ', Sensitivity)
    print('-----------------------------End of',k+1,'Fold--------------------------')
    return test_accuracy,Specificity,Sensitivity,cm1
```

In [15]:

```
CM= []
test_accuracy=[]
test_sensitivity=[]
test_specificity=[]
train_acc = []
val_acc = []
train_loss = []
val_loss = []
```

DenseNet169-LSTM 5 Fold Cross Validation

In [16]:

```
for k in range (5): # for loop to run 5 folds
    n=30  #specifying the number of images for each class in test phase,calulated as per 10% of total images in each class images 300.


    # Adding the images in normal validation set by using k*n to (k+1)*n as index values for normal dataset divided in cell 6.
    test_normal= normal[k*n:(k+1)*n]
    print('------------------------Start of',k+1,'Fold------------------------')
    print('test images for normal class from',k*n,(k+1)*n)

    # Adding the images in cataract validation set by using k*n to (k+1)*nas index values for cataract dataset divided in cell 7.
    test_cataract= cataract[k*n:(k+1)*n]
    print('test images for cataract class from',k*n,(k+1)*n)

    # Adding the images in gluacoma validation set by using k*nto (k+1)*n as index values for gluacoma dataset divided in cell 8.
    test_glaucoma= glaucoma[k*n:(k+1)*n]
    print('test images for glaucoma class from',k*n,(k+1)*n)

    # Adding the images in retina disease validation set by using k*n to (k+1)*n as index values for retina disease dataset divided in cell 9.
    test_retina= retina_disease[k*n:(k+1)*n]
    print('test images for retina disease class from',k*n,(k+1)*n)

    # Now for train and validation set of Normal images first adding 0 to k*n images and then adding all the images from (k+1)*n till last image.

    train_validation_normal= normal[:k*n]
    train_validation_normal= np.append(train_validation_normal,normal[(k+1)*n:],axis=0)
    print('train_validation images for normal class from 0 to',k*n,'and',(k+1)*n,'to 300')

    # Now for train and validation set of cataract images first adding 0 to k*n images and then adding all the images from (k+1)*n till last image.

    train_validation_cataract= cataract[:k*n]
    train_validation_cataract= np.append(train_validation_cataract,cataract[(k+1)*n:],axis=0)
    print('train_validation images for cataract class from 0 to',k*n,'and',(k+1)*n,'to 300')

    # Now for train and validation set of glaucoma images first adding 0 to k*n images and then adding all the images from (k+1)*n till last image.

    train_validation_glaucoma= glaucoma[:k*n]
    train_validation_glaucoma= np.append(train_validation_glaucoma,glaucoma[(k+1)*n:],axis=0)
    print('train_validation  images for glaucoma class from 0',k*n,'and',(k+1)*n,'to 300')

    # Now for train and validation set of retina disease images first adding 0 to k*n images and then adding all the images from (k+1)*n till last image.

    train_validation_retina= retina_disease[:k*n]
    train_validation_retina= np.append(train_validation_retina,retina_disease[(k+1)*n:],axis=0)
    print('train_validation images for retina disease class from 0 to',k*n,'and',(k+1)*n,'to 300')



    # Splitting the train validation datasets in 80:20 ratio which would eventually give us 70% images in train and 20% images in validation and 10% in test.

    normal_train, normal_validation                 = train_test_split(train_validation_normal, test_size=0.20, random_state=14,shuffle=True)
    cataract_train, cataract_validation             = train_test_split(train_validation_cataract, test_size=0.20, random_state=14,shuffle=True)
    glaucoma_train, glaucoma_validation             = train_test_split(train_validation_glaucoma, test_size=0.20, random_state=14,shuffle=True)
    retina_disease_train, retina_disease_validation = train_test_split(train_validation_retina, test_size=0.20, random_state=14,shuffle=True)

    # Appending all train set images for all classes
    train= np.append(normal_train,cataract_train,axis=0)
    train= np.append(train,glaucoma_train,axis=0)
    train= np.append(train,retina_disease_train,axis=0)

    # Appending all validation set images for all classes
    validation= np.append(normal_validation,cataract_validation,axis=0)
    validation= np.append(validation,glaucoma_validation,axis=0)
    validation= np.append(validation,retina_disease_validation,axis=0)

    # Appending all test set images for all classes
    test= np.append(test_normal,test_cataract,axis=0)
    test= np.append(test,test_glaucoma,axis=0)
    test= np.append(test,test_retina,axis=0)


    # Shuffling the train validation and test set as they are added sequentially.
    random.seed(6)
    np.random.shuffle(train)
    np.random.shuffle(validation)
    np.random.shuffle(test)


    # Passing the train validation test as argument for image_label_split function that return features and labels sep
arated.
    x_train,y_train,x_val,y_val,x_test,y_test = image_label_split(train,validation,test)

    # Passing the x_Train x_val and x_test as a argument for normalize function that returns the normalized and reshap
ed sets.
    x_train,x_val,x_test = normalize(x_train,x_val,x_test)

    # model building and model compile is done using a model_build_compile().

    model = model_build_compile(k)

    history = model.fit(x_train,y_train,epochs =50, validation_data = (x_val,y_val))


    train_acc = np.append(train_acc,history.history['accuracy'])
    val_acc = np.append(val_acc,history.history['val_accuracy'])

    train_loss = np.append(train_loss,history.history['loss'])
    val_loss = np.append(val_loss,history.history['val_loss'])

    x,y,z,c = test_pred(x_test,y_test,k)


    CM.append([c])
    test_accuracy.append(x)
    test_specificity.append(y)
    test_sensitivity.append(z)
```

```
------------------------Start of 1 Fold------------------------
test images for normal class from 0 30
test images for cataract class from 0 30
test images for glaucoma class from 0 30
test images for retina disease class from 0 30
train_validation images for normal class from 0 to 0 and 30 to 300
train_validation images for cataract class from 0 to 0 and 30 to 300
train_validation  images for glaucoma class from 0 0 and 30 to 300
train_validation images for retina disease class from 0 to 0 and 30 to 300
model building and compiling for fold 1
Epoch 1/50
27/27 [==============================] - 214s 8s/step - loss: 11.7136 - accuracy: 0.5058 - val_loss: 24.5036 - val_ac
curacy: 0.4306
Epoch 2/50
27/27 [==============================] - 218s 8s/step - loss: 6.3867 - accuracy: 0.5706 - val_loss: 13.7179 - val_acc
uracy: 0.4537
Epoch 3/50
27/27 [==============================] - 221s 8s/step - loss: 3.5130 - accuracy: 0.6181 - val_loss: 11.5519 - val_acc
uracy: 0.2778
Epoch 4/50
27/27 [==============================] - 220s 8s/step - loss: 1.9169 - accuracy: 0.6794 - val_loss: 5.7847 - val_accu
racy: 0.3565
Epoch 5/50
27/27 [==============================] - 220s 8s/step - loss: 1.9586 - accuracy: 0.7164 - val_loss: 11.5178 - val_acc
uracy: 0.2917
Epoch 6/50
27/27 [==============================] - 219s 8s/step - loss: 1.2259 - accuracy: 0.7650 - val_loss: 7.1992 - val_accu
racy: 0.3287
Epoch 7/50
27/27 [==============================] - 219s 8s/step - loss: 0.7201 - accuracy: 0.8275 - val_loss: 3.2643 - val_accu
racy: 0.3843
Epoch 8/50
27/27 [==============================] - 217s 8s/step - loss: 0.5741 - accuracy: 0.8542 - val_loss: 6.4144 - val_accu
racy: 0.4028
Epoch 9/50
27/27 [==============================] - 221s 8s/step - loss: 0.3542 - accuracy: 0.9086 - val_loss: 5.4909 - val_accu
racy: 0.4167
Epoch 10/50
27/27 [==============================] - 220s 8s/step - loss: 0.4614 - accuracy: 0.8773 - val_loss: 3.7004 - val_accu
racy: 0.5000
Epoch 11/50
27/27 [==============================] - 221s 8s/step - loss: 0.5354 - accuracy: 0.8912 - val_loss: 14.0985 - val_acc
uracy: 0.3426
Epoch 12/50
27/27 [==============================] - 223s 8s/step - loss: 0.3914 - accuracy: 0.9225 - val_loss: 3.1777 - val_accu
racy: 0.6343
Epoch 13/50
27/27 [==============================] - 221s 8s/step - loss: 0.2803 - accuracy: 0.9375 - val_loss: 2.5212 - val_accu
racy: 0.6852
Epoch 14/50
27/27 [==============================] - 220s 8s/step - loss: 0.2349 - accuracy: 0.9398 - val_loss: 3.2649 - val_accu
racy: 0.5880
Epoch 15/50
27/27 [==============================] - 221s 8s/step - loss: 0.2071 - accuracy: 0.9595 - val_loss: 5.4794 - val_accu
racy: 0.4630
Epoch 16/50
27/27 [==============================] - 221s 8s/step - loss: 0.2975 - accuracy: 0.9387 - val_loss: 4.4033 - val_accu
racy: 0.5602
Epoch 17/50
27/27 [==============================] - 220s 8s/step - loss: 0.1413 - accuracy: 0.9688 - val_loss: 3.9952 - val_accu
racy: 0.6019
Epoch 18/50
27/27 [==============================] - 220s 8s/step - loss: 0.2053 - accuracy: 0.9572 - val_loss: 3.7448 - val_accu
racy: 0.5648
Epoch 19/50
27/27 [==============================] - 223s 8s/step - loss: 0.1743 - accuracy: 0.9606 - val_loss: 12.0007 - val_acc
uracy: 0.5556
Epoch 20/50
27/27 [==============================] - 221s 8s/step - loss: 0.1884 - accuracy: 0.9549 - val_loss: 23.0579 - val_acc
uracy: 0.6343
Epoch 21/50
27/27 [==============================] - 221s 8s/step - loss: 0.1882 - accuracy: 0.9653 - val_loss: 5.0771 - val_accu
racy: 0.6574
Epoch 22/50
27/27 [==============================] - 220s 8s/step - loss: 0.0882 - accuracy: 0.9734 - val_loss: 4.6248 - val_accu
racy: 0.6806
Epoch 23/50
27/27 [==============================] - 221s 8s/step - loss: 0.1110 - accuracy: 0.9780 - val_loss: 2.9822 - val_accu
racy: 0.6852
Epoch 24/50
27/27 [==============================] - 220s 8s/step - loss: 0.1383 - accuracy: 0.9688 - val_loss: 4.7006 - val_accu
racy: 0.7222
Epoch 25/50
27/27 [==============================] - 220s 8s/step - loss: 0.0424 - accuracy: 0.9850 - val_loss: 6.0230 - val_accu
racy: 0.7083
Epoch 26/50
27/27 [==============================] - 221s 8s/step - loss: 0.1157 - accuracy: 0.9653 - val_loss: 3.5579 - val_accu
racy: 0.6759
```

```
Epoch 27/50
27/27 [==============================] - 219s 8s/step - loss: 0.0796 - accuracy: 0.9792 - val_loss: 6.2487 - val_accu
racy: 0.7361
Epoch 28/50
27/27 [==============================] - 220s 8s/step - loss: 0.0615 - accuracy: 0.9815 - val_loss: 5.1919 - val_accu
racy: 0.6435
Epoch 29/50
27/27 [==============================] - 221s 8s/step - loss: 0.1247 - accuracy: 0.9757 - val_loss: 5.6298 - val_accu
racy: 0.7269
Epoch 30/50
27/27 [==============================] - 221s 8s/step - loss: 0.0720 - accuracy: 0.9850 - val_loss: 9.2303 - val_accu
racy: 0.6667
Epoch 31/50
27/27 [==============================] - 222s 8s/step - loss: 0.0697 - accuracy: 0.9850 - val_loss: 8.8590 - val_accu
racy: 0.7037
Epoch 32/50
27/27 [==============================] - 221s 8s/step - loss: 0.1106 - accuracy: 0.9769 - val_loss: 12.1722 - val_acc
uracy: 0.6898
Epoch 33/50
27/27 [==============================] - 220s 8s/step - loss: 0.0177 - accuracy: 0.9954 - val_loss: 2.7695 - val_accu
racy: 0.7500
Epoch 34/50
27/27 [==============================] - 220s 8s/step - loss: 0.0975 - accuracy: 0.9769 - val_loss: 9.4472 - val_accu
racy: 0.7546
Epoch 35/50
27/27 [==============================] - 221s 8s/step - loss: 0.0865 - accuracy: 0.9780 - val_loss: 6.0042 - val_accu
racy: 0.7454
Epoch 36/50
27/27 [==============================] - 221s 8s/step - loss: 0.0308 - accuracy: 0.9896 - val_loss: 280.5748 - val_ac
curacy: 0.5463
Epoch 37/50
27/27 [==============================] - 227s 8s/step - loss: 0.0834 - accuracy: 0.9815 - val_loss: 11.3532 - val_acc
uracy: 0.6759
Epoch 38/50
27/27 [==============================] - 220s 8s/step - loss: 0.0485 - accuracy: 0.9850 - val_loss: 27.4715 - val_acc
uracy: 0.6250
Epoch 39/50
27/27 [==============================] - 221s 8s/step - loss: 0.0728 - accuracy: 0.9792 - val_loss: 34.0248 - val_acc
uracy: 0.6667
Epoch 40/50
27/27 [==============================] - 221s 8s/step - loss: 0.0861 - accuracy: 0.9861 - val_loss: 41.9391 - val_acc
uracy: 0.6574
Epoch 41/50
27/27 [==============================] - 221s 8s/step - loss: 0.0374 - accuracy: 0.9861 - val_loss: 112.5504 - val_ac
curacy: 0.6944
Epoch 42/50
27/27 [==============================] - 220s 8s/step - loss: 0.0338 - accuracy: 0.9873 - val_loss: 223.7536 - val_ac
curacy: 0.6713
Epoch 43/50
27/27 [==============================] - 222s 8s/step - loss: 0.0493 - accuracy: 0.9896 - val_loss: 77.0841 - val_acc
uracy: 0.7222
Epoch 44/50
27/27 [==============================] - 221s 8s/step - loss: 0.0263 - accuracy: 0.9931 - val_loss: 7.1089 - val_accu
racy: 0.6389
Epoch 45/50
27/27 [==============================] - 221s 8s/step - loss: 0.0416 - accuracy: 0.9884 - val_loss: 138.3571 - val_ac
curacy: 0.6759
Epoch 46/50
27/27 [==============================] - 221s 8s/step - loss: 0.0315 - accuracy: 0.9931 - val_loss: 428.3932 - val_ac
curacy: 0.6574
Epoch 47/50
27/27 [==============================] - 222s 8s/step - loss: 0.1008 - accuracy: 0.9803 - val_loss: 6.0184 - val_accu
racy: 0.6759
Epoch 48/50
27/27 [==============================] - 220s 8s/step - loss: 0.0050 - accuracy: 0.9965 - val_loss: 10.1305 - val_acc
uracy: 0.6806
Epoch 49/50
27/27 [==============================] - 221s 8s/step - loss: 0.0907 - accuracy: 0.9792 - val_loss: 125.8059 - val_ac
curacy: 0.7176
Epoch 50/50
27/27 [==============================] - 221s 8s/step - loss: 0.0298 - accuracy: 0.9954 - val_loss: 239.8303 - val_ac
curacy: 0.6852
----------------Test accuracy for 1 fold----------------
Confusion Matrix :
 [[17  3  4  6]
 [ 4 23  3  0]
 [ 4  1 25  0]
 [ 3  1  9 17]]
Accuracy    :  0.6833333333333333
Specificity :  0.8683632583623587
Sensitivity :  0.6833333333333333
-----------------------------End of 1 Fold-------------------------
------------------------Start of 2 Fold------------------------
test images for normal class from 30 60
test images for cataract class from 30 60
test images for glaucoma class from 30 60
test images for retina disease class from 30 60
train_validation images for normal class from 0 to 30 and 60 to 300
train_validation images for cataract class from 0 to 30 and 60 to 300
train_validation  images for glaucoma class from 0 30 and 60 to 300
train_validation images for retina disease class from 0 to 30 and 60 to 300
model building and compiling for fold 2
Epoch 1/50
27/27 [==============================] - 251s 9s/step - loss: 12.5064 - accuracy: 0.5023 - val_loss: 15.9334 - val_ac
curacy: 0.3148
Epoch 2/50
27/27 [==============================] - 224s 8s/step - loss: 5.0495 - accuracy: 0.5301 - val_loss: 5.1200 - val_accu
racy: 0.5093
Epoch 3/50
27/27 [==============================] - 224s 8s/step - loss: 3.1115 - accuracy: 0.6273 - val_loss: 7.5052 - val_accu
racy: 0.3056
Epoch 4/50
27/27 [==============================] - 223s 8s/step - loss: 1.9022 - accuracy: 0.6574 - val_loss: 3.8409 - val_accu
racy: 0.3889
Epoch 5/50
27/27 [==============================] - 222s 8s/step - loss: 1.6997 - accuracy: 0.7060 - val_loss: 4.8268 - val_accu
racy: 0.5185
Epoch 6/50
27/27 [==============================] - 223s 8s/step - loss: 1.0343 - accuracy: 0.7975 - val_loss: 7.8802 - val_accu
racy: 0.3380
Epoch 7/50
27/27 [==============================] - 225s 8s/step - loss: 1.0928 - accuracy: 0.8368 - val_loss: 20.6616 - val_acc
uracy: 0.2593
Epoch 8/50
27/27 [==============================] - 239s 9s/step - loss: 0.6352 - accuracy: 0.8762 - val_loss: 7.1705 - val_accu
racy: 0.3889
Epoch 9/50
27/27 [==============================] - 225s 8s/step - loss: 0.4914 - accuracy: 0.9120 - val_loss: 7.3796 - val_accu
racy: 0.4306
Epoch 10/50
27/27 [==============================] - 223s 8s/step - loss: 0.3543 - accuracy: 0.9097 - val_loss: 4.1549 - val_accu
racy: 0.5463
Epoch 11/50
27/27 [==============================] - 223s 8s/step - loss: 0.3074 - accuracy: 0.9190 - val_loss: 9.6577 - val_accu
racy: 0.3102
Epoch 12/50
27/27 [==============================] - 224s 8s/step - loss: 0.3027 - accuracy: 0.9282 - val_loss: 3.7970 - val_accu
racy: 0.5972
Epoch 13/50
27/27 [==============================] - 222s 8s/step - loss: 0.2478 - accuracy: 0.9259 - val_loss: 5.7629 - val_accu
racy: 0.4954
Epoch 14/50
27/27 [==============================] - 223s 8s/step - loss: 0.3033 - accuracy: 0.9306 - val_loss: 3.3551 - val_accu
racy: 0.6713
Epoch 15/50
27/27 [==============================] - 244s 9s/step - loss: 0.1197 - accuracy: 0.9549 - val_loss: 5.1760 - val_accu
racy: 0.5185
Epoch 16/50
27/27 [==============================] - 240s 9s/step - loss: 0.2018 - accuracy: 0.9479 - val_loss: 6.5323 - val_accu
racy: 0.4722
Epoch 17/50
27/27 [==============================] - 229s 9s/step - loss: 0.1484 - accuracy: 0.9606 - val_loss: 4.7462 - val_accu
racy: 0.6065
Epoch 18/50
27/27 [==============================] - 233s 9s/step - loss: 0.1569 - accuracy: 0.9630 - val_loss: 9.1238 - val_accu
racy: 0.5185
Epoch 19/50
27/27 [==============================] - 234s 9s/step - loss: 0.1091 - accuracy: 0.9699 - val_loss: 4.3358 - val_accu
racy: 0.5648
Epoch 20/50
27/27 [==============================] - 229s 9s/step - loss: 0.1624 - accuracy: 0.9618 - val_loss: 5.2333 - val_accu
racy: 0.6343
Epoch 21/50
27/27 [==============================] - 232s 9s/step - loss: 0.2177 - accuracy: 0.9549 - val_loss: 7.0286 - val_accu
racy: 0.6065
Epoch 22/50
27/27 [==============================] - 231s 9s/step - loss: 0.0911 - accuracy: 0.9711 - val_loss: 2.9840 - val_accu
racy: 0.7037
Epoch 23/50
27/27 [==============================] - 239s 9s/step - loss: 0.1035 - accuracy: 0.9780 - val_loss: 57.1042 - val_acc
uracy: 0.4954
Epoch 24/50
27/27 [==============================] - 231s 9s/step - loss: 0.1214 - accuracy: 0.9630 - val_loss: 4.7654 - val_accu
racy: 0.6204
Epoch 25/50
27/27 [==============================] - 242s 9s/step - loss: 0.0850 - accuracy: 0.9734 - val_loss: 2.7000 - val_accu
racy: 0.7454
Epoch 26/50
27/27 [==============================] - 245s 9s/step - loss: 0.1129 - accuracy: 0.9734 - val_loss: 2.8402 - val_accu
racy: 0.7500
Epoch 27/50
27/27 [==============================] - 243s 9s/step - loss: 0.1044 - accuracy: 0.9699 - val_loss: 10.1072 - val_acc
uracy: 0.6389
Epoch 28/50
27/27 [==============================] - 231s 9s/step - loss: 0.0876 - accuracy: 0.9757 - val_loss: 3.3233 - val_accu
racy: 0.6806
```

```
Epoch 29/50
27/27 [==============================] - 231s 9s/step - loss: 0.1141 - accuracy: 0.9722 - val_loss: 6.1670 - val_accu
racy: 0.5602
Epoch 30/50
27/27 [==============================] - 231s 9s/step - loss: 0.1531 - accuracy: 0.9618 - val_loss: 4.2978 - val_accu
racy: 0.7315
Epoch 31/50
27/27 [==============================] - 231s 9s/step - loss: 0.0348 - accuracy: 0.9850 - val_loss: 6.1345 - val_accu
racy: 0.7222
Epoch 32/50
27/27 [==============================] - 233s 9s/step - loss: 0.0434 - accuracy: 0.9896 - val_loss: 4.0512 - val_accu
racy: 0.6713
Epoch 33/50
27/27 [==============================] - 237s 9s/step - loss: 0.0933 - accuracy: 0.9873 - val_loss: 3.6567 - val_accu
racy: 0.6852
Epoch 34/50
27/27 [==============================] - 223s 8s/step - loss: 0.1048 - accuracy: 0.9769 - val_loss: 4.7404 - val_accu
racy: 0.6852
Epoch 35/50
27/27 [==============================] - 224s 8s/step - loss: 0.0429 - accuracy: 0.9873 - val_loss: 4.5488 - val_accu
racy: 0.6944
Epoch 36/50
27/27 [==============================] - 222s 8s/step - loss: 0.0394 - accuracy: 0.9931 - val_loss: 5.5653 - val_accu
racy: 0.7176
Epoch 37/50
27/27 [==============================] - 222s 8s/step - loss: 0.0551 - accuracy: 0.9861 - val_loss: 3.1409 - val_accu
racy: 0.7407
Epoch 38/50
27/27 [==============================] - 223s 8s/step - loss: 0.0619 - accuracy: 0.9826 - val_loss: 4.2687 - val_accu
racy: 0.7407
Epoch 39/50
27/27 [==============================] - 233s 9s/step - loss: 0.0688 - accuracy: 0.9873 - val_loss: 8.5608 - val_accu
racy: 0.7454
Epoch 40/50
27/27 [==============================] - 245s 9s/step - loss: 0.0687 - accuracy: 0.9850 - val_loss: 8.5091 - val_accu
racy: 0.7176
Epoch 41/50
27/27 [==============================] - 224s 8s/step - loss: 0.0556 - accuracy: 0.9907 - val_loss: 6.9203 - val_accu
racy: 0.6852
Epoch 42/50
27/27 [==============================] - 225s 8s/step - loss: 0.0777 - accuracy: 0.9884 - val_loss: 12.0831 - val_acc
uracy: 0.7269
Epoch 43/50
27/27 [==============================] - 226s 8s/step - loss: 0.0342 - accuracy: 0.9907 - val_loss: 14.0005 - val_acc
uracy: 0.7361
Epoch 44/50
27/27 [==============================] - 239s 9s/step - loss: 0.0983 - accuracy: 0.9803 - val_loss: 56.3754 - val_acc
uracy: 0.6713
Epoch 45/50
27/27 [==============================] - 223s 8s/step - loss: 0.0567 - accuracy: 0.9850 - val_loss: 29.0877 - val_acc
uracy: 0.7361
Epoch 46/50
27/27 [==============================] - 228s 8s/step - loss: 0.0503 - accuracy: 0.9884 - val_loss: 3.6209 - val_accu
racy: 0.7176
Epoch 47/50
27/27 [==============================] - 224s 8s/step - loss: 0.0777 - accuracy: 0.9780 - val_loss: 9.0729 - val_accu
racy: 0.6944
Epoch 48/50
27/27 [==============================] - 227s 8s/step - loss: 0.1213 - accuracy: 0.9815 - val_loss: 5.0018 - val_accu
racy: 0.6250
Epoch 49/50
27/27 [==============================] - 223s 8s/step - loss: 0.0233 - accuracy: 0.9942 - val_loss: 27.8078 - val_acc
uracy: 0.6991
Epoch 50/50
27/27 [==============================] - 223s 8s/step - loss: 0.0365 - accuracy: 0.9896 - val_loss: 3.3431 - val_accu
racy: 0.6852
----------------Test accuracy for 2 fold----------------
Confusion Matrix :
 [[16  1 11  2]
 [ 1 18 10  1]
 [ 2  0 28  0]
 [ 0  2 12 16]]
Accuracy    :  0.65
Specificity :  0.8656207246568692
Sensitivity :  0.6499999999999999
----------------------------End of 2 Fold-------------------------
------------------------Start of 3 Fold-----------------------
test images for normal class from 60 90
test images for cataract class from 60 90
test images for glaucoma class from 60 90
test images for retina disease class from 60 90
train_validation images for normal class from 0 to 60 and 90 to 300
train_validation images for cataract class from 0 to 60 and 90 to 300
train_validation  images for glaucoma class from 0 60 and 90 to 300
train_validation images for retina disease class from 0 to 60 and 90 to 300
model building and compiling for fold 3
Epoch 1/50
27/27 [==============================] - 255s 9s/step - loss: 12.7556 - accuracy: 0.4734 - val_loss: 26.2583 - val_ac
```

```
curacy: 0.4769
Epoch 2/50
27/27 [==============================] - 230s 8s/step - loss: 5.5078 - accuracy: 0.5660 - val_loss: 13.3359 - val_acc
uracy: 0.3704
Epoch 3/50
27/27 [==============================] - 227s 8s/step - loss: 2.9738 - accuracy: 0.6447 - val_loss: 14.5456 - val_acc
uracy: 0.2963
Epoch 4/50
27/27 [==============================] - 226s 8s/step - loss: 1.7947 - accuracy: 0.6481 - val_loss: 8.0374 - val_accu
racy: 0.3333
Epoch 5/50
27/27 [==============================] - 244s 9s/step - loss: 1.4656 - accuracy: 0.7199 - val_loss: 9.2674 - val_accu
racy: 0.3056
Epoch 6/50
27/27 [==============================] - 235s 9s/step - loss: 1.3223 - accuracy: 0.7512 - val_loss: 10.6677 - val_acc
uracy: 0.3426
Epoch 7/50
27/27 [==============================] - 231s 9s/step - loss: 0.6510 - accuracy: 0.8345 - val_loss: 7.9405 - val_accu
racy: 0.3750
Epoch 8/50
27/27 [==============================] - 230s 9s/step - loss: 0.5879 - accuracy: 0.8785 - val_loss: 12.4358 - val_acc
uracy: 0.2917
Epoch 9/50
27/27 [==============================] - 233s 9s/step - loss: 0.4193 - accuracy: 0.8924 - val_loss: 9.8201 - val_accu
racy: 0.2870
Epoch 10/50
27/27 [==============================] - 235s 9s/step - loss: 0.3708 - accuracy: 0.9259 - val_loss: 5.3287 - val_accu
racy: 0.4954
Epoch 11/50
27/27 [==============================] - 226s 8s/step - loss: 0.1577 - accuracy: 0.9572 - val_loss: 5.8573 - val_accu
racy: 0.4630
Epoch 12/50
27/27 [==============================] - 226s 8s/step - loss: 0.2144 - accuracy: 0.9340 - val_loss: 6.7670 - val_accu
racy: 0.4352
Epoch 13/50
27/27 [==============================] - 226s 8s/step - loss: 0.2481 - accuracy: 0.9421 - val_loss: 4.0915 - val_accu
racy: 0.5787
Epoch 14/50
27/27 [==============================] - 226s 8s/step - loss: 0.2965 - accuracy: 0.9294 - val_loss: 3.5442 - val_accu
racy: 0.5417
Epoch 15/50
27/27 [==============================] - 246s 9s/step - loss: 0.2781 - accuracy: 0.9352 - val_loss: 3.1746 - val_accu
racy: 0.6065
Epoch 16/50
27/27 [==============================] - 234s 9s/step - loss: 0.1167 - accuracy: 0.9676 - val_loss: 2.8724 - val_accu
racy: 0.6759
Epoch 17/50
27/27 [==============================] - 240s 9s/step - loss: 0.2469 - accuracy: 0.9688 - val_loss: 3.9201 - val_accu
racy: 0.6157
Epoch 18/50
27/27 [==============================] - 229s 9s/step - loss: 0.1175 - accuracy: 0.9664 - val_loss: 1.7321 - val_accu
racy: 0.7361
Epoch 19/50
27/27 [==============================] - 236s 9s/step - loss: 0.1581 - accuracy: 0.9595 - val_loss: 3.6991 - val_accu
racy: 0.6157
Epoch 20/50
27/27 [==============================] - 227s 8s/step - loss: 0.0800 - accuracy: 0.9745 - val_loss: 2.3444 - val_accu
racy: 0.7130
Epoch 21/50
27/27 [==============================] - 227s 8s/step - loss: 0.1363 - accuracy: 0.9560 - val_loss: 1.9825 - val_accu
racy: 0.7593
Epoch 22/50
27/27 [==============================] - 227s 8s/step - loss: 0.1880 - accuracy: 0.9468 - val_loss: 4.7746 - val_accu
racy: 0.7083
Epoch 23/50
27/27 [==============================] - 232s 9s/step - loss: 0.1241 - accuracy: 0.9699 - val_loss: 2.5292 - val_accu
racy: 0.7454
Epoch 24/50
27/27 [==============================] - 229s 9s/step - loss: 0.1739 - accuracy: 0.9664 - val_loss: 1.8897 - val_accu
racy: 0.7639
Epoch 25/50
27/27 [==============================] - 241s 9s/step - loss: 0.0297 - accuracy: 0.9907 - val_loss: 2.1299 - val_accu
racy: 0.7176
Epoch 26/50
27/27 [==============================] - 232s 9s/step - loss: 0.1123 - accuracy: 0.9734 - val_loss: 3.0589 - val_accu
racy: 0.6991
Epoch 27/50
27/27 [==============================] - 242s 9s/step - loss: 0.0308 - accuracy: 0.9919 - val_loss: 2.8153 - val_accu
racy: 0.7361
Epoch 28/50
27/27 [==============================] - 229s 9s/step - loss: 0.1449 - accuracy: 0.9664 - val_loss: 5.9329 - val_accu
racy: 0.7361
Epoch 29/50
27/27 [==============================] - 235s 9s/step - loss: 0.0466 - accuracy: 0.9826 - val_loss: 2.8935 - val_accu
racy: 0.6852
Epoch 30/50
27/27 [==============================] - 226s 8s/step - loss: 0.1062 - accuracy: 0.9745 - val_loss: 2.4799 - val_accu
racy: 0.7454
```

```
Epoch 31/50
27/27 [==============================] - 234s 9s/step - loss: 0.0774 - accuracy: 0.9780 - val_loss: 2.1388 - val_accu
racy: 0.7731
Epoch 32/50
27/27 [==============================] - 236s 9s/step - loss: 0.0382 - accuracy: 0.9873 - val_loss: 3.0209 - val_accu
racy: 0.6806
Epoch 33/50
27/27 [==============================] - 232s 9s/step - loss: 0.0869 - accuracy: 0.9780 - val_loss: 3.9424 - val_accu
racy: 0.6528
Epoch 34/50
27/27 [==============================] - 233s 9s/step - loss: 0.0837 - accuracy: 0.9734 - val_loss: 4.2098 - val_accu
racy: 0.6620
Epoch 35/50
27/27 [==============================] - 238s 9s/step - loss: 0.0201 - accuracy: 0.9931 - val_loss: 5.9721 - val_accu
racy: 0.5972
Epoch 36/50
27/27 [==============================] - 227s 8s/step - loss: 0.0322 - accuracy: 0.9896 - val_loss: 11.5409 - val_acc
uracy: 0.5787
Epoch 37/50
27/27 [==============================] - 226s 8s/step - loss: 0.0425 - accuracy: 0.9815 - val_loss: 7.1973 - val_accu
racy: 0.6759
Epoch 38/50
27/27 [==============================] - 226s 8s/step - loss: 0.1353 - accuracy: 0.9757 - val_loss: 5.2469 - val_accu
racy: 0.7176
Epoch 39/50
27/27 [==============================] - 233s 9s/step - loss: 0.0082 - accuracy: 0.9977 - val_loss: 5.4861 - val_accu
racy: 0.7685
Epoch 40/50
27/27 [==============================] - 226s 8s/step - loss: 0.0412 - accuracy: 0.9873 - val_loss: 3.5743 - val_accu
racy: 0.7361
Epoch 41/50
27/27 [==============================] - 224s 8s/step - loss: 0.0544 - accuracy: 0.9873 - val_loss: 10.4505 - val_acc
uracy: 0.7407
Epoch 42/50
27/27 [==============================] - 240s 9s/step - loss: 0.0592 - accuracy: 0.9861 - val_loss: 8.0629 - val_accu
racy: 0.7361
Epoch 43/50
27/27 [==============================] - 229s 8s/step - loss: 0.1160 - accuracy: 0.9769 - val_loss: 14.4447 - val_acc
uracy: 0.6620
Epoch 44/50
27/27 [==============================] - 236s 9s/step - loss: 0.0540 - accuracy: 0.9896 - val_loss: 7.3198 - val_accu
racy: 0.7361
Epoch 45/50
27/27 [==============================] - 231s 9s/step - loss: 0.0359 - accuracy: 0.9907 - val_loss: 10.7483 - val_acc
uracy: 0.7222
Epoch 46/50
27/27 [==============================] - 234s 9s/step - loss: 0.0292 - accuracy: 0.9919 - val_loss: 4.8207 - val_accu
racy: 0.7037
Epoch 47/50
27/27 [==============================] - 233s 9s/step - loss: 0.0253 - accuracy: 0.9954 - val_loss: 3.2336 - val_accu
racy: 0.7593
Epoch 48/50
27/27 [==============================] - 245s 9s/step - loss: 0.0655 - accuracy: 0.9792 - val_loss: 4.2374 - val_accu
racy: 0.7269
Epoch 49/50
27/27 [==============================] - 236s 9s/step - loss: 0.0683 - accuracy: 0.9873 - val_loss: 30.7317 - val_acc
uracy: 0.6898
Epoch 50/50
27/27 [==============================] - 233s 9s/step - loss: 0.0131 - accuracy: 0.9965 - val_loss: 31.1848 - val_acc
uracy: 0.7315
----------------Test accuracy for 3 fold----------------
Confusion Matrix :
 [[21  0  7  2]
 [ 2 22  2  4]
 [ 0  1 27  2]
 [ 4  2  5 19]]
Accuracy    :  0.7416666666666667
Specificity :  0.897321786795471
Sensitivity :  0.7416666666666666
-----------------------------End of 3 Fold-------------------------
------------------------Start of 4 Fold------------------------
test images for normal class from 90 120
test images for cataract class from 90 120
test images for glaucoma class from 90 120
test images for retina disease class from 90 120
train_validation images for normal class from 0 to 90 and 120 to 300
train_validation images for cataract class from 0 to 90 and 120 to 300
train_validation  images for glaucoma class from 0 90 and 120 to 300
train_validation images for retina disease class from 0 to 90 and 120 to 300
model building and compiling for fold 4
Epoch 1/50
27/27 [==============================] - 284s 10s/step - loss: 13.7455 - accuracy: 0.4514 - val_loss: 27.1163 - val_a
ccuracy: 0.4630
Epoch 2/50
27/27 [==============================] - 246s 9s/step - loss: 5.3571 - accuracy: 0.5405 - val_loss: 14.5049 - val_acc
uracy: 0.3889
Epoch 3/50
27/27 [==============================] - 247s 9s/step - loss: 2.9848 - accuracy: 0.6250 - val_loss: 11.9622 - val_acc
```

```
uracy: 0.3519
Epoch 4/50
27/27 [==============================] - 244s 9s/step - loss: 1.7517 - accuracy: 0.6562 - val_loss: 9.4896 - val_accu
racy: 0.3287
Epoch 5/50
27/27 [==============================] - 239s 9s/step - loss: 1.5434 - accuracy: 0.7269 - val_loss: 7.4874 - val_accu
racy: 0.3889
Epoch 6/50
27/27 [==============================] - 238s 9s/step - loss: 1.1456 - accuracy: 0.7674 - val_loss: 11.1404 - val_acc
uracy: 0.2917
Epoch 7/50
27/27 [==============================] - 242s 9s/step - loss: 0.6893 - accuracy: 0.8079 - val_loss: 4.0957 - val_accu
racy: 0.5046
Epoch 8/50
27/27 [==============================] - 235s 9s/step - loss: 0.4084 - accuracy: 0.8843 - val_loss: 3.0095 - val_accu
racy: 0.5370
Epoch 9/50
27/27 [==============================] - 232s 9s/step - loss: 0.4869 - accuracy: 0.8785 - val_loss: 10.0974 - val_acc
uracy: 0.3750
Epoch 10/50
27/27 [==============================] - 238s 9s/step - loss: 0.3080 - accuracy: 0.9039 - val_loss: 5.1284 - val_accu
racy: 0.4722
Epoch 11/50
27/27 [==============================] - 241s 9s/step - loss: 0.2590 - accuracy: 0.9259 - val_loss: 5.8363 - val_accu
racy: 0.4306
Epoch 12/50
27/27 [==============================] - 248s 9s/step - loss: 0.2420 - accuracy: 0.9259 - val_loss: 5.2826 - val_accu
racy: 0.4306
Epoch 13/50
27/27 [==============================] - 232s 9s/step - loss: 0.1595 - accuracy: 0.9572 - val_loss: 6.0363 - val_accu
racy: 0.4120
Epoch 14/50
27/27 [==============================] - 235s 9s/step - loss: 0.2011 - accuracy: 0.9398 - val_loss: 4.2265 - val_accu
racy: 0.5926
Epoch 15/50
27/27 [==============================] - 232s 9s/step - loss: 0.1670 - accuracy: 0.9410 - val_loss: 5.1416 - val_accu
racy: 0.5093
Epoch 16/50
27/27 [==============================] - 237s 9s/step - loss: 0.1574 - accuracy: 0.9537 - val_loss: 2.8258 - val_accu
racy: 0.6157
Epoch 17/50
27/27 [==============================] - 231s 9s/step - loss: 0.1078 - accuracy: 0.9711 - val_loss: 4.0091 - val_accu
racy: 0.6481
Epoch 18/50
27/27 [==============================] - 236s 9s/step - loss: 0.0782 - accuracy: 0.9780 - val_loss: 2.1700 - val_accu
racy: 0.7037
Epoch 19/50
27/27 [==============================] - 242s 9s/step - loss: 0.2287 - accuracy: 0.9664 - val_loss: 4.2002 - val_accu
racy: 0.6481
Epoch 20/50
27/27 [==============================] - 243s 9s/step - loss: 0.1030 - accuracy: 0.9711 - val_loss: 3.3689 - val_accu
racy: 0.6435
Epoch 21/50
27/27 [==============================] - 238s 9s/step - loss: 0.1477 - accuracy: 0.9676 - val_loss: 2.8921 - val_accu
racy: 0.6435
Epoch 22/50
27/27 [==============================] - 238s 9s/step - loss: 0.1030 - accuracy: 0.9792 - val_loss: 3.5626 - val_accu
racy: 0.5556
Epoch 23/50
27/27 [==============================] - 241s 9s/step - loss: 0.0880 - accuracy: 0.9769 - val_loss: 6.2233 - val_accu
racy: 0.4907
Epoch 24/50
27/27 [==============================] - 241s 9s/step - loss: 0.0579 - accuracy: 0.9861 - val_loss: 3.9569 - val_accu
racy: 0.6204
Epoch 25/50
27/27 [==============================] - 239s 9s/step - loss: 0.0548 - accuracy: 0.9815 - val_loss: 55.8555 - val_acc
uracy: 0.5880
Epoch 26/50
27/27 [==============================] - 240s 9s/step - loss: 0.1842 - accuracy: 0.9664 - val_loss: 4.1264 - val_accu
racy: 0.6528
Epoch 27/50
27/27 [==============================] - 241s 9s/step - loss: 0.0980 - accuracy: 0.9826 - val_loss: 4.1768 - val_accu
racy: 0.6481
Epoch 28/50
27/27 [==============================] - 242s 9s/step - loss: 0.0739 - accuracy: 0.9873 - val_loss: 3.9520 - val_accu
racy: 0.6667
Epoch 29/50
27/27 [==============================] - 243s 9s/step - loss: 0.0231 - accuracy: 0.9907 - val_loss: 3.6964 - val_accu
racy: 0.6806
Epoch 30/50
27/27 [==============================] - 240s 9s/step - loss: 0.0671 - accuracy: 0.9850 - val_loss: 3.5790 - val_accu
racy: 0.7176
Epoch 31/50
27/27 [==============================] - 241s 9s/step - loss: 0.0695 - accuracy: 0.9826 - val_loss: 3.5308 - val_accu
racy: 0.6944
Epoch 32/50
27/27 [==============================] - 244s 9s/step - loss: 0.0507 - accuracy: 0.9896 - val_loss: 3.7906 - val_accu
racy: 0.6898
```

```
Epoch 33/50
27/27 [==============================] - 242s 9s/step - loss: 0.0473 - accuracy: 0.9861 - val_loss: 3.2462 - val_accu
racy: 0.7130
Epoch 34/50
27/27 [==============================] - 245s 9s/step - loss: 0.0362 - accuracy: 0.9942 - val_loss: 2.3332 - val_accu
racy: 0.7546
Epoch 35/50
27/27 [==============================] - 258s 10s/step - loss: 0.0868 - accuracy: 0.9780 - val_loss: 3.2089 - val_acc
uracy: 0.7176
Epoch 36/50
27/27 [==============================] - 241s 9s/step - loss: 0.0200 - accuracy: 0.9907 - val_loss: 4.2837 - val_accu
racy: 0.6759
Epoch 37/50
27/27 [==============================] - 240s 9s/step - loss: 0.0672 - accuracy: 0.9850 - val_loss: 6.7182 - val_accu
racy: 0.6019
Epoch 38/50
27/27 [==============================] - 245s 9s/step - loss: 0.0732 - accuracy: 0.9803 - val_loss: 4.1826 - val_accu
racy: 0.6620
Epoch 39/50
27/27 [==============================] - 244s 9s/step - loss: 0.0883 - accuracy: 0.9838 - val_loss: 6.1183 - val_accu
racy: 0.6343
Epoch 40/50
27/27 [==============================] - 253s 9s/step - loss: 0.0162 - accuracy: 0.9942 - val_loss: 4.1627 - val_accu
racy: 0.6944
Epoch 41/50
27/27 [==============================] - 251s 9s/step - loss: 0.0733 - accuracy: 0.9826 - val_loss: 3.0225 - val_accu
racy: 0.7315
Epoch 42/50
27/27 [==============================] - 256s 10s/step - loss: 0.0334 - accuracy: 0.9907 - val_loss: 3.4308 - val_acc
uracy: 0.6991
Epoch 43/50
27/27 [==============================] - 254s 9s/step - loss: 0.0649 - accuracy: 0.9884 - val_loss: 3.1138 - val_accu
racy: 0.6991
Epoch 44/50
27/27 [==============================] - 248s 9s/step - loss: 0.0456 - accuracy: 0.9896 - val_loss: 2.7693 - val_accu
racy: 0.7083
Epoch 45/50
27/27 [==============================] - 246s 9s/step - loss: 0.0863 - accuracy: 0.9838 - val_loss: 3.6117 - val_accu
racy: 0.7083
Epoch 46/50
27/27 [==============================] - 254s 9s/step - loss: 0.0211 - accuracy: 0.9907 - val_loss: 4.4322 - val_accu
racy: 0.6065
Epoch 47/50
27/27 [==============================] - 253s 9s/step - loss: 0.0769 - accuracy: 0.9873 - val_loss: 3.3834 - val_accu
racy: 0.7176
Epoch 48/50
27/27 [==============================] - 246s 9s/step - loss: 0.0801 - accuracy: 0.9907 - val_loss: 3.0600 - val_accu
racy: 0.7269
Epoch 49/50
27/27 [==============================] - 231s 9s/step - loss: 0.0062 - accuracy: 0.9988 - val_loss: 3.1241 - val_accu
racy: 0.7176
Epoch 50/50
27/27 [==============================] - 228s 8s/step - loss: 0.0723 - accuracy: 0.9884 - val_loss: 24.1819 - val_acc
uracy: 0.6574
----------------Test accuracy for 4 fold----------------
Confusion Matrix :
 [[26  2  0  2]
 [ 0 29  1  0]
 [ 5  3 22  0]
 [ 7  6  6 11]]
Accuracy    :  0.7333333333333333
Specificity :  0.8898720285099685
Sensitivity :  0.7333333333333334
-----------------------------End of 4 Fold--------------------------
------------------------Start of 5 Fold------------------------
test images for normal class from 120 150
test images for cataract class from 120 150
test images for glaucoma class from 120 150
test images for retina disease class from 120 150
train_validation images for normal class from 0 to 120 and 150 to 300
train_validation images for cataract class from 0 to 120 and 150 to 300
train_validation  images for glaucoma class from 0 120 and 150 to 300
train_validation images for retina disease class from 0 to 120 and 150 to 300
model building and compiling for fold 5
Epoch 1/50
27/27 [==============================] - 282s 10s/step - loss: 11.6037 - accuracy: 0.4826 - val_loss: 44.1180 - val_a
ccuracy: 0.2731
Epoch 2/50
27/27 [==============================] - 248s 9s/step - loss: 5.2843 - accuracy: 0.5799 - val_loss: 14.7519 - val_acc
uracy: 0.4167
Epoch 3/50
27/27 [==============================] - 244s 9s/step - loss: 3.2120 - accuracy: 0.5961 - val_loss: 5.2850 - val_accu
racy: 0.4167
Epoch 4/50
27/27 [==============================] - 241s 9s/step - loss: 2.7039 - accuracy: 0.6366 - val_loss: 7.7214 - val_accu
racy: 0.3796
Epoch 5/50
27/27 [==============================] - 243s 9s/step - loss: 1.4764 - accuracy: 0.7315 - val_loss: 17.6622 - val_acc
```

```
uracy: 0.3009
Epoch 6/50
27/27 [==============================] - 245s 9s/step - loss: 0.9311 - accuracy: 0.7766 - val_loss: 8.8572 - val_accu
racy: 0.3102
Epoch 7/50
27/27 [==============================] - 244s 9s/step - loss: 1.1029 - accuracy: 0.7882 - val_loss: 4.9625 - val_accu
racy: 0.4769
Epoch 8/50
27/27 [==============================] - 243s 9s/step - loss: 0.5588 - accuracy: 0.8692 - val_loss: 3.8356 - val_accu
racy: 0.5509
Epoch 9/50
27/27 [==============================] - 242s 9s/step - loss: 0.4421 - accuracy: 0.8958 - val_loss: 7.4948 - val_accu
racy: 0.4120
Epoch 10/50
27/27 [==============================] - 242s 9s/step - loss: 0.3168 - accuracy: 0.9190 - val_loss: 6.6234 - val_accu
racy: 0.5278
Epoch 11/50
27/27 [==============================] - 244s 9s/step - loss: 0.2549 - accuracy: 0.9363 - val_loss: 12.7185 - val_acc
uracy: 0.3287
Epoch 12/50
27/27 [==============================] - 241s 9s/step - loss: 0.4094 - accuracy: 0.9306 - val_loss: 2.8043 - val_accu
racy: 0.6111
Epoch 13/50
27/27 [==============================] - 242s 9s/step - loss: 0.3084 - accuracy: 0.9456 - val_loss: 4.6164 - val_accu
racy: 0.5463
Epoch 14/50
27/27 [==============================] - 243s 9s/step - loss: 0.2918 - accuracy: 0.9398 - val_loss: 7.5523 - val_accu
racy: 0.4306
Epoch 15/50
27/27 [==============================] - 239s 9s/step - loss: 0.1922 - accuracy: 0.9502 - val_loss: 7.6876 - val_accu
racy: 0.4769
Epoch 16/50
27/27 [==============================] - 231s 9s/step - loss: 0.2402 - accuracy: 0.9514 - val_loss: 3.1345 - val_accu
racy: 0.5648
Epoch 17/50
27/27 [==============================] - 233s 9s/step - loss: 0.0931 - accuracy: 0.9850 - val_loss: 2.7022 - val_accu
racy: 0.6852
Epoch 18/50
27/27 [==============================] - 231s 9s/step - loss: 0.1009 - accuracy: 0.9757 - val_loss: 3.4234 - val_accu
racy: 0.6481
Epoch 19/50
27/27 [==============================] - 231s 9s/step - loss: 0.1643 - accuracy: 0.9606 - val_loss: 2.2799 - val_accu
racy: 0.7083
Epoch 20/50
27/27 [==============================] - 230s 9s/step - loss: 0.2111 - accuracy: 0.9537 - val_loss: 4.7080 - val_accu
racy: 0.6204
Epoch 21/50
27/27 [==============================] - 228s 8s/step - loss: 0.1244 - accuracy: 0.9711 - val_loss: 2.5338 - val_accu
racy: 0.6759
Epoch 22/50
27/27 [==============================] - 229s 9s/step - loss: 0.1008 - accuracy: 0.9745 - val_loss: 3.3255 - val_accu
racy: 0.7037
Epoch 23/50
27/27 [==============================] - 225s 8s/step - loss: 0.1514 - accuracy: 0.9699 - val_loss: 2.9033 - val_accu
racy: 0.6898
Epoch 24/50
27/27 [==============================] - 238s 9s/step - loss: 0.0902 - accuracy: 0.9711 - val_loss: 2.9789 - val_accu
racy: 0.7037
Epoch 25/50
27/27 [==============================] - 237s 9s/step - loss: 0.0843 - accuracy: 0.9676 - val_loss: 3.5972 - val_accu
racy: 0.6852
Epoch 26/50
27/27 [==============================] - 239s 9s/step - loss: 0.0799 - accuracy: 0.9815 - val_loss: 5.5905 - val_accu
racy: 0.6296
Epoch 27/50
27/27 [==============================] - 238s 9s/step - loss: 0.0893 - accuracy: 0.9769 - val_loss: 4.8286 - val_accu
racy: 0.6389
Epoch 28/50
27/27 [==============================] - 252s 9s/step - loss: 0.0857 - accuracy: 0.9850 - val_loss: 4.0645 - val_accu
racy: 0.6389
Epoch 29/50
27/27 [==============================] - 250s 9s/step - loss: 0.0562 - accuracy: 0.9873 - val_loss: 3.1791 - val_accu
racy: 0.6806
Epoch 30/50
27/27 [==============================] - 247s 9s/step - loss: 0.0381 - accuracy: 0.9896 - val_loss: 4.0392 - val_accu
racy: 0.6019
Epoch 31/50
27/27 [==============================] - 241s 9s/step - loss: 0.1578 - accuracy: 0.9583 - val_loss: 3.7354 - val_accu
racy: 0.6852
Epoch 32/50
27/27 [==============================] - 234s 9s/step - loss: 0.0792 - accuracy: 0.9838 - val_loss: 2.9466 - val_accu
racy: 0.6574
Epoch 33/50
27/27 [==============================] - 236s 9s/step - loss: 0.0827 - accuracy: 0.9861 - val_loss: 2.9564 - val_accu
racy: 0.6759
Epoch 34/50
27/27 [==============================] - 232s 9s/step - loss: 0.0856 - accuracy: 0.9815 - val_loss: 7.7787 - val_accu
racy: 0.4815
```

```
Epoch 35/50
27/27 [==============================] - 227s 8s/step - loss: 0.0558 - accuracy: 0.9873 - val_loss: 4.5030 - val_accu
racy: 0.6157
Epoch 36/50
27/27 [==============================] - 232s 9s/step - loss: 0.0184 - accuracy: 0.9896 - val_loss: 3.6016 - val_accu
racy: 0.6759
Epoch 37/50
27/27 [==============================] - 230s 9s/step - loss: 0.0276 - accuracy: 0.9907 - val_loss: 3.7481 - val_accu
racy: 0.6713
Epoch 38/50
27/27 [==============================] - 224s 8s/step - loss: 0.0460 - accuracy: 0.9861 - val_loss: 4.6857 - val_accu
racy: 0.6620
Epoch 39/50
27/27 [==============================] - 231s 9s/step - loss: 0.0097 - accuracy: 0.9965 - val_loss: 3.2670 - val_accu
racy: 0.7130
Epoch 40/50
27/27 [==============================] - 224s 8s/step - loss: 0.0649 - accuracy: 0.9873 - val_loss: 15.3663 - val_acc
uracy: 0.5139
Epoch 41/50
27/27 [==============================] - 227s 8s/step - loss: 0.0504 - accuracy: 0.9850 - val_loss: 8.5933 - val_accu
racy: 0.5787
Epoch 42/50
27/27 [==============================] - 222s 8s/step - loss: 0.0520 - accuracy: 0.9919 - val_loss: 5.6893 - val_accu
racy: 0.6435
Epoch 43/50
27/27 [==============================] - 225s 8s/step - loss: 0.0203 - accuracy: 0.9907 - val_loss: 3.1864 - val_accu
racy: 0.7361
Epoch 44/50
27/27 [==============================] - 223s 8s/step - loss: 0.0410 - accuracy: 0.9873 - val_loss: 4.2820 - val_accu
racy: 0.6389
Epoch 45/50
27/27 [==============================] - 236s 9s/step - loss: 0.0273 - accuracy: 0.9919 - val_loss: 5.4782 - val_accu
racy: 0.6991
Epoch 46/50
27/27 [==============================] - 235s 9s/step - loss: 0.0702 - accuracy: 0.9838 - val_loss: 5.4797 - val_accu
racy: 0.6667
Epoch 47/50
27/27 [==============================] - 226s 8s/step - loss: 0.0829 - accuracy: 0.9838 - val_loss: 3.6174 - val_accu
racy: 0.7361
Epoch 48/50
27/27 [==============================] - 226s 8s/step - loss: 0.0036 - accuracy: 0.9977 - val_loss: 3.9319 - val_accu
racy: 0.6944
Epoch 49/50
27/27 [==============================] - 226s 8s/step - loss: 0.0550 - accuracy: 0.9838 - val_loss: 7.3273 - val_accu
racy: 0.6019
Epoch 50/50
27/27 [==============================] - 227s 8s/step - loss: 0.0271 - accuracy: 0.9931 - val_loss: 5.5964 - val_accu
racy: 0.6806
----------------Test accuracy for 5 fold----------------
Confusion Matrix :
 [[28  2  0  0]
 [ 9 20  1  0]
 [ 8  1 21  0]
 [11  2  6 11]]
Accuracy    :  0.6666666666666666
Specificity :  0.8667540792540793
Sensitivity :  0.6666666666666666
-----------------------------End of 5 Fold-------------------------
```

Test Evaluation Results

In [17]:

```
test_accuracy
```

Out[17]:

```
[0.6833333333333333,
 0.65,
 0.7416666666666667,
 0.7333333333333333,
 0.6666666666666666]
```

In [18]:

```
mean_test_accuracy=np.mean(test_accuracy)
mean_test_accuracy
```

Out[18]:

```
0.6950000000000001
```

In [19]:

```
test_sensitivity
```

Out[19]:

```
[0.6833333333333333,
 0.6499999999999999,
 0.741666666666666,
 0.7333333333333334,
 0.6666666666666666]
```

In [20]:

```
mean_test_sensitivity= np.mean(test_sensitivity)
mean_test_sensitivity
```

Out[20]:

```
0.695
```

In [21]:

```
test_specificity
```

Out[21]:

```
[0.8683632583623587,
 0.8656207246568692,
 0.897321786795471,
 0.8898720285099685,
 0.8667540792540793]
```

In [22]:

```
mean_test_specificity= np.mean(test_specificity)
mean_test_specificity
```

Out[22]:

```
0.8775863755157495
```

Training and Validation Evaluation Results

In [23]:

```
train_acc
```

Out[23]:

```
array([0.50578701, 0.57060188, 0.61805558, 0.67939812, 0.71643519,
       0.7650463 , 0.8275463 , 0.85416669, 0.90856481, 0.87731481,
       0.8912037 , 0.9224537 , 0.9375    , 0.93981481, 0.95949072,
       0.9386574 , 0.96875   , 0.95717591, 0.96064812, 0.9548611 ,
       0.96527779, 0.97337961, 0.97800928, 0.96875   , 0.9849537 ,
       0.96527779, 0.97916669, 0.98148149, 0.97569442, 0.9849537 ,
       0.9849537 , 0.97685188, 0.99537039, 0.97685188, 0.97800928,
       0.98958331, 0.98148149, 0.9849537 , 0.97916669, 0.9861111 ,
       0.9861111 , 0.98726851, 0.98958331, 0.99305558, 0.98842591,
       0.99305558, 0.98032409, 0.99652779, 0.97916669, 0.99537039,
       0.50231481, 0.5300926 , 0.62731481, 0.6574074 , 0.70601851,
       0.7974537 , 0.83680558, 0.8761574 , 0.91203701, 0.90972221,
       0.91898149, 0.92824072, 0.92592591, 0.93055558, 0.9548611 ,
       0.94791669, 0.96064812, 0.96296299, 0.9699074 , 0.96180558,
       0.9548611 , 0.97106481, 0.97800928, 0.96296299, 0.97337961,
       0.97337961, 0.9699074 , 0.97569442, 0.97222221, 0.96180558,
       0.9849537 , 0.98958331, 0.98726851, 0.97685188, 0.98726851,
       0.99305558, 0.9861111 , 0.9826389 , 0.98726851, 0.9849537 ,
       0.99074072, 0.98842591, 0.99074072, 0.98032409, 0.9849537 ,
       0.98842591, 0.97800928, 0.98148149, 0.99421299, 0.98958331,
       0.47337964, 0.56597221, 0.64467591, 0.64814812, 0.7199074 ,
       0.7511574 , 0.83449072, 0.87847221, 0.8923611 , 0.92592591,
       0.95717591, 0.93402779, 0.94212961, 0.92939812, 0.93518519,
       0.9675926 , 0.96875   , 0.96643519, 0.95949072, 0.97453701,
       0.95601851, 0.94675928, 0.9699074 , 0.96643519, 0.99074072,
       0.97337961, 0.99189812, 0.96643519, 0.9826389 , 0.97453701,
       0.97800928, 0.98726851, 0.97800928, 0.97337961, 0.99305558,
       0.98958331, 0.98148149, 0.97569442, 0.99768519, 0.98726851,
       0.98726851, 0.9861111 , 0.97685188, 0.98958331, 0.99074072,
       0.99189812, 0.99537039, 0.97916669, 0.98726851, 0.99652779,
       0.4513889 , 0.54050928, 0.625     , 0.65625   , 0.72685188,
       0.7673611 , 0.80787039, 0.88425928, 0.87847221, 0.90393519,
       0.92592591, 0.92592591, 0.95717591, 0.93981481, 0.94097221,
       0.9537037 , 0.97106481, 0.97800928, 0.96643519, 0.97106481,
       0.9675926 , 0.97916669, 0.97685188, 0.9861111 , 0.98148149,
       0.96643519, 0.9826389 , 0.98726851, 0.99074072, 0.9849537 ,
       0.9826389 , 0.98958331, 0.9861111 , 0.99421299, 0.97800928,
       0.99074072, 0.9849537 , 0.98032409, 0.9837963 , 0.99421299,
       0.9826389 , 0.99074072, 0.98842591, 0.98958331, 0.9837963 ,
       0.99074072, 0.98726851, 0.99074072, 0.9988426 , 0.98842591,
       0.4826389 , 0.5798611 , 0.59606481, 0.63657409, 0.73148149,
       0.77662039, 0.78819442, 0.86921299, 0.89583331, 0.91898149,
       0.9363426 , 0.93055558, 0.94560188, 0.93981481, 0.95023149,
       0.9513889 , 0.9849537 , 0.97569442, 0.96064812, 0.9537037 ,
       0.97106481, 0.97453701, 0.9699074 , 0.97106481, 0.9675926 ,
       0.98148149, 0.97685188, 0.9849537 , 0.98726851, 0.98958331,
       0.95833331, 0.9837963 , 0.9861111 , 0.98148149, 0.98726851,
       0.98958331, 0.99074072, 0.9861111 , 0.99652779, 0.98726851,
       0.9849537 , 0.99189812, 0.99074072, 0.98726851, 0.99189812,
       0.9837963 , 0.9837963 , 0.99768519, 0.9837963 , 0.99305558])
```

In [24]:

```
mean_train_accuracy=np.mean(train_acc)
mean_train_accuracy
```

Out[24]:

```
0.9257037023305893
```

In [25]:
```
val_acc
```

Out[25]:
```
array([0.43055555, 0.4537037 , 0.27777779, 0.35648149, 0.29166666,
       0.3287037 , 0.38425925, 0.40277779, 0.41666666, 0.5       ,
       0.3425926 , 0.63425928, 0.68518519, 0.58796299, 0.46296296,
       0.56018519, 0.60185188, 0.56481481, 0.55555558, 0.63425928,
       0.6574074 , 0.68055558, 0.68518519, 0.72222221, 0.70833331,
       0.67592591, 0.7361111 , 0.64351851, 0.72685188, 0.66666669,
       0.7037037 , 0.68981481, 0.75      , 0.75462961, 0.74537039,
       0.5462963 , 0.67592591, 0.625     , 0.66666669, 0.6574074 ,
       0.69444442, 0.6712963 , 0.72222221, 0.6388889 , 0.67592591,
       0.6574074 , 0.67592591, 0.68055558, 0.7175926 , 0.68518519,
       0.31481481, 0.50925928, 0.30555555, 0.3888889 , 0.51851851,
       0.33796296, 0.25925925, 0.3888889 , 0.43055555, 0.5462963 ,
       0.31018519, 0.59722221, 0.49537036, 0.6712963 , 0.51851851,
       0.47222221, 0.60648149, 0.51851851, 0.56481481, 0.63425928,
       0.60648149, 0.7037037 , 0.49537036, 0.62037039, 0.74537039,
       0.75      , 0.6388889 , 0.68055558, 0.56018519, 0.73148149,
       0.72222221, 0.6712963 , 0.68518519, 0.68518519, 0.69444442,
       0.7175926 , 0.74074072, 0.74074072, 0.74537039, 0.7175926 ,
       0.68518519, 0.72685188, 0.7361111 , 0.6712963 , 0.7361111 ,
       0.7175926 , 0.69444442, 0.625     , 0.69907409, 0.68518519,
       0.47685185, 0.37037036, 0.2962963 , 0.33333334, 0.30555555,
       0.3425926 , 0.375     , 0.29166666, 0.28703704, 0.49537036,
       0.46296296, 0.43518519, 0.5787037 , 0.54166669, 0.60648149,
       0.67592591, 0.61574072, 0.7361111 , 0.61574072, 0.71296299,
       0.75925928, 0.70833331, 0.74537039, 0.7638889 , 0.7175926 ,
       0.69907409, 0.7361111 , 0.7361111 , 0.68518519, 0.74537039,
       0.77314812, 0.68055558, 0.65277779, 0.66203701, 0.59722221,
       0.5787037 , 0.67592591, 0.7175926 , 0.76851851, 0.7361111 ,
       0.74074072, 0.7361111 , 0.66203701, 0.7361111 , 0.72222221,
       0.7037037 , 0.75925928, 0.72685188, 0.68981481, 0.73148149,
       0.46296296, 0.3888889 , 0.35185185, 0.3287037 , 0.3888889 ,
       0.29166666, 0.50462961, 0.53703701, 0.375     , 0.47222221,
       0.43055555, 0.43055555, 0.41203704, 0.5925926 , 0.50925928,
       0.61574072, 0.64814812, 0.7037037 , 0.64814812, 0.64351851,
       0.64351851, 0.55555558, 0.49074075, 0.62037039, 0.58796299,
       0.65277779, 0.64814812, 0.66666669, 0.68055558, 0.7175926 ,
       0.69444442, 0.68981481, 0.71296299, 0.75462961, 0.7175926 ,
       0.67592591, 0.60185188, 0.66203701, 0.63425928, 0.69444442,
       0.73148149, 0.69907409, 0.69907409, 0.70833331, 0.70833331,
       0.60648149, 0.7175926 , 0.72685188, 0.7175926 , 0.6574074 ,
       0.27314815, 0.41666666, 0.41666666, 0.37962964, 0.30092594,
       0.31018519, 0.47685185, 0.55092591, 0.41203704, 0.52777779,
       0.3287037 , 0.6111111 , 0.5462963 , 0.43055555, 0.47685185,
       0.56481481, 0.68518519, 0.64814812, 0.70833331, 0.62037039,
       0.67592591, 0.7037037 , 0.68981481, 0.7037037 , 0.68518519,
       0.62962961, 0.6388889 , 0.6388889 , 0.68055558, 0.60185188,
       0.68518519, 0.6574074 , 0.67592591, 0.48148149, 0.61574072,
       0.67592591, 0.6712963 , 0.66203701, 0.71296299, 0.5138889 ,
       0.5787037 , 0.64351851, 0.7361111 , 0.6388889 , 0.69907409,
       0.66666669, 0.7361111 , 0.69444442, 0.60185188, 0.68055558])
```

In [26]:
```
mean_val_accuracy=np.mean(val_acc)
mean_val_accuracy
```

Out[26]:
```
0.6004074078798294
```

```
In [27]: train_loss
```

```
Out[27]: array([1.17135706e+01, 6.38666487e+00, 3.51297641e+00, 1.91685009e+00,
                1.95859861e+00, 1.22591114e+00, 7.20051944e-01, 5.74148059e-01,
                3.54200631e-01, 4.61351037e-01, 5.35433471e-01, 3.91402036e-01,
                2.80295163e-01, 2.34892085e-01, 2.07070097e-01, 2.97496468e-01,
                1.41313627e-01, 2.05331132e-01, 1.74335599e-01, 1.88435853e-01,
                1.88248426e-01, 8.82019177e-02, 1.11027174e-01, 1.38275594e-01,
                4.23851572e-02, 1.15716495e-01, 7.96397701e-02, 6.15428723e-02,
                1.24747530e-01, 7.20200166e-02, 6.96803257e-02, 1.10577710e-01,
                1.76808331e-02, 9.75238383e-02, 8.64869505e-02, 3.08388099e-02,
                8.33916217e-02, 4.85222042e-02, 7.28347898e-02, 8.60523358e-02,
                3.73556577e-02, 3.38391699e-02, 4.93248478e-02, 2.62614861e-02,
                4.15797979e-02, 3.14575620e-02, 1.00816682e-01, 4.99448366e-03,
                9.07085091e-02, 2.97741797e-02, 1.25063944e+01, 5.04951572e+00,
                3.11151075e+00, 1.90221035e+00, 1.69968474e+00, 1.03428662e+00,
                1.09280312e+00, 6.35229528e-01, 4.91428882e-01, 3.54343921e-01,
                3.07415336e-01, 3.02704126e-01, 2.47766584e-01, 3.03276032e-01,
                1.19690098e-01, 2.01849654e-01, 1.48391053e-01, 1.56946450e-01,
                1.09084062e-01, 1.62391558e-01, 2.17742041e-01, 9.11291093e-02,
                1.03515908e-01, 1.21415682e-01, 8.49769637e-02, 1.12927042e-01,
                1.04393296e-01, 8.76280665e-02, 1.14056692e-01, 1.53147981e-01,
                3.48444767e-02, 4.34497781e-02, 9.33248922e-02, 1.04848102e-01,
                4.28604148e-02, 3.94118950e-02, 5.51207960e-02, 6.19285777e-02,
                6.88118935e-02, 6.86789006e-02, 5.55868782e-02, 7.77035728e-02,
                3.42150666e-02, 9.82716978e-02, 5.67375235e-02, 5.03144450e-02,
                7.76948482e-02, 1.21304147e-01, 2.32746173e-02, 3.65100168e-02,
                1.27555742e+01, 5.50783110e+00, 2.97384501e+00, 1.79468083e+00,
                1.46560287e+00, 1.32227802e+00, 6.51029944e-01, 5.87860882e-01,
                4.19303656e-01, 3.70818883e-01, 1.57738820e-01, 2.14373514e-01,
                2.48081699e-01, 2.96547294e-01, 2.78145909e-01, 1.16726287e-01,
                2.46879935e-01, 1.17468223e-01, 1.58109590e-01, 8.00499767e-02,
                1.36267483e-01, 1.87997058e-01, 1.24116033e-01, 1.73893422e-01,
                2.97000315e-02, 1.12336688e-01, 3.07979416e-02, 1.44947946e-01,
                4.66164127e-02, 1.06233805e-01, 7.73573443e-02, 3.81879136e-02,
                8.68922397e-02, 8.36757794e-02, 2.00891364e-02, 3.22002433e-02,
                4.24790680e-02, 1.35288954e-01, 8.21984466e-03, 4.11967896e-02,
                5.44477850e-02, 5.92095181e-02, 1.15998335e-01, 5.40498234e-02,
                3.58810835e-02, 2.92157866e-02, 2.52793878e-02, 6.55411184e-02,
                6.82602525e-02, 1.31045002e-02, 1.37455006e+01, 5.35711288e+00,
                2.98476386e+00, 1.75174856e+00, 1.54340279e+00, 1.14559114e+00,
                6.89294159e-01, 4.08382475e-01, 4.86877650e-01, 3.07989538e-01,
                2.58993119e-01, 2.42017925e-01, 1.59457028e-01, 2.01142386e-01,
                1.66952819e-01, 1.57354936e-01, 1.07844241e-01, 7.81507865e-02,
                2.28652745e-01, 1.03042856e-01, 1.47734031e-01, 1.02982841e-01,
                8.79945159e-02, 5.78793250e-02, 5.47868758e-02, 1.84157789e-01,
                9.79524180e-02, 7.39328191e-02, 2.30986029e-02, 6.71191365e-02,
                6.95172995e-02, 5.07428087e-02, 4.72582802e-02, 3.61742117e-02,
                8.67755935e-02, 1.99948084e-02, 6.71984255e-02, 7.31719062e-02,
                8.83215293e-02, 1.61843970e-02, 7.33388811e-02, 3.34252231e-02,
                6.49256185e-02, 4.56007943e-02, 8.63434449e-02, 2.10811459e-02,
                7.69309849e-02, 8.00956339e-02, 6.15152065e-03, 7.22955912e-02,
                1.16037006e+01, 5.28429985e+00, 3.21196103e+00, 2.70389700e+00,
                1.47637177e+00, 9.31112647e-01, 1.10291064e+00, 5.58815300e-01,
                4.42062765e-01, 3.16799581e-01, 2.54916161e-01, 4.09373790e-01,
                3.08373660e-01, 2.91755289e-01, 1.92238405e-01, 2.40235925e-01,
                9.31299105e-02, 1.00929923e-01, 1.64325461e-01, 2.11115092e-01,
                1.24417886e-01, 1.00801647e-01, 1.51432097e-01, 9.02242139e-02,
                8.43018517e-02, 7.98718929e-02, 8.92794803e-02, 8.56740028e-02,
                5.62358052e-02, 3.80788296e-02, 1.57825246e-01, 7.91798532e-02,
                8.27428177e-02, 8.56418759e-02, 5.58294505e-02, 1.83987580e-02,
                2.75695231e-02, 4.60234694e-02, 9.72722936e-03, 6.48939312e-02,
                5.04196920e-02, 5.19880317e-02, 2.02786420e-02, 4.10170145e-02,
                2.73191221e-02, 7.02173635e-02, 8.28502700e-02, 3.62058845e-03,
                5.50361946e-02, 2.71206405e-02])
```

```
In [28]: mean_train_loss=np.mean(train_loss)
         mean_train_loss
```

```
Out[28]: 0.6478431741381064
```

In [29]:

```
val_loss
```

Out[29]:

```
array([ 24.50358582,  13.71792221,  11.55187416,   5.78467035,
        11.5177536 ,   7.19924498,   3.2643404 ,   6.41444492,
         5.4908638 ,   3.70043039,  14.09852791,   3.17769504,
         2.52124977,   3.26490426,   5.47941875,   4.40330744,
         3.99522543,   3.74482274,  12.00065804,  23.05793571,
         5.07710314,   4.62481117,   2.98224735,   4.70060396,
         6.02304125,   3.55785871,   6.24872208,   5.19193745,
         5.62975073,   9.23026657,   8.85900688,  12.17224121,
         2.76951289,   9.44723701,   6.0042491 , 280.5748291 ,
        11.35315132,  27.47146988,  34.02479935,  41.93907928,
       112.55037689, 223.75364685,  77.08407593,   7.10890818,
       138.35705566, 428.39321899,   6.01841545,  10.13053417,
       125.8059082 , 239.83030701,  15.93342113,   5.11999416,
         7.50522423,   3.84086919,   4.82679701,   7.88022852,
        20.66157722,   7.17051458,   7.37955523,   4.15494013,
         9.65765285,   3.79697704,   5.76285458,   3.35506344,
         5.17604351,   6.53227663,   4.74621964,   9.12382889,
         4.33583069,   5.23331499,   7.02855635,   2.98404837,
        57.10422897,   4.76541519,   2.69999337,   2.84016466,
        10.10723019,   3.32333159,   6.16697931,   4.29780817,
         6.13448572,   4.05119324,   3.65672135,   4.74036932,
         4.54884958,   5.56531429,   3.14094806,   4.26865625,
         8.56075478,   8.50905514,   6.92034912,  12.08310413,
        14.00052452,  56.3754425 ,  29.08768463,   3.62087679,
         9.07287312,   5.00176287,  27.80783653,   3.3431201 ,
        26.2583046 ,  13.33585739,  14.54563713,   8.03736019,
         9.26742172,  10.66771793,   7.94054365,  12.43579006,
         9.82008648,   5.32873774,   5.85733557,   6.76704788,
         4.09153795,   3.5441916 ,   3.17455602,   2.87242413,
         3.92007303,   1.73210883,   3.6990869 ,   2.34442353,
         1.98250067,   4.7746315 ,   2.52919722,   1.88971376,
         2.12986779,   3.05893517,   2.81526375,   5.9329257 ,
         2.89353681,   2.47987485,   2.13883042,   3.02085543,
         3.94240713,   4.20982122,   5.97210789,  11.5409317 ,
         7.19725657,   5.24689674,   5.486063  ,   3.57427311,
        10.45045662,   8.06287289,  14.44467831,   7.31977558,
        10.74833202,   4.82068968,   3.23362422,   4.23737383,
        30.73168945,  31.18476486,  27.11626244,  14.50491428,
        11.96224403,   9.48959827,   7.48743963,  11.14036369,
         4.09568834,   3.00952196,  10.09739017,   5.1284008 ,
         5.83625746,   5.28258753,   6.03626728,   4.2264924 ,
         5.14158869,   2.82581973,   4.00913477,   2.1699667 ,
         4.20015335,   3.36893034,   2.89208126,   3.56263018,
         6.22325659,   3.95691872,  55.85554886,   4.12635756,
         4.1768012 ,   3.9520216 ,   3.69637394,   3.57895875,
         3.53076029,   3.79061937,   3.24615216,   2.33322859,
         3.20891213,   4.2837019 ,   6.71820021,   4.18257666,
         6.11831903,   4.16269732,   3.02253294,   3.4307785 ,
         3.11379457,   2.76925206,   3.61171818,   4.43222952,
         3.38339853,   3.06000924,   3.12408257,  24.18190002,
        44.11797333,  14.75194645,   5.28497505,   7.72140169,
        17.6622448 ,   8.85721207,   4.96248388,   3.83556819,
         7.49478245,   6.6233511 ,  12.71845245,   2.8042562 ,
         4.61637163,   7.55230045,   7.68760395,   3.13446808,
         2.70222378,   3.4233532 ,   2.27994275,   4.70801497,
         2.53376603,   3.32550097,   2.90334892,   2.97887135,
         3.59723496,   5.59048557,   4.82858038,   4.06447029,
         3.17909193,   4.03916073,   3.73535442,   2.94662833,
         2.95639586,   7.77871943,   4.50304747,   3.60158825,
         3.74807072,   4.68565035,   3.26700783,  15.36628342,
         8.59329319,   5.68930769,   3.18642235,   4.28201485,
         5.47823429,   5.47971296,   3.61743379,   3.93185711,
         7.32728291,   5.59636307])
```

In [30]:

```
mean_val_loss=np.mean(val_loss)
mean_val_loss
```

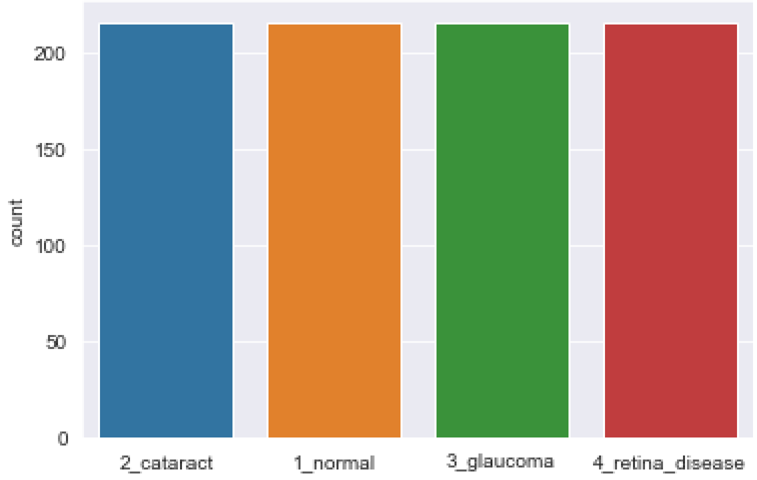
Out[30]:

```
14.016397735118867
```

Plot to Visualize the Number of Images in Each Label of Trainig Dataset

```
In [31]: l = []
         for i in train:
             if(i[1] == 0):
                 l.append("1_normal")

             elif (i[1] == 1):
                 l.append("2_cataract")

             elif (i[1] == 2):
                 l.append("3_glaucoma")

             else :
                 l.append("4_retina_disease")


         sns.set_style('darkgrid')
         sns.countplot(l)
```

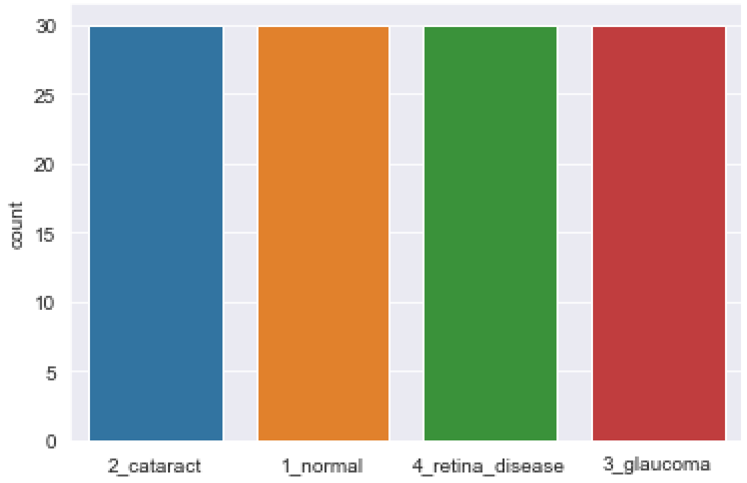
```
Out[31]: <matplotlib.axes._subplots.AxesSubplot at 0x1d7034b7f70>
```



Plot to Visualize the Number of Images in Each Label of Test Dataset.

```
In [32]: l = []
         for i in test:
             if(i[1] == 0):
                 l.append("1_normal")

             elif (i[1] == 1):
                 l.append("2_cataract")

             elif (i[1] == 2):
                 l.append("3_glaucoma")

             else :
                 l.append("4_retina_disease")


         sns.set_style('darkgrid')
         sns.countplot(l)
```

```
Out[32]: <matplotlib.axes._subplots.AxesSubplot at 0x1d71c20aaf0>
```



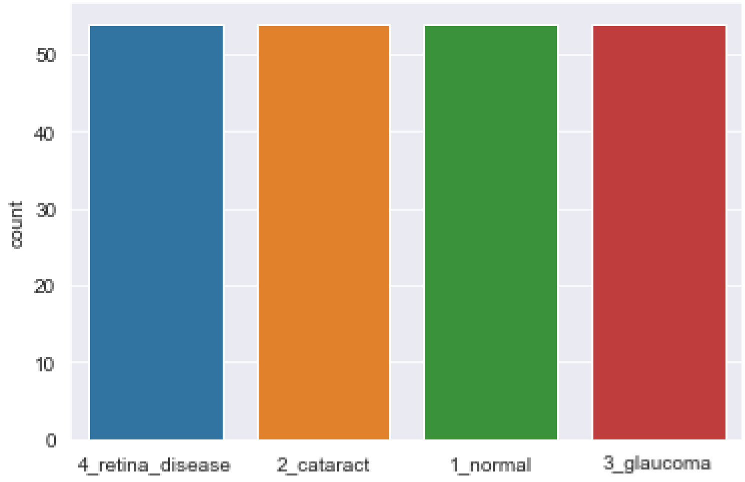
Plot to Visualize the Number of Images in Each Label of Validation Dataset.

In [33]:

```
l = []
for i in validation:
    if(i[1] == 0):
        l.append("1_normal")

    elif (i[1] == 1):
        l.append("2_cataract")

    elif (i[1] == 2):
        l.append("3_glaucoma")

    else :
        l.append("4_retina_disease")


sns.set_style('darkgrid')
sns.countplot(l)
```

Out[33]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1d736817610>
```



Training,Validation Accuracy and Loss Plot for 50 Epochs

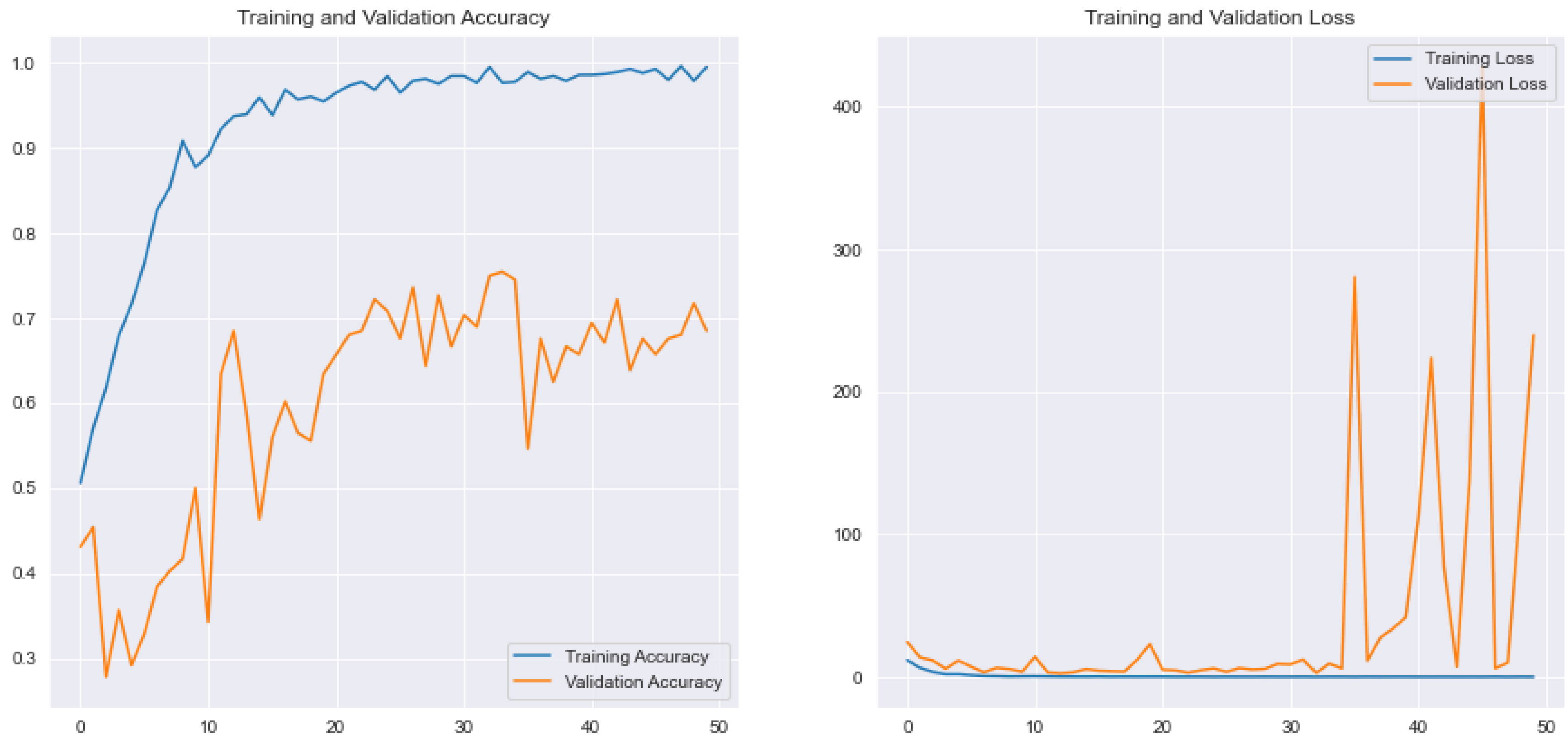
In [34]:

```
def plot_print(i,j):
    epochs_range = range(50)

    plt.figure(figsize=(15, 15))
    plt.subplot(2, 2, 1)
    plt.plot(epochs_range, train_acc[i:j], label='Training Accuracy')
    plt.plot(epochs_range, val_acc[i:j], label='Validation Accuracy')
    plt.legend(loc='lower right')
    plt.title('Training and Validation Accuracy')

    plt.subplot(2, 2, 2)
    plt.plot(epochs_range, train_loss[i:j], label='Training Loss')
    plt.plot(epochs_range, val_loss[i:j], label='Validation Loss')
    plt.legend(loc='upper right')
    plt.title('Training and Validation Loss')

    return plt.show()
```

In [35]:

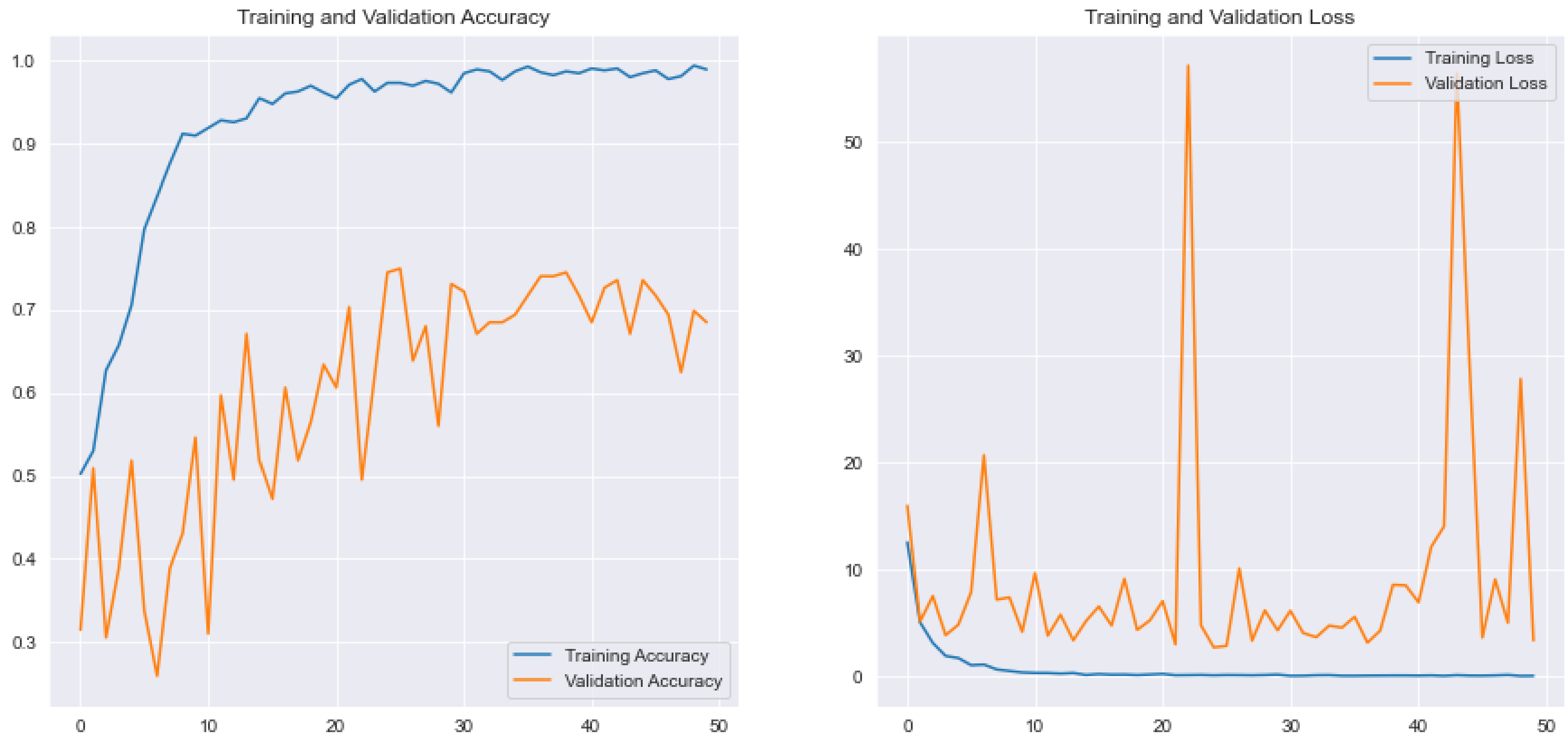
```
k=1
j=0
for i in range(0,250,50):
    j +=50
    print('Plot for ',k,'cross validation accuracy and loss for Training and Validation phase')
    k +=1
    plot_print(i,j)
```

Plot for 1 cross validation accuracy and loss for Training and Validation phase


Training and Validation Accuracy

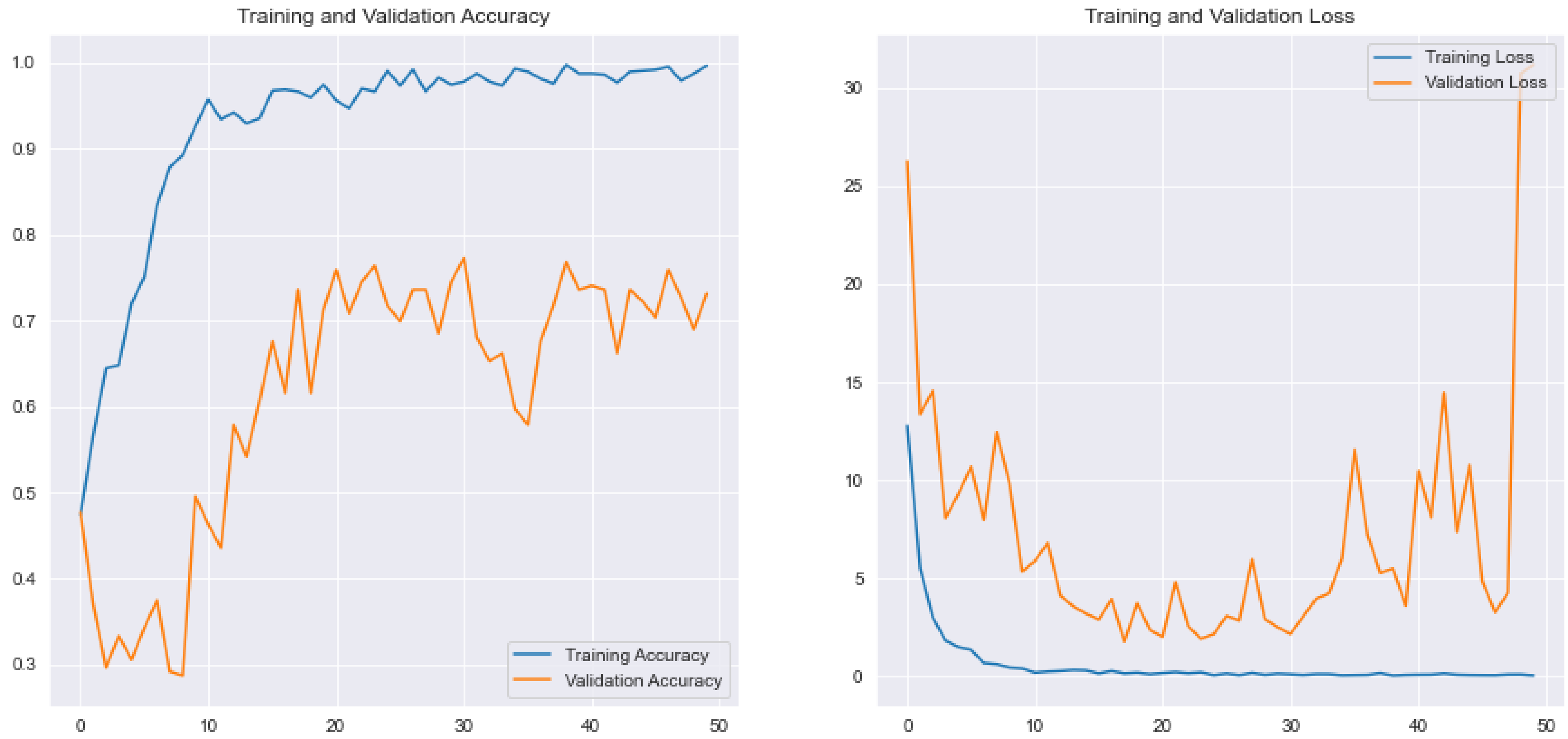
Training and Validation Loss

Plot for 2 cross validation accuracy and loss for Training and Validation phase


Training and Validation Accuracy

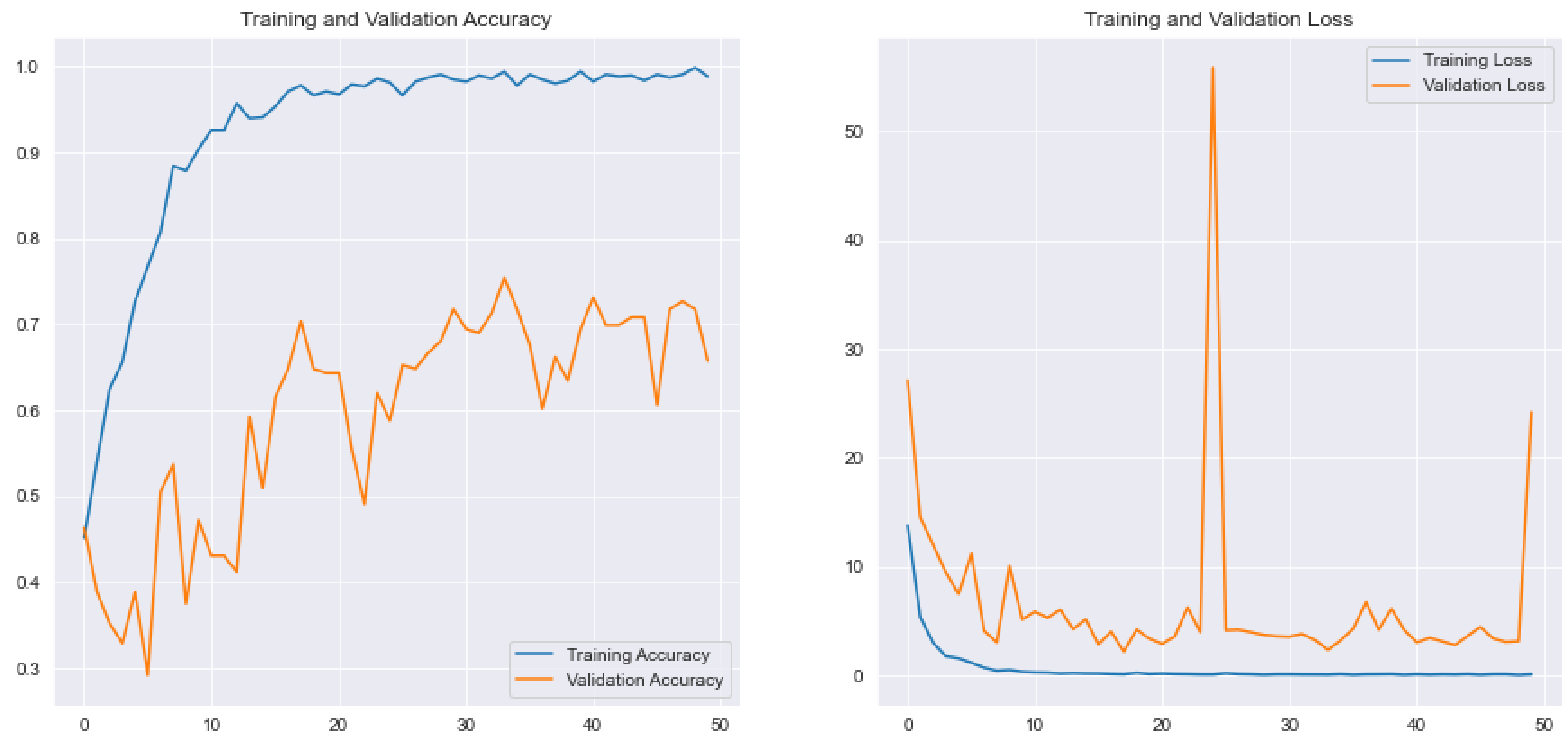
Training and Validation Loss

Plot for 3 cross validation accuracy and loss for Training and Validation phase

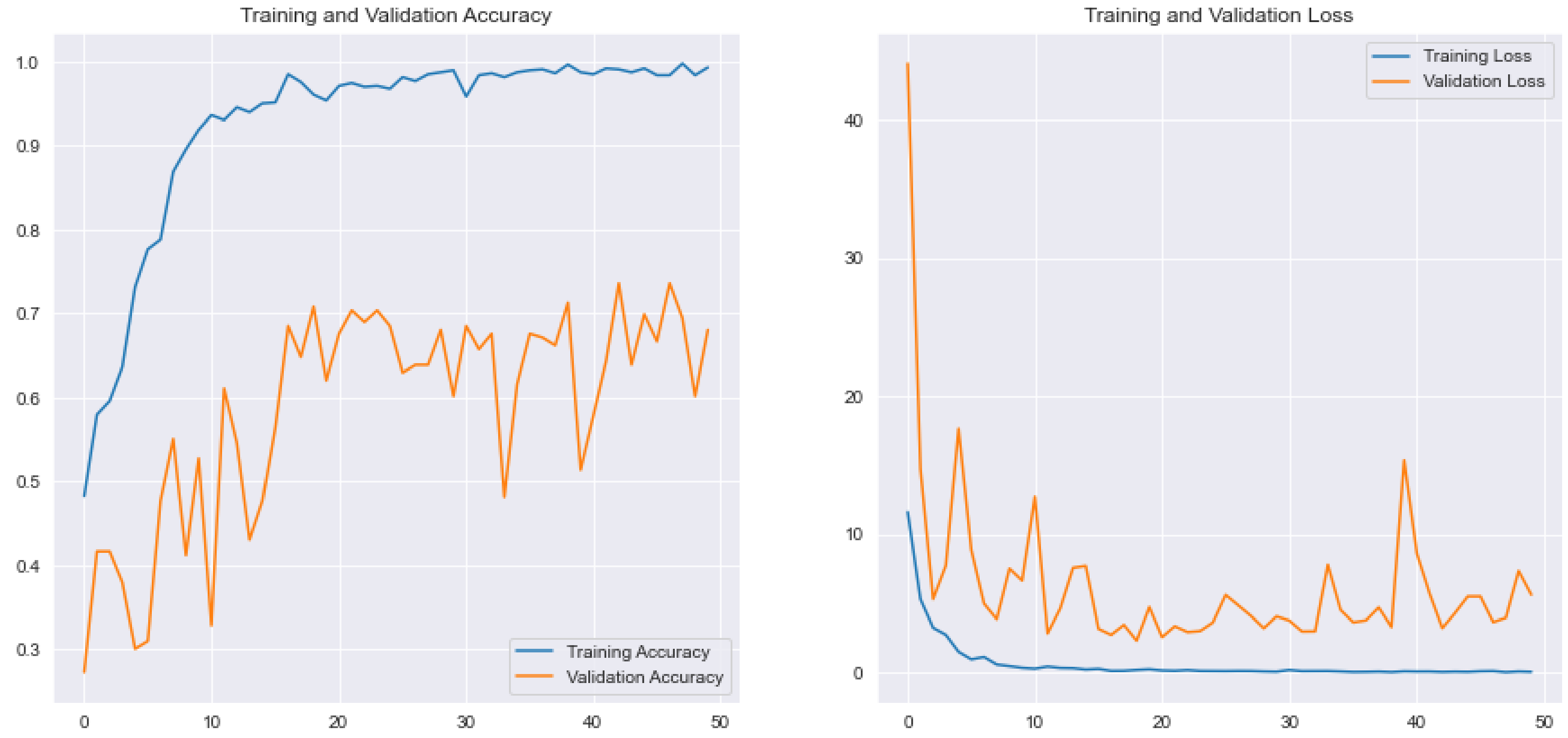

Training and Validation Accuracy

Training and Validation Loss

Plot for 4 cross validation accuracy and loss for Training and Validation phase



```
Plot for  5 cross validation accuracy and loss for Training and Validation phase
```



Visualizing Confusion Matrix for Each Fold

In [36]:

```
CM= np.array(CM)
CM.resize(5,4,4)
```

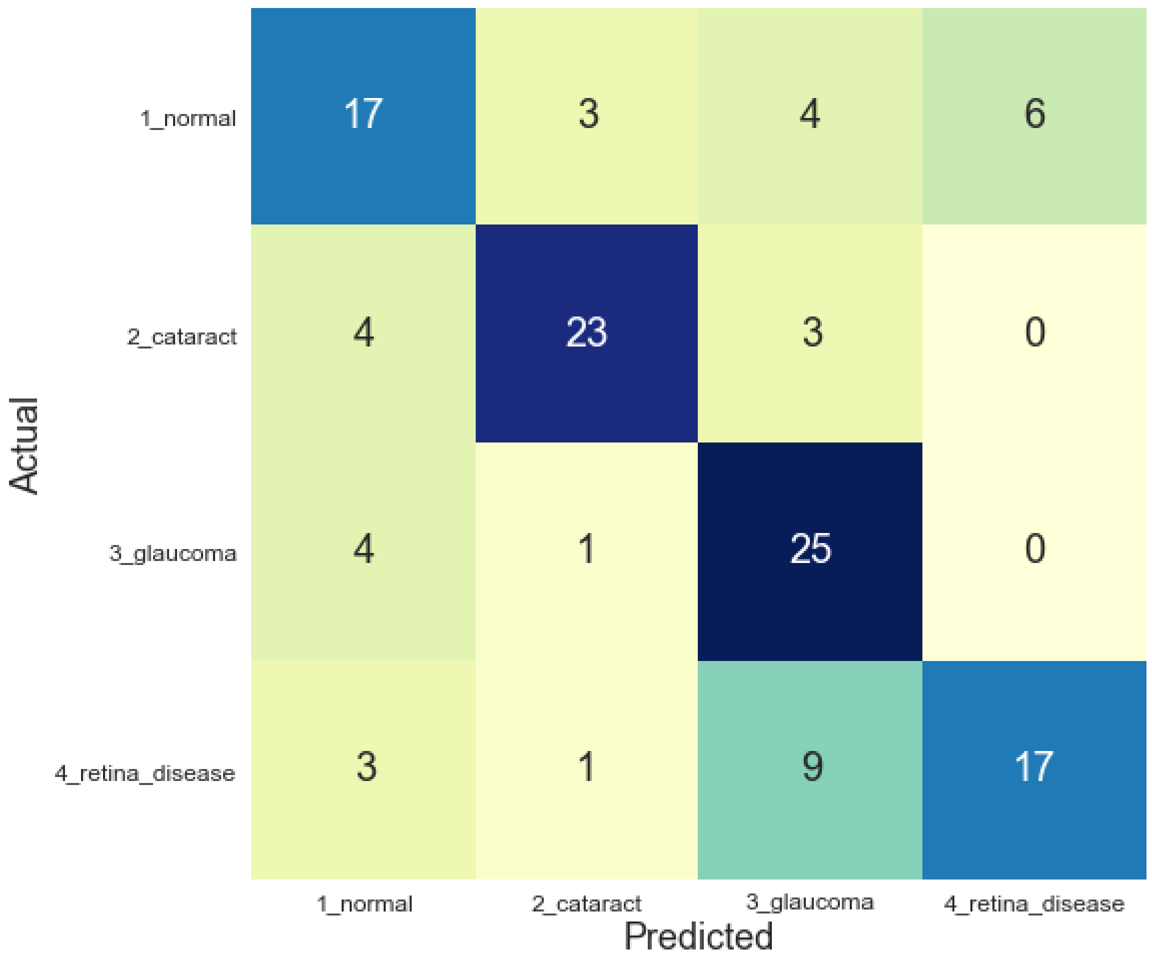
In [37]:

```
def confusionmatrix_vis(i):

        yticklabels=['1_normal', '2_cataract','3_glaucoma','4_retina_disease']
        xticklabels=['1_normal', '2_cataract','3_glaucoma','4_retina_disease']
        plt.figure(figsize=(8, 8))
        hm =sns.heatmap(CM[i], annot=True,annot_kws={"size": 20}, cbar=False,cmap="YlGnBu",yticklabels=yticklabels,xti
cklabels=xticklabels)

        hm.set_xticklabels(hm.get_xticklabels(), rotation=0, fontsize = 12, )
        hm.set_yticklabels(hm.get_yticklabels(), rotation=0, fontsize = 12)

        plt.ylabel("Actual", fontsize = 18)
        plt.xlabel("Predicted",fontsize = 18)

        return plt.show()
```

In [38]:

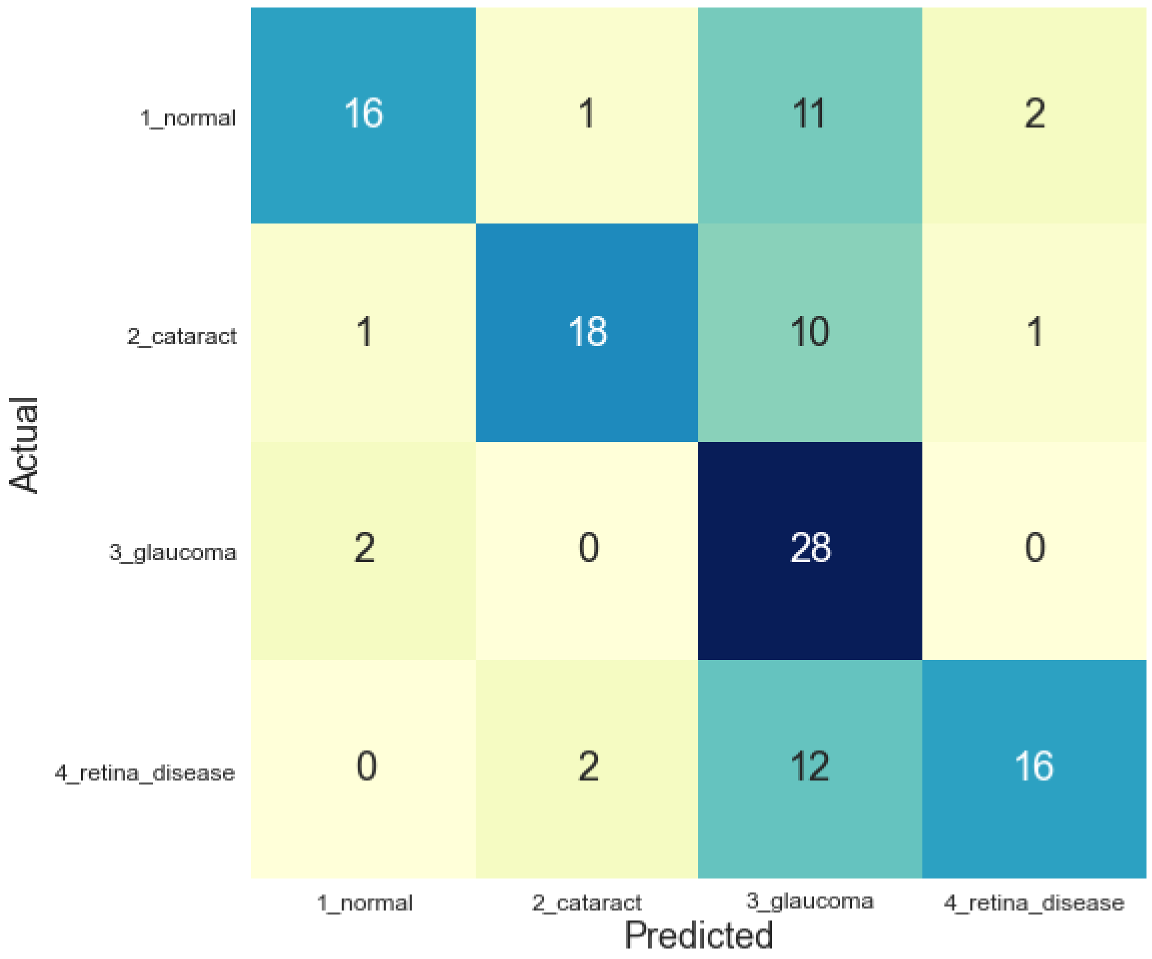
```
k=1
for i in range(5):
    print('Confusion Matrix for ',k,'Cross Validation Test phase')
    k +=1
    confusionmatrix_vis(i)
```

```
Confusion Matrix for  1 Cross Validation Test phase
```



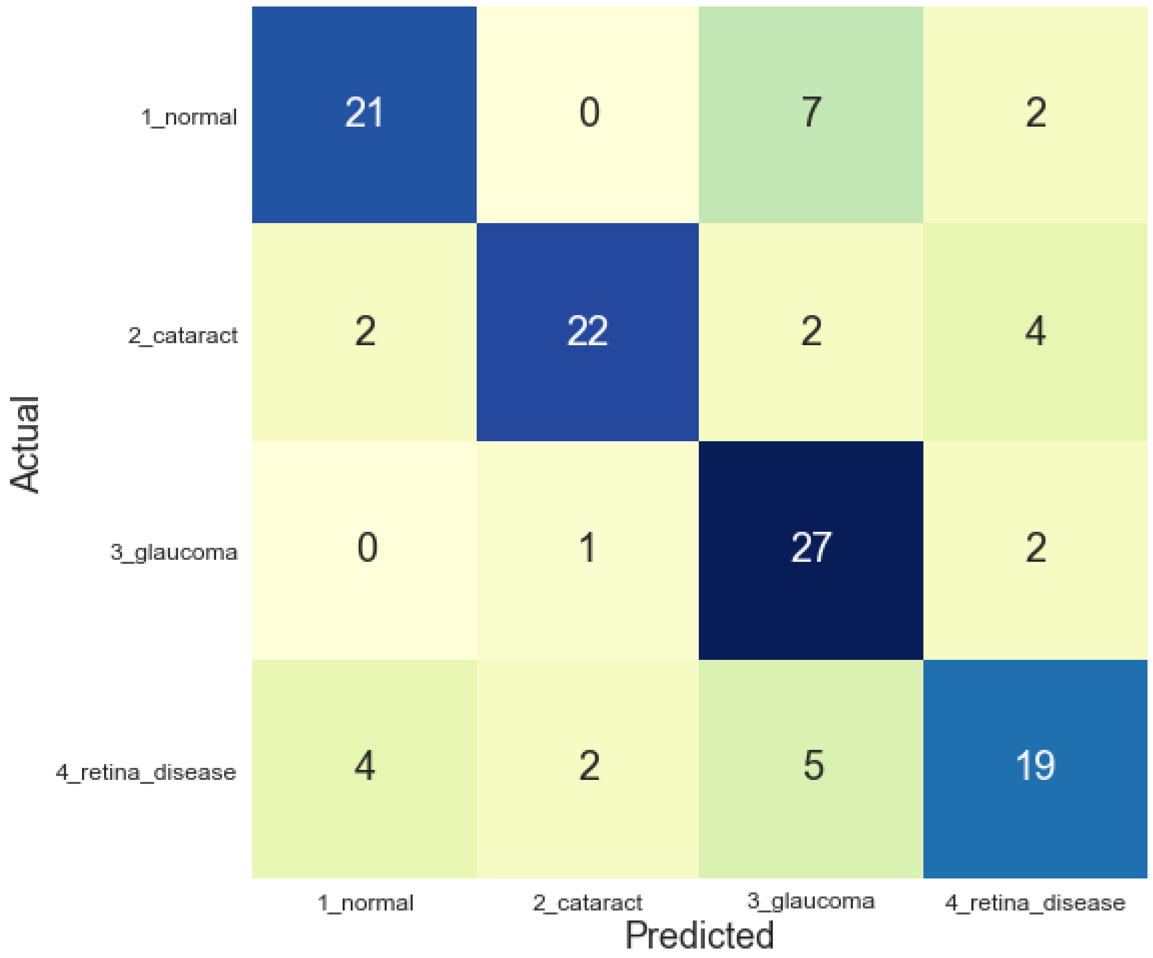
	1_normal	2_cataract	3_glaucoma	4_retina_disease
1_normal	17	3	4	6
2_cataract	4	23	3	0
3_glaucoma	4	1	25	0
4_retina_disease	3	1	9	17

```
Confusion Matrix for  2 Cross Validation Test phase
```

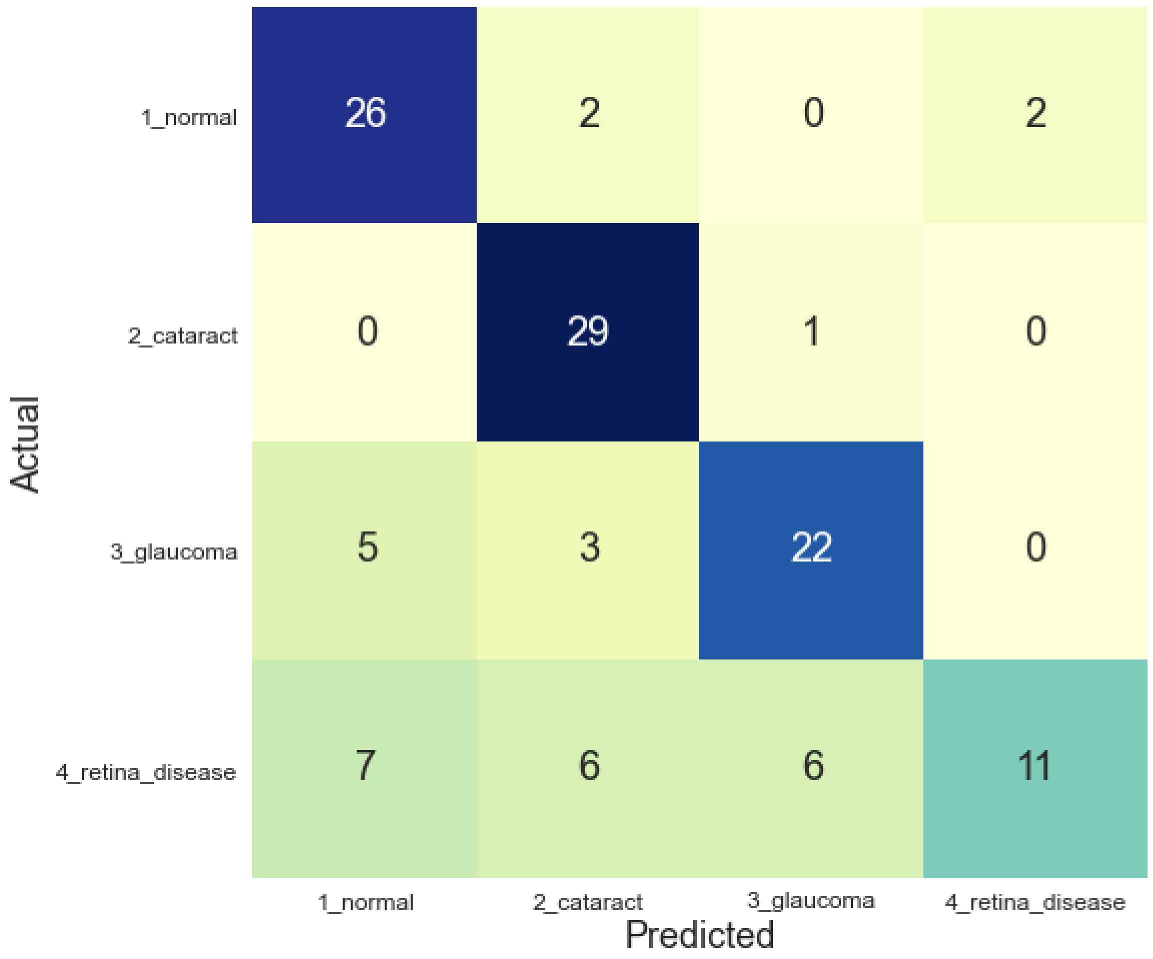


	1_normal	2_cataract	3_glaucoma	4_retina_disease
1_normal	16	1	11	2
2_cataract	1	18	10	1
3_glaucoma	2	0	28	0
4_retina_disease	0	2	12	16

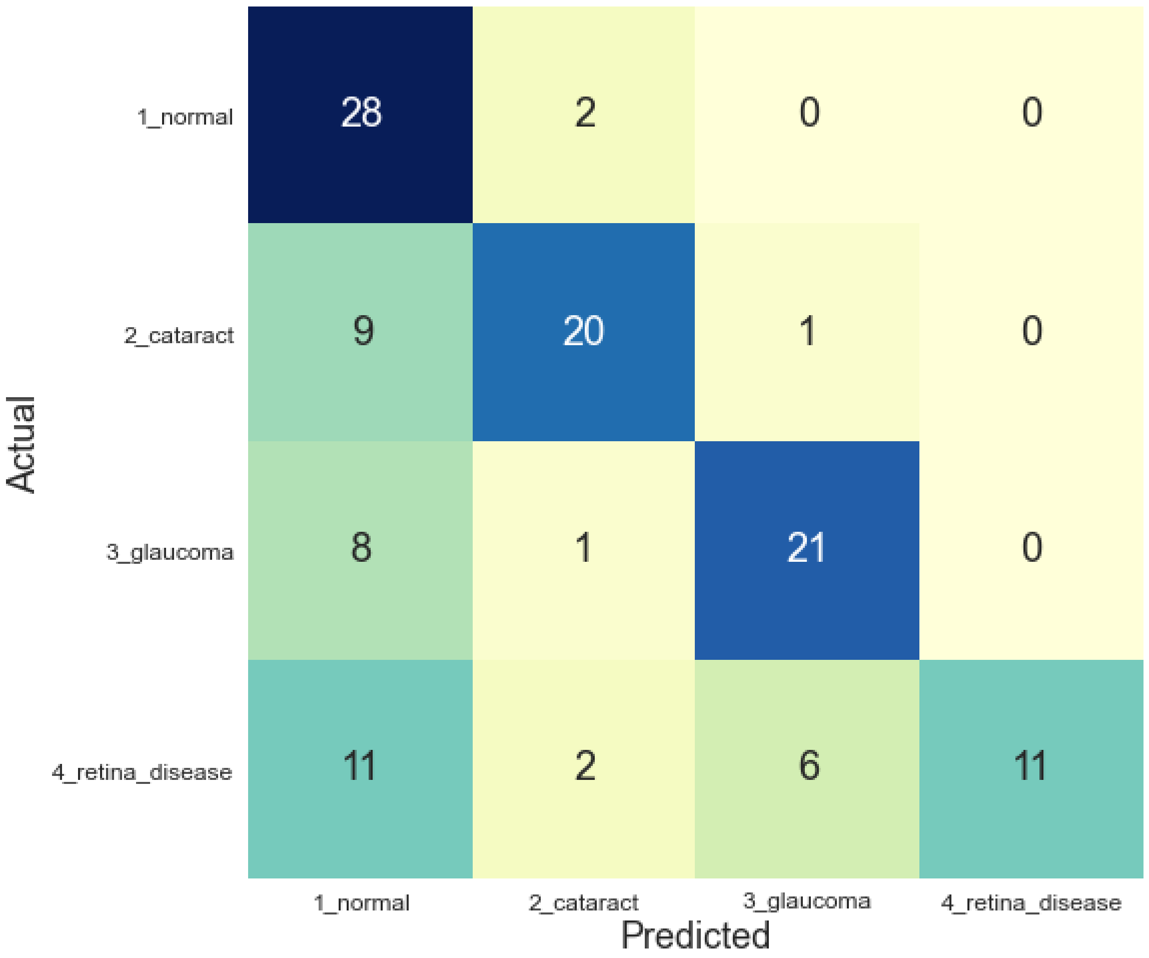
```
Confusion Matrix for  3 Cross Validation Test phase
```



```
Confusion Matrix for  4 Cross Validation Test phase
```



```
Confusion Matrix for  5 Cross Validation Test phase
```

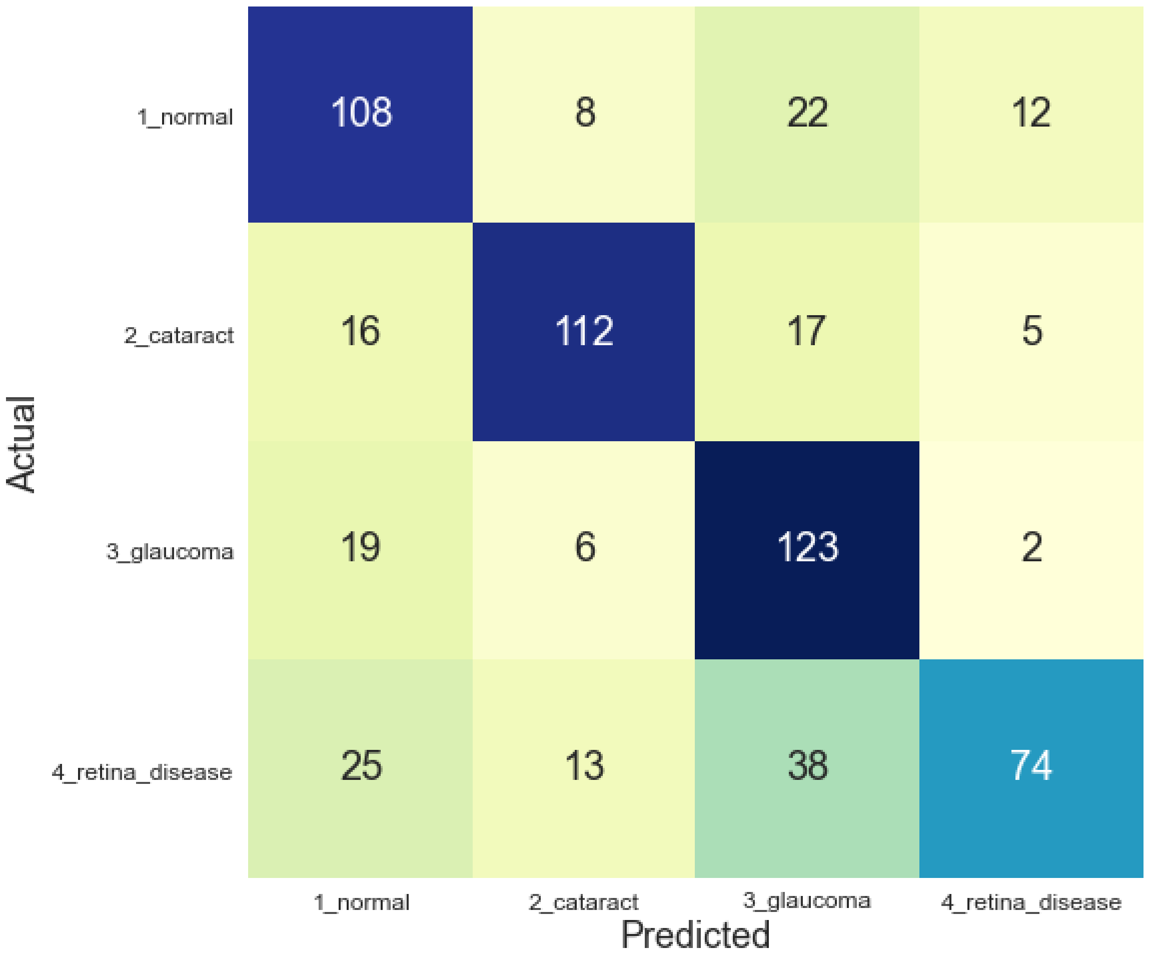


Visualizing Summarized Confusion Matrix of all 5 folds

```
In [39]: CM_sum = CM[0]+CM[1]+CM[2]+CM[3]+CM[4]
         CM_sum
```

```
Out[39]: array([[108,   8,  22,  12],
                [ 16, 112,  17,   5],
                [ 19,   6, 123,   2],
                [ 25,  13,  38,  74]], dtype=int64)
```

```
In [40]: yticklabels=['1_normal', '2_cataract','3_glaucoma','4_retina_disease']
         xticklabels=['1_normal', '2_cataract','3_glaucoma','4_retina_disease']
         plt.figure(figsize=(8, 8))
         hm =sns.heatmap(CM_sum, annot=True,annot_kws={"size": 20},fmt='g', cbar=False,cmap="YlGnBu",yticklabels=yticklabels,xt
         icklabels=xticklabels)

         hm.set_xticklabels(hm.get_xticklabels(), rotation=0, fontsize = 12, )
         hm.set_yticklabels(hm.get_yticklabels(), rotation=0, fontsize = 12)

         plt.ylabel("Actual", fontsize = 18)
         plt.xlabel("Predicted",fontsize = 18)

         plt.show()
```



Reconfirming the values of Accuracy,Sensitivity and Specificity

In [41]:

```
    sensitivity_1_normal = (CM_sum[0,0])/(CM_sum[0,0]+CM_sum[0,1]+CM_sum[0,2]+CM_sum[0,3])
    #print('Sensitivity_1_normal          : ', sensitivity_1_normal )

    sensitivity_2_cataract = (CM_sum[1,1])/(CM_sum[1,0]+CM_sum[1,1]+CM_sum[1,2]+CM_sum[1,3])
    #print('Sensitivity_2_cataract        : ', sensitivity_2_cataract )


    sensitivity_3_glaucoma = (CM_sum[2,2])/(CM_sum[2,0]+CM_sum[2,1]+CM_sum[2,2]+CM_sum[2,3])
    #print('Sensitivity_3_glaucoma        : ', sensitivity_3_glaucoma )

    sensitivity_4_retina_disease = (CM_sum[3,3])/(CM_sum[3,0]+CM_sum[3,1]+CM_sum[3,2]+CM_sum[3,3])
    #print('Sensitivity_4_retina_disease  : ', sensitivity_4_retina_disease )

    specificity_1_normal = (CM_sum[1,1]+CM_sum[1,2]+CM_sum[1,3]+CM_sum[2,1]+CM_sum[2,2]+CM_sum[2,3]+CM_sum[3,1]+CM_sum
[3,2]+CM_sum[3,3])/(CM_sum[1,0]+CM_sum[2,0]+CM_sum[3,0]+CM_sum[1,1]+CM_sum[1,2]+CM_sum[1,3]+CM_sum[2,1]+CM_sum[2,2]+CM
_sum[2,3]+CM_sum[3,1]+CM_sum[3,2]+CM_sum[3,3])
    #print('Specificity : ', specificity_1_normal)

    specificity_2_cataract = (CM_sum[0,0]+CM_sum[0,2]+CM_sum[0,3]+CM_sum[2,0]+CM_sum[2,2]+CM_sum[2,3]+CM_sum[3,0]+CM_s
um[3,2]+CM_sum[3,3])/(CM_sum[0,1]+CM_sum[2,1]+CM_sum[3,1]+CM_sum[0,0]+CM_sum[0,2]+CM_sum[0,3]+CM_sum[2,0]+CM_sum[2,2]+
CM_sum[2,3]+CM_sum[3,0]+CM_sum[3,2]+CM_sum[3,3])
    #print('Specificity : ', specificity_2_cataract)

    specificity_3_glaucoma = (CM_sum[0,0]+CM_sum[0,1]+CM_sum[0,3]+CM_sum[1,0]+CM_sum[1,1]+CM_sum[1,3]+CM_sum[3,0]+CM_s
um[3,1]+CM_sum[3,3])/(CM_sum[0,2]+CM_sum[1,2]+CM_sum[3,2]+CM_sum[0,0]+CM_sum[0,1]+CM_sum[0,3]+CM_sum[1,0]+CM_sum[1,1]+
CM_sum[1,3]+CM_sum[3,0]+CM_sum[3,1]+CM_sum[3,3])
    #print('Specificity : ', specificity_3_glaucoma)

    specificity_4_retina_disease= (CM_sum[0,0]+CM_sum[0,1]+CM_sum[0,2]+CM_sum[1,0]+CM_sum[1,1]+CM_sum[1,2]+CM_sum[2,0]
+CM_sum[2,1]+CM_sum[2,2])/(CM_sum[0,3]+CM_sum[1,3]+CM_sum[2,3]+CM_sum[0,0]+CM_sum[0,1]+CM_sum[0,2]+CM_sum[1,0]+CM_sum[
1,1]+CM_sum[1,2]+CM_sum[2,0]+CM_sum[2,1]+CM_sum[2,2])
    #print('Specificity : ', specificity_4_retina_disease)

    Sensitivity= (sensitivity_1_normal + sensitivity_2_cataract + sensitivity_3_glaucoma + sensitivity_4_retina_diseas
e)/4
    #print(Sensitivity)

    Specificity= (specificity_1_normal + specificity_2_cataract + specificity_3_glaucoma + specificity_4_retina_diseas
e)/4
    #print(Specificity)

    total1=sum(sum(CM_sum))
    test_accuracy=(CM_sum[0,0]+CM_sum[1,1]+CM_sum[2,2]+CM_sum[3,3])/total1

    print ('Accuracy    : ', test_accuracy)
    print ('Specificity : ', Specificity)
    print ('Sensitivity : ', Sensitivity)
```

```
Accuracy    :  0.695
Specificity :  0.874009928780574
Sensitivity :  0.695
```

Model Summary

In [42]:

```
model_build_compile(k)
```

```
model building and compiling for fold 7
```

Out[42]:

```
<tensorflow.python.keras.engine.functional.Functional at 0x1d722ae1610>
```

In [43]:

```
model.summary()
```

```
Model: "model_4"
__________________________________________________________________________________________________
Layer (type)                    Output Shape         Param #     Connected to
==================================================================================================
input_5 (InputLayer)            [(None, 224, 224, 3) 0
__________________________________________________________________________________________________
zero_padding2d_8 (ZeroPadding2D (None, 230, 230, 3)  0           input_5[0][0]
__________________________________________________________________________________________________
conv1/conv (Conv2D)             (None, 112, 112, 64) 9408        zero_padding2d_8[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]
__________________________________________________________________________________________________
zero_padding2d_9 (ZeroPadding2D (None, 114, 114, 64) 0           conv1/relu[0][0]
__________________________________________________________________________________________________
pool1 (MaxPooling2D)            (None, 56, 56, 64)   0           zero_padding2d_9[0][0]
__________________________________________________________________________________________________
conv2_block1_0_bn (BatchNormali (None, 56, 56, 64)   256         pool1[0][0]
__________________________________________________________________________________________________
conv2_block1_0_relu (Activation (None, 56, 56, 64)   0           conv2_block1_0_bn[0][0]
__________________________________________________________________________________________________
conv2_block1_1_conv (Conv2D)    (None, 56, 56, 128)  8192        conv2_block1_0_relu[0][0]
__________________________________________________________________________________________________
conv2_block1_1_bn (BatchNormali (None, 56, 56, 128)  512         conv2_block1_1_conv[0][0]
__________________________________________________________________________________________________
conv2_block1_1_relu (Activation (None, 56, 56, 128)  0           conv2_block1_1_bn[0][0]
__________________________________________________________________________________________________
conv2_block1_2_conv (Conv2D)    (None, 56, 56, 32)   36864       conv2_block1_1_relu[0][0]
__________________________________________________________________________________________________
conv2_block1_concat (Concatenat (None, 56, 56, 96)   0           pool1[0][0]
                                                                 conv2_block1_2_conv[0][0]
__________________________________________________________________________________________________
conv2_block2_0_bn (BatchNormali (None, 56, 56, 96)   384         conv2_block1_concat[0][0]
__________________________________________________________________________________________________
conv2_block2_0_relu (Activation (None, 56, 56, 96)   0           conv2_block2_0_bn[0][0]
__________________________________________________________________________________________________
conv2_block2_1_conv (Conv2D)    (None, 56, 56, 128)  12288       conv2_block2_0_relu[0][0]
__________________________________________________________________________________________________
conv2_block2_1_bn (BatchNormali (None, 56, 56, 128)  512         conv2_block2_1_conv[0][0]
__________________________________________________________________________________________________
conv2_block2_1_relu (Activation (None, 56, 56, 128)  0           conv2_block2_1_bn[0][0]
__________________________________________________________________________________________________
conv2_block2_2_conv (Conv2D)    (None, 56, 56, 32)   36864       conv2_block2_1_relu[0][0]
__________________________________________________________________________________________________
conv2_block2_concat (Concatenat (None, 56, 56, 128)  0           conv2_block1_concat[0][0]
                                                                 conv2_block2_2_conv[0][0]
__________________________________________________________________________________________________
conv2_block3_0_bn (BatchNormali (None, 56, 56, 128)  512         conv2_block2_concat[0][0]
__________________________________________________________________________________________________
conv2_block3_0_relu (Activation (None, 56, 56, 128)  0           conv2_block3_0_bn[0][0]
__________________________________________________________________________________________________
conv2_block3_1_conv (Conv2D)    (None, 56, 56, 128)  16384       conv2_block3_0_relu[0][0]
__________________________________________________________________________________________________
conv2_block3_1_bn (BatchNormali (None, 56, 56, 128)  512         conv2_block3_1_conv[0][0]
__________________________________________________________________________________________________
conv2_block3_1_relu (Activation (None, 56, 56, 128)  0           conv2_block3_1_bn[0][0]
__________________________________________________________________________________________________
conv2_block3_2_conv (Conv2D)    (None, 56, 56, 32)   36864       conv2_block3_1_relu[0][0]
__________________________________________________________________________________________________
conv2_block3_concat (Concatenat (None, 56, 56, 160)  0           conv2_block2_concat[0][0]
                                                                 conv2_block3_2_conv[0][0]
__________________________________________________________________________________________________
conv2_block4_0_bn (BatchNormali (None, 56, 56, 160)  640         conv2_block3_concat[0][0]
__________________________________________________________________________________________________
conv2_block4_0_relu (Activation (None, 56, 56, 160)  0           conv2_block4_0_bn[0][0]
__________________________________________________________________________________________________
conv2_block4_1_conv (Conv2D)    (None, 56, 56, 128)  20480       conv2_block4_0_relu[0][0]
__________________________________________________________________________________________________
conv2_block4_1_bn (BatchNormali (None, 56, 56, 128)  512         conv2_block4_1_conv[0][0]
__________________________________________________________________________________________________
conv2_block4_1_relu (Activation (None, 56, 56, 128)  0           conv2_block4_1_bn[0][0]
__________________________________________________________________________________________________
conv2_block4_2_conv (Conv2D)    (None, 56, 56, 32)   36864       conv2_block4_1_relu[0][0]
__________________________________________________________________________________________________
conv2_block4_concat (Concatenat (None, 56, 56, 192)  0           conv2_block3_concat[0][0]
                                                                 conv2_block4_2_conv[0][0]
__________________________________________________________________________________________________
conv2_block5_0_bn (BatchNormali (None, 56, 56, 192)  768         conv2_block4_concat[0][0]
__________________________________________________________________________________________________
conv2_block5_0_relu (Activation (None, 56, 56, 192)  0           conv2_block5_0_bn[0][0]
__________________________________________________________________________________________________
conv2_block5_1_conv (Conv2D)    (None, 56, 56, 128)  24576       conv2_block5_0_relu[0][0]
__________________________________________________________________________________________________
conv2_block5_1_bn (BatchNormali (None, 56, 56, 128)  512         conv2_block5_1_conv[0][0]
__________________________________________________________________________________________________
conv2_block5_1_relu (Activation (None, 56, 56, 128)  0           conv2_block5_1_bn[0][0]
__________________________________________________________________________________________________
```

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conv2_block5_2_conv (Conv2D)    (None, 56, 56, 32)   36864       conv2_block5_1_relu[0][0]
__________________________________________________________________________________________________
conv2_block5_concat (Concatenat (None, 56, 56, 224)  0           conv2_block4_concat[0][0]
                                                                 conv2_block5_2_conv[0][0]
__________________________________________________________________________________________________
conv2_block6_0_bn (BatchNormali (None, 56, 56, 224)  896         conv2_block5_concat[0][0]
__________________________________________________________________________________________________
conv2_block6_0_relu (Activation (None, 56, 56, 224)  0           conv2_block6_0_bn[0][0]
__________________________________________________________________________________________________
conv2_block6_1_conv (Conv2D)    (None, 56, 56, 128)  28672       conv2_block6_0_relu[0][0]
__________________________________________________________________________________________________
conv2_block6_1_bn (BatchNormali (None, 56, 56, 128)  512         conv2_block6_1_conv[0][0]
__________________________________________________________________________________________________
conv2_block6_1_relu (Activation (None, 56, 56, 128)  0           conv2_block6_1_bn[0][0]
__________________________________________________________________________________________________
conv2_block6_2_conv (Conv2D)    (None, 56, 56, 32)   36864       conv2_block6_1_relu[0][0]
__________________________________________________________________________________________________
conv2_block6_concat (Concatenat (None, 56, 56, 256)  0           conv2_block5_concat[0][0]
                                                                 conv2_block6_2_conv[0][0]
__________________________________________________________________________________________________
pool2_bn (BatchNormalization)   (None, 56, 56, 256)  1024        conv2_block6_concat[0][0]
__________________________________________________________________________________________________
pool2_relu (Activation)         (None, 56, 56, 256)  0           pool2_bn[0][0]
__________________________________________________________________________________________________
pool2_conv (Conv2D)             (None, 56, 56, 128)  32768       pool2_relu[0][0]
__________________________________________________________________________________________________
pool2_pool (AveragePooling2D)   (None, 28, 28, 128)  0           pool2_conv[0][0]
__________________________________________________________________________________________________
conv3_block1_0_bn (BatchNormali (None, 28, 28, 128)  512         pool2_pool[0][0]
__________________________________________________________________________________________________
conv3_block1_0_relu (Activation (None, 28, 28, 128)  0           conv3_block1_0_bn[0][0]
__________________________________________________________________________________________________
conv3_block1_1_conv (Conv2D)    (None, 28, 28, 128)  16384       conv3_block1_0_relu[0][0]
__________________________________________________________________________________________________
conv3_block1_1_bn (BatchNormali (None, 28, 28, 128)  512         conv3_block1_1_conv[0][0]
__________________________________________________________________________________________________
conv3_block1_1_relu (Activation (None, 28, 28, 128)  0           conv3_block1_1_bn[0][0]
__________________________________________________________________________________________________
conv3_block1_2_conv (Conv2D)    (None, 28, 28, 32)   36864       conv3_block1_1_relu[0][0]
__________________________________________________________________________________________________
conv3_block1_concat (Concatenat (None, 28, 28, 160)  0           pool2_pool[0][0]
                                                                 conv3_block1_2_conv[0][0]
__________________________________________________________________________________________________
conv3_block2_0_bn (BatchNormali (None, 28, 28, 160)  640         conv3_block1_concat[0][0]
__________________________________________________________________________________________________
conv3_block2_0_relu (Activation (None, 28, 28, 160)  0           conv3_block2_0_bn[0][0]
__________________________________________________________________________________________________
conv3_block2_1_conv (Conv2D)    (None, 28, 28, 128)  20480       conv3_block2_0_relu[0][0]
__________________________________________________________________________________________________
conv3_block2_1_bn (BatchNormali (None, 28, 28, 128)  512         conv3_block2_1_conv[0][0]
__________________________________________________________________________________________________
conv3_block2_1_relu (Activation (None, 28, 28, 128)  0           conv3_block2_1_bn[0][0]
__________________________________________________________________________________________________
conv3_block2_2_conv (Conv2D)    (None, 28, 28, 32)   36864       conv3_block2_1_relu[0][0]
__________________________________________________________________________________________________
conv3_block2_concat (Concatenat (None, 28, 28, 192)  0           conv3_block1_concat[0][0]
                                                                 conv3_block2_2_conv[0][0]
__________________________________________________________________________________________________
conv3_block3_0_bn (BatchNormali (None, 28, 28, 192)  768         conv3_block2_concat[0][0]
__________________________________________________________________________________________________
conv3_block3_0_relu (Activation (None, 28, 28, 192)  0           conv3_block3_0_bn[0][0]
__________________________________________________________________________________________________
conv3_block3_1_conv (Conv2D)    (None, 28, 28, 128)  24576       conv3_block3_0_relu[0][0]
__________________________________________________________________________________________________
conv3_block3_1_bn (BatchNormali (None, 28, 28, 128)  512         conv3_block3_1_conv[0][0]
__________________________________________________________________________________________________
conv3_block3_1_relu (Activation (None, 28, 28, 128)  0           conv3_block3_1_bn[0][0]
__________________________________________________________________________________________________
conv3_block3_2_conv (Conv2D)    (None, 28, 28, 32)   36864       conv3_block3_1_relu[0][0]
__________________________________________________________________________________________________
conv3_block3_concat (Concatenat (None, 28, 28, 224)  0           conv3_block2_concat[0][0]
                                                                 conv3_block3_2_conv[0][0]
__________________________________________________________________________________________________
conv3_block4_0_bn (BatchNormali (None, 28, 28, 224)  896         conv3_block3_concat[0][0]
__________________________________________________________________________________________________
conv3_block4_0_relu (Activation (None, 28, 28, 224)  0           conv3_block4_0_bn[0][0]
__________________________________________________________________________________________________
conv3_block4_1_conv (Conv2D)    (None, 28, 28, 128)  28672       conv3_block4_0_relu[0][0]
__________________________________________________________________________________________________
conv3_block4_1_bn (BatchNormali (None, 28, 28, 128)  512         conv3_block4_1_conv[0][0]
__________________________________________________________________________________________________
conv3_block4_1_relu (Activation (None, 28, 28, 128)  0           conv3_block4_1_bn[0][0]
__________________________________________________________________________________________________
conv3_block4_2_conv (Conv2D)    (None, 28, 28, 32)   36864       conv3_block4_1_relu[0][0]
__________________________________________________________________________________________________
conv3_block4_concat (Concatenat (None, 28, 28, 256)  0           conv3_block3_concat[0][0]
                                                                 conv3_block4_2_conv[0][0]
__________________________________________________________________________________________________
```

```
conv3_block5_0_bn (BatchNormali (None, 28, 28, 256)  1024        conv3_block4_concat[0][0]

conv3_block5_0_relu (Activation (None, 28, 28, 256)  0           conv3_block5_0_bn[0][0]

conv3_block5_1_conv (Conv2D)    (None, 28, 28, 128)  32768       conv3_block5_0_relu[0][0]

conv3_block5_1_bn (BatchNormali (None, 28, 28, 128)  512         conv3_block5_1_conv[0][0]

conv3_block5_1_relu (Activation (None, 28, 28, 128)  0           conv3_block5_1_bn[0][0]

conv3_block5_2_conv (Conv2D)    (None, 28, 28, 32)   36864       conv3_block5_1_relu[0][0]

conv3_block5_concat (Concatenat (None, 28, 28, 288)  0           conv3_block4_concat[0][0]
                                                                 conv3_block5_2_conv[0][0]

conv3_block6_0_bn (BatchNormali (None, 28, 28, 288)  1152        conv3_block5_concat[0][0]

conv3_block6_0_relu (Activation (None, 28, 28, 288)  0           conv3_block6_0_bn[0][0]

conv3_block6_1_conv (Conv2D)    (None, 28, 28, 128)  36864       conv3_block6_0_relu[0][0]

conv3_block6_1_bn (BatchNormali (None, 28, 28, 128)  512         conv3_block6_1_conv[0][0]

conv3_block6_1_relu (Activation (None, 28, 28, 128)  0           conv3_block6_1_bn[0][0]

conv3_block6_2_conv (Conv2D)    (None, 28, 28, 32)   36864       conv3_block6_1_relu[0][0]

conv3_block6_concat (Concatenat (None, 28, 28, 320)  0           conv3_block5_concat[0][0]
                                                                 conv3_block6_2_conv[0][0]

conv3_block7_0_bn (BatchNormali (None, 28, 28, 320)  1280        conv3_block6_concat[0][0]

conv3_block7_0_relu (Activation (None, 28, 28, 320)  0           conv3_block7_0_bn[0][0]

conv3_block7_1_conv (Conv2D)    (None, 28, 28, 128)  40960       conv3_block7_0_relu[0][0]

conv3_block7_1_bn (BatchNormali (None, 28, 28, 128)  512         conv3_block7_1_conv[0][0]

conv3_block7_1_relu (Activation (None, 28, 28, 128)  0           conv3_block7_1_bn[0][0]

conv3_block7_2_conv (Conv2D)    (None, 28, 28, 32)   36864       conv3_block7_1_relu[0][0]

conv3_block7_concat (Concatenat (None, 28, 28, 352)  0           conv3_block6_concat[0][0]
                                                                 conv3_block7_2_conv[0][0]

conv3_block8_0_bn (BatchNormali (None, 28, 28, 352)  1408        conv3_block7_concat[0][0]

conv3_block8_0_relu (Activation (None, 28, 28, 352)  0           conv3_block8_0_bn[0][0]

conv3_block8_1_conv (Conv2D)    (None, 28, 28, 128)  45056       conv3_block8_0_relu[0][0]

conv3_block8_1_bn (BatchNormali (None, 28, 28, 128)  512         conv3_block8_1_conv[0][0]

conv3_block8_1_relu (Activation (None, 28, 28, 128)  0           conv3_block8_1_bn[0][0]

conv3_block8_2_conv (Conv2D)    (None, 28, 28, 32)   36864       conv3_block8_1_relu[0][0]

conv3_block8_concat (Concatenat (None, 28, 28, 384)  0           conv3_block7_concat[0][0]
                                                                 conv3_block8_2_conv[0][0]

conv3_block9_0_bn (BatchNormali (None, 28, 28, 384)  1536        conv3_block8_concat[0][0]

conv3_block9_0_relu (Activation (None, 28, 28, 384)  0           conv3_block9_0_bn[0][0]

conv3_block9_1_conv (Conv2D)    (None, 28, 28, 128)  49152       conv3_block9_0_relu[0][0]

conv3_block9_1_bn (BatchNormali (None, 28, 28, 128)  512         conv3_block9_1_conv[0][0]

conv3_block9_1_relu (Activation (None, 28, 28, 128)  0           conv3_block9_1_bn[0][0]

conv3_block9_2_conv (Conv2D)    (None, 28, 28, 32)   36864       conv3_block9_1_relu[0][0]

conv3_block9_concat (Concatenat (None, 28, 28, 416)  0           conv3_block8_concat[0][0]
                                                                 conv3_block9_2_conv[0][0]

conv3_block10_0_bn (BatchNormal (None, 28, 28, 416)  1664        conv3_block9_concat[0][0]

conv3_block10_0_relu (Activatio (None, 28, 28, 416)  0           conv3_block10_0_bn[0][0]

conv3_block10_1_conv (Conv2D)   (None, 28, 28, 128)  53248       conv3_block10_0_relu[0][0]

conv3_block10_1_bn (BatchNormal (None, 28, 28, 128)  512         conv3_block10_1_conv[0][0]

conv3_block10_1_relu (Activatio (None, 28, 28, 128)  0           conv3_block10_1_bn[0][0]

conv3_block10_2_conv (Conv2D)   (None, 28, 28, 32)   36864       conv3_block10_1_relu[0][0]

conv3_block10_concat (Concatena (None, 28, 28, 448)  0           conv3_block9_concat[0][0]
                                                                 conv3_block10_2_conv[0][0]
__________________________________________________________________________________________________
conv3_block11_0_bn (BatchNormal (None, 28, 28, 448)  1792        conv3_block10_concat[0][0]
__________________________________________________________________________________________________
conv3_block11_0_relu (Activatio (None, 28, 28, 448)  0           conv3_block11_0_bn[0][0]
__________________________________________________________________________________________________
conv3_block11_1_conv (Conv2D)   (None, 28, 28, 128)  57344       conv3_block11_0_relu[0][0]
__________________________________________________________________________________________________
conv3_block11_1_bn (BatchNormal (None, 28, 28, 128)  512         conv3_block11_1_conv[0][0]
__________________________________________________________________________________________________
conv3_block11_1_relu (Activatio (None, 28, 28, 128)  0           conv3_block11_1_bn[0][0]
__________________________________________________________________________________________________
conv3_block11_2_conv (Conv2D)   (None, 28, 28, 32)   36864       conv3_block11_1_relu[0][0]
__________________________________________________________________________________________________
conv3_block11_concat (Concatena (None, 28, 28, 480)  0           conv3_block10_concat[0][0]
                                                                 conv3_block11_2_conv[0][0]
__________________________________________________________________________________________________
conv3_block12_0_bn (BatchNormal (None, 28, 28, 480)  1920        conv3_block11_concat[0][0]
__________________________________________________________________________________________________
conv3_block12_0_relu (Activatio (None, 28, 28, 480)  0           conv3_block12_0_bn[0][0]
__________________________________________________________________________________________________
conv3_block12_1_conv (Conv2D)   (None, 28, 28, 128)  61440       conv3_block12_0_relu[0][0]
__________________________________________________________________________________________________
conv3_block12_1_bn (BatchNormal (None, 28, 28, 128)  512         conv3_block12_1_conv[0][0]
__________________________________________________________________________________________________
conv3_block12_1_relu (Activatio (None, 28, 28, 128)  0           conv3_block12_1_bn[0][0]
__________________________________________________________________________________________________
conv3_block12_2_conv (Conv2D)   (None, 28, 28, 32)   36864       conv3_block12_1_relu[0][0]
__________________________________________________________________________________________________
conv3_block12_concat (Concatena (None, 28, 28, 512)  0           conv3_block11_concat[0][0]
                                                                 conv3_block12_2_conv[0][0]
__________________________________________________________________________________________________
pool3_bn (BatchNormalization)   (None, 28, 28, 512)  2048        conv3_block12_concat[0][0]
__________________________________________________________________________________________________
pool3_relu (Activation)         (None, 28, 28, 512)  0           pool3_bn[0][0]
__________________________________________________________________________________________________
pool3_conv (Conv2D)             (None, 28, 28, 256)  131072      pool3_relu[0][0]
__________________________________________________________________________________________________
pool3_pool (AveragePooling2D)   (None, 14, 14, 256)  0           pool3_conv[0][0]
__________________________________________________________________________________________________
conv4_block1_0_bn (BatchNormali (None, 14, 14, 256)  1024        pool3_pool[0][0]
__________________________________________________________________________________________________
conv4_block1_0_relu (Activation (None, 14, 14, 256)  0           conv4_block1_0_bn[0][0]
__________________________________________________________________________________________________
conv4_block1_1_conv (Conv2D)    (None, 14, 14, 128)  32768       conv4_block1_0_relu[0][0]
__________________________________________________________________________________________________
conv4_block1_1_bn (BatchNormali (None, 14, 14, 128)  512         conv4_block1_1_conv[0][0]
__________________________________________________________________________________________________
conv4_block1_1_relu (Activation (None, 14, 14, 128)  0           conv4_block1_1_bn[0][0]
__________________________________________________________________________________________________
conv4_block1_2_conv (Conv2D)    (None, 14, 14, 32)   36864       conv4_block1_1_relu[0][0]
__________________________________________________________________________________________________
conv4_block1_concat (Concatenat (None, 14, 14, 288)  0           pool3_pool[0][0]
                                                                 conv4_block1_2_conv[0][0]
__________________________________________________________________________________________________
conv4_block2_0_bn (BatchNormali (None, 14, 14, 288)  1152        conv4_block1_concat[0][0]
__________________________________________________________________________________________________
conv4_block2_0_relu (Activation (None, 14, 14, 288)  0           conv4_block2_0_bn[0][0]
__________________________________________________________________________________________________
conv4_block2_1_conv (Conv2D)    (None, 14, 14, 128)  36864       conv4_block2_0_relu[0][0]
__________________________________________________________________________________________________
conv4_block2_1_bn (BatchNormali (None, 14, 14, 128)  512         conv4_block2_1_conv[0][0]
__________________________________________________________________________________________________
conv4_block2_1_relu (Activation (None, 14, 14, 128)  0           conv4_block2_1_bn[0][0]
__________________________________________________________________________________________________
conv4_block2_2_conv (Conv2D)    (None, 14, 14, 32)   36864       conv4_block2_1_relu[0][0]
__________________________________________________________________________________________________
conv4_block2_concat (Concatenat (None, 14, 14, 320)  0           conv4_block1_concat[0][0]
                                                                 conv4_block2_2_conv[0][0]
__________________________________________________________________________________________________
conv4_block3_0_bn (BatchNormali (None, 14, 14, 320)  1280        conv4_block2_concat[0][0]
__________________________________________________________________________________________________
conv4_block3_0_relu (Activation (None, 14, 14, 320)  0           conv4_block3_0_bn[0][0]
__________________________________________________________________________________________________
conv4_block3_1_conv (Conv2D)    (None, 14, 14, 128)  40960       conv4_block3_0_relu[0][0]
__________________________________________________________________________________________________
conv4_block3_1_bn (BatchNormali (None, 14, 14, 128)  512         conv4_block3_1_conv[0][0]
__________________________________________________________________________________________________
conv4_block3_1_relu (Activation (None, 14, 14, 128)  0           conv4_block3_1_bn[0][0]
__________________________________________________________________________________________________
conv4_block3_2_conv (Conv2D)    (None, 14, 14, 32)   36864       conv4_block3_1_relu[0][0]
__________________________________________________________________________________________________
conv4_block3_concat (Concatenat (None, 14, 14, 352)  0           conv4_block2_concat[0][0]
                                                                 conv4_block3_2_conv[0][0]
__________________________________________________________________________________________________
conv4_block4_0_bn (BatchNormali (None, 14, 14, 352)  1408        conv4_block3_concat[0][0]
__________________________________________________________________________________________________
conv4_block4_0_relu (Activation (None, 14, 14, 352)  0           conv4_block4_0_bn[0][0]
conv4_block4_1_conv (Conv2D)    (None, 14, 14, 128)  45056       conv4_block4_0_relu[0][0]

conv4_block4_1_bn (BatchNormali (None, 14, 14, 128)  512         conv4_block4_1_conv[0][0]

conv4_block4_1_relu (Activation (None, 14, 14, 128)  0           conv4_block4_1_bn[0][0]

conv4_block4_2_conv (Conv2D)    (None, 14, 14, 32)   36864       conv4_block4_1_relu[0][0]

conv4_block4_concat (Concatenat (None, 14, 14, 384)  0           conv4_block3_concat[0][0]
                                                                 conv4_block4_2_conv[0][0]

conv4_block5_0_bn (BatchNormali (None, 14, 14, 384)  1536        conv4_block4_concat[0][0]

conv4_block5_0_relu (Activation (None, 14, 14, 384)  0           conv4_block5_0_bn[0][0]

conv4_block5_1_conv (Conv2D)    (None, 14, 14, 128)  49152       conv4_block5_0_relu[0][0]

conv4_block5_1_bn (BatchNormali (None, 14, 14, 128)  512         conv4_block5_1_conv[0][0]

conv4_block5_1_relu (Activation (None, 14, 14, 128)  0           conv4_block5_1_bn[0][0]

conv4_block5_2_conv (Conv2D)    (None, 14, 14, 32)   36864       conv4_block5_1_relu[0][0]

conv4_block5_concat (Concatenat (None, 14, 14, 416)  0           conv4_block4_concat[0][0]
                                                                 conv4_block5_2_conv[0][0]

conv4_block6_0_bn (BatchNormali (None, 14, 14, 416)  1664        conv4_block5_concat[0][0]

conv4_block6_0_relu (Activation (None, 14, 14, 416)  0           conv4_block6_0_bn[0][0]

conv4_block6_1_conv (Conv2D)    (None, 14, 14, 128)  53248       conv4_block6_0_relu[0][0]

conv4_block6_1_bn (BatchNormali (None, 14, 14, 128)  512         conv4_block6_1_conv[0][0]

conv4_block6_1_relu (Activation (None, 14, 14, 128)  0           conv4_block6_1_bn[0][0]

conv4_block6_2_conv (Conv2D)    (None, 14, 14, 32)   36864       conv4_block6_1_relu[0][0]

conv4_block6_concat (Concatenat (None, 14, 14, 448)  0           conv4_block5_concat[0][0]
                                                                 conv4_block6_2_conv[0][0]

conv4_block7_0_bn (BatchNormali (None, 14, 14, 448)  1792        conv4_block6_concat[0][0]

conv4_block7_0_relu (Activation (None, 14, 14, 448)  0           conv4_block7_0_bn[0][0]

conv4_block7_1_conv (Conv2D)    (None, 14, 14, 128)  57344       conv4_block7_0_relu[0][0]

conv4_block7_1_bn (BatchNormali (None, 14, 14, 128)  512         conv4_block7_1_conv[0][0]

conv4_block7_1_relu (Activation (None, 14, 14, 128)  0           conv4_block7_1_bn[0][0]

conv4_block7_2_conv (Conv2D)    (None, 14, 14, 32)   36864       conv4_block7_1_relu[0][0]

conv4_block7_concat (Concatenat (None, 14, 14, 480)  0           conv4_block6_concat[0][0]
                                                                 conv4_block7_2_conv[0][0]

conv4_block8_0_bn (BatchNormali (None, 14, 14, 480)  1920        conv4_block7_concat[0][0]

conv4_block8_0_relu (Activation (None, 14, 14, 480)  0           conv4_block8_0_bn[0][0]

conv4_block8_1_conv (Conv2D)    (None, 14, 14, 128)  61440       conv4_block8_0_relu[0][0]

conv4_block8_1_bn (BatchNormali (None, 14, 14, 128)  512         conv4_block8_1_conv[0][0]

conv4_block8_1_relu (Activation (None, 14, 14, 128)  0           conv4_block8_1_bn[0][0]

conv4_block8_2_conv (Conv2D)    (None, 14, 14, 32)   36864       conv4_block8_1_relu[0][0]

conv4_block8_concat (Concatenat (None, 14, 14, 512)  0           conv4_block7_concat[0][0]
                                                                 conv4_block8_2_conv[0][0]

conv4_block9_0_bn (BatchNormali (None, 14, 14, 512)  2048        conv4_block8_concat[0][0]

conv4_block9_0_relu (Activation (None, 14, 14, 512)  0           conv4_block9_0_bn[0][0]

conv4_block9_1_conv (Conv2D)    (None, 14, 14, 128)  65536       conv4_block9_0_relu[0][0]

conv4_block9_1_bn (BatchNormali (None, 14, 14, 128)  512         conv4_block9_1_conv[0][0]

conv4_block9_1_relu (Activation (None, 14, 14, 128)  0           conv4_block9_1_bn[0][0]

conv4_block9_2_conv (Conv2D)    (None, 14, 14, 32)   36864       conv4_block9_1_relu[0][0]

conv4_block9_concat (Concatenat (None, 14, 14, 544)  0           conv4_block8_concat[0][0]
                                                                 conv4_block9_2_conv[0][0]

conv4_block10_0_bn (BatchNormal (None, 14, 14, 544)  2176        conv4_block9_concat[0][0]
__________________________________________________________________________________________________
conv4_block10_0_relu (Activatio (None, 14, 14, 544)  0           conv4_block10_0_bn[0][0]
__________________________________________________________________________________________________
conv4_block10_1_conv (Conv2D)   (None, 14, 14, 128)  69632       conv4_block10_0_relu[0][0]
__________________________________________________________________________________________________
conv4_block10_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block10_1_conv[0][0]
__________________________________________________________________________________________________
conv4_block10_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block10_1_bn[0][0]
__________________________________________________________________________________________________
conv4_block10_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block10_1_relu[0][0]
__________________________________________________________________________________________________
conv4_block10_concat (Concatena (None, 14, 14, 576)  0           conv4_block9_concat[0][0]
                                                                 conv4_block10_2_conv[0][0]
__________________________________________________________________________________________________
conv4_block11_0_bn (BatchNormal (None, 14, 14, 576)  2304        conv4_block10_concat[0][0]
__________________________________________________________________________________________________
conv4_block11_0_relu (Activatio (None, 14, 14, 576)  0           conv4_block11_0_bn[0][0]
__________________________________________________________________________________________________
conv4_block11_1_conv (Conv2D)   (None, 14, 14, 128)  73728       conv4_block11_0_relu[0][0]
__________________________________________________________________________________________________
conv4_block11_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block11_1_conv[0][0]
__________________________________________________________________________________________________
conv4_block11_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block11_1_bn[0][0]
__________________________________________________________________________________________________
conv4_block11_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block11_1_relu[0][0]
__________________________________________________________________________________________________
conv4_block11_concat (Concatena (None, 14, 14, 608)  0           conv4_block10_concat[0][0]
                                                                 conv4_block11_2_conv[0][0]
__________________________________________________________________________________________________
conv4_block12_0_bn (BatchNormal (None, 14, 14, 608)  2432        conv4_block11_concat[0][0]
__________________________________________________________________________________________________
conv4_block12_0_relu (Activatio (None, 14, 14, 608)  0           conv4_block12_0_bn[0][0]
__________________________________________________________________________________________________
conv4_block12_1_conv (Conv2D)   (None, 14, 14, 128)  77824       conv4_block12_0_relu[0][0]
__________________________________________________________________________________________________
conv4_block12_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block12_1_conv[0][0]
__________________________________________________________________________________________________
conv4_block12_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block12_1_bn[0][0]
__________________________________________________________________________________________________
conv4_block12_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block12_1_relu[0][0]
__________________________________________________________________________________________________
conv4_block12_concat (Concatena (None, 14, 14, 640)  0           conv4_block11_concat[0][0]
                                                                 conv4_block12_2_conv[0][0]
__________________________________________________________________________________________________
conv4_block13_0_bn (BatchNormal (None, 14, 14, 640)  2560        conv4_block12_concat[0][0]
__________________________________________________________________________________________________
conv4_block13_0_relu (Activatio (None, 14, 14, 640)  0           conv4_block13_0_bn[0][0]
__________________________________________________________________________________________________
conv4_block13_1_conv (Conv2D)   (None, 14, 14, 128)  81920       conv4_block13_0_relu[0][0]
__________________________________________________________________________________________________
conv4_block13_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block13_1_conv[0][0]
__________________________________________________________________________________________________
conv4_block13_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block13_1_bn[0][0]
__________________________________________________________________________________________________
conv4_block13_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block13_1_relu[0][0]
__________________________________________________________________________________________________
conv4_block13_concat (Concatena (None, 14, 14, 672)  0           conv4_block12_concat[0][0]
                                                                 conv4_block13_2_conv[0][0]
__________________________________________________________________________________________________
conv4_block14_0_bn (BatchNormal (None, 14, 14, 672)  2688        conv4_block13_concat[0][0]
__________________________________________________________________________________________________
conv4_block14_0_relu (Activatio (None, 14, 14, 672)  0           conv4_block14_0_bn[0][0]
__________________________________________________________________________________________________
conv4_block14_1_conv (Conv2D)   (None, 14, 14, 128)  86016       conv4_block14_0_relu[0][0]
__________________________________________________________________________________________________
conv4_block14_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block14_1_conv[0][0]
__________________________________________________________________________________________________
conv4_block14_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block14_1_bn[0][0]
__________________________________________________________________________________________________
conv4_block14_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block14_1_relu[0][0]
__________________________________________________________________________________________________
conv4_block14_concat (Concatena (None, 14, 14, 704)  0           conv4_block13_concat[0][0]
                                                                 conv4_block14_2_conv[0][0]
__________________________________________________________________________________________________
conv4_block15_0_bn (BatchNormal (None, 14, 14, 704)  2816        conv4_block14_concat[0][0]
__________________________________________________________________________________________________
conv4_block15_0_relu (Activatio (None, 14, 14, 704)  0           conv4_block15_0_bn[0][0]
__________________________________________________________________________________________________
conv4_block15_1_conv (Conv2D)   (None, 14, 14, 128)  90112       conv4_block15_0_relu[0][0]
__________________________________________________________________________________________________
conv4_block15_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block15_1_conv[0][0]
__________________________________________________________________________________________________
conv4_block15_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block15_1_bn[0][0]
__________________________________________________________________________________________________
conv4_block15_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block15_1_relu[0][0]
__________________________________________________________________________________________________
conv4_block15_concat (Concatena (None, 14, 14, 736)  0           conv4_block14_concat[0][0]
                                                                 conv4_block15_2_conv[0][0]
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conv4_block16_0_bn (BatchNormal (None, 14, 14, 736)  2944        conv4_block15_concat[0][0]

conv4_block16_0_relu (Activatio (None, 14, 14, 736)  0           conv4_block16_0_bn[0][0]

conv4_block16_1_conv (Conv2D)   (None, 14, 14, 128)  94208       conv4_block16_0_relu[0][0]

conv4_block16_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block16_1_conv[0][0]

conv4_block16_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block16_1_bn[0][0]

conv4_block16_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block16_1_relu[0][0]

conv4_block16_concat (Concatena (None, 14, 14, 768)  0           conv4_block15_concat[0][0]
                                                                 conv4_block16_2_conv[0][0]

conv4_block17_0_bn (BatchNormal (None, 14, 14, 768)  3072        conv4_block16_concat[0][0]

conv4_block17_0_relu (Activatio (None, 14, 14, 768)  0           conv4_block17_0_bn[0][0]

conv4_block17_1_conv (Conv2D)   (None, 14, 14, 128)  98304       conv4_block17_0_relu[0][0]

conv4_block17_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block17_1_conv[0][0]

conv4_block17_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block17_1_bn[0][0]

conv4_block17_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block17_1_relu[0][0]

conv4_block17_concat (Concatena (None, 14, 14, 800)  0           conv4_block16_concat[0][0]
                                                                 conv4_block17_2_conv[0][0]

conv4_block18_0_bn (BatchNormal (None, 14, 14, 800)  3200        conv4_block17_concat[0][0]

conv4_block18_0_relu (Activatio (None, 14, 14, 800)  0           conv4_block18_0_bn[0][0]

conv4_block18_1_conv (Conv2D)   (None, 14, 14, 128)  102400      conv4_block18_0_relu[0][0]

conv4_block18_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block18_1_conv[0][0]

conv4_block18_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block18_1_bn[0][0]

conv4_block18_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block18_1_relu[0][0]

conv4_block18_concat (Concatena (None, 14, 14, 832)  0           conv4_block17_concat[0][0]
                                                                 conv4_block18_2_conv[0][0]

conv4_block19_0_bn (BatchNormal (None, 14, 14, 832)  3328        conv4_block18_concat[0][0]

conv4_block19_0_relu (Activatio (None, 14, 14, 832)  0           conv4_block19_0_bn[0][0]

conv4_block19_1_conv (Conv2D)   (None, 14, 14, 128)  106496      conv4_block19_0_relu[0][0]

conv4_block19_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block19_1_conv[0][0]

conv4_block19_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block19_1_bn[0][0]

conv4_block19_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block19_1_relu[0][0]

conv4_block19_concat (Concatena (None, 14, 14, 864)  0           conv4_block18_concat[0][0]
                                                                 conv4_block19_2_conv[0][0]

conv4_block20_0_bn (BatchNormal (None, 14, 14, 864)  3456        conv4_block19_concat[0][0]

conv4_block20_0_relu (Activatio (None, 14, 14, 864)  0           conv4_block20_0_bn[0][0]

conv4_block20_1_conv (Conv2D)   (None, 14, 14, 128)  110592      conv4_block20_0_relu[0][0]

conv4_block20_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block20_1_conv[0][0]

conv4_block20_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block20_1_bn[0][0]

conv4_block20_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block20_1_relu[0][0]

conv4_block20_concat (Concatena (None, 14, 14, 896)  0           conv4_block19_concat[0][0]
                                                                 conv4_block20_2_conv[0][0]

conv4_block21_0_bn (BatchNormal (None, 14, 14, 896)  3584        conv4_block20_concat[0][0]

conv4_block21_0_relu (Activatio (None, 14, 14, 896)  0           conv4_block21_0_bn[0][0]

conv4_block21_1_conv (Conv2D)   (None, 14, 14, 128)  114688      conv4_block21_0_relu[0][0]

conv4_block21_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block21_1_conv[0][0]

conv4_block21_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block21_1_bn[0][0]

conv4_block21_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block21_1_relu[0][0]
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conv4_block21_concat (Concatena (None, 14, 14, 928)  0           conv4_block20_concat[0][0]
                                                                 conv4_block21_2_conv[0][0]

conv4_block22_0_bn (BatchNormal (None, 14, 14, 928)  3712        conv4_block21_concat[0][0]

conv4_block22_0_relu (Activatio (None, 14, 14, 928)  0           conv4_block22_0_bn[0][0]

conv4_block22_1_conv (Conv2D)   (None, 14, 14, 128)  118784      conv4_block22_0_relu[0][0]

conv4_block22_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block22_1_conv[0][0]

conv4_block22_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block22_1_bn[0][0]

conv4_block22_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block22_1_relu[0][0]

conv4_block22_concat (Concatena (None, 14, 14, 960)  0           conv4_block21_concat[0][0]
                                                                 conv4_block22_2_conv[0][0]

conv4_block23_0_bn (BatchNormal (None, 14, 14, 960)  3840        conv4_block22_concat[0][0]

conv4_block23_0_relu (Activatio (None, 14, 14, 960)  0           conv4_block23_0_bn[0][0]

conv4_block23_1_conv (Conv2D)   (None, 14, 14, 128)  122880      conv4_block23_0_relu[0][0]

conv4_block23_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block23_1_conv[0][0]

conv4_block23_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block23_1_bn[0][0]

conv4_block23_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block23_1_relu[0][0]

conv4_block23_concat (Concatena (None, 14, 14, 992)  0           conv4_block22_concat[0][0]
                                                                 conv4_block23_2_conv[0][0]

conv4_block24_0_bn (BatchNormal (None, 14, 14, 992)  3968        conv4_block23_concat[0][0]

conv4_block24_0_relu (Activatio (None, 14, 14, 992)  0           conv4_block24_0_bn[0][0]

conv4_block24_1_conv (Conv2D)   (None, 14, 14, 128)  126976      conv4_block24_0_relu[0][0]

conv4_block24_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block24_1_conv[0][0]

conv4_block24_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block24_1_bn[0][0]

conv4_block24_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block24_1_relu[0][0]

conv4_block24_concat (Concatena (None, 14, 14, 1024) 0           conv4_block23_concat[0][0]
                                                                 conv4_block24_2_conv[0][0]

conv4_block25_0_bn (BatchNormal (None, 14, 14, 1024) 4096        conv4_block24_concat[0][0]

conv4_block25_0_relu (Activatio (None, 14, 14, 1024) 0           conv4_block25_0_bn[0][0]

conv4_block25_1_conv (Conv2D)   (None, 14, 14, 128)  131072      conv4_block25_0_relu[0][0]

conv4_block25_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block25_1_conv[0][0]

conv4_block25_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block25_1_bn[0][0]

conv4_block25_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block25_1_relu[0][0]

conv4_block25_concat (Concatena (None, 14, 14, 1056) 0           conv4_block24_concat[0][0]
                                                                 conv4_block25_2_conv[0][0]

conv4_block26_0_bn (BatchNormal (None, 14, 14, 1056) 4224        conv4_block25_concat[0][0]

conv4_block26_0_relu (Activatio (None, 14, 14, 1056) 0           conv4_block26_0_bn[0][0]

conv4_block26_1_conv (Conv2D)   (None, 14, 14, 128)  135168      conv4_block26_0_relu[0][0]

conv4_block26_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block26_1_conv[0][0]

conv4_block26_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block26_1_bn[0][0]

conv4_block26_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block26_1_relu[0][0]

conv4_block26_concat (Concatena (None, 14, 14, 1088) 0           conv4_block25_concat[0][0]
                                                                 conv4_block26_2_conv[0][0]

conv4_block27_0_bn (BatchNormal (None, 14, 14, 1088) 4352        conv4_block26_concat[0][0]

conv4_block27_0_relu (Activatio (None, 14, 14, 1088) 0           conv4_block27_0_bn[0][0]

conv4_block27_1_conv (Conv2D)   (None, 14, 14, 128)  139264      conv4_block27_0_relu[0][0]

conv4_block27_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block27_1_conv[0][0]

conv4_block27_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block27_1_bn[0][0]
conv4_block27_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block27_1_relu[0][0]
__________________________________________________________________________________________________
conv4_block27_concat (Concatena (None, 14, 14, 1120) 0           conv4_block26_concat[0][0]
                                                                 conv4_block27_2_conv[0][0]
__________________________________________________________________________________________________
conv4_block28_0_bn (BatchNormal (None, 14, 14, 1120) 4480        conv4_block27_concat[0][0]
__________________________________________________________________________________________________
conv4_block28_0_relu (Activatio (None, 14, 14, 1120) 0           conv4_block28_0_bn[0][0]
__________________________________________________________________________________________________
conv4_block28_1_conv (Conv2D)   (None, 14, 14, 128)  143360      conv4_block28_0_relu[0][0]
__________________________________________________________________________________________________
conv4_block28_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block28_1_conv[0][0]
__________________________________________________________________________________________________
conv4_block28_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block28_1_bn[0][0]
__________________________________________________________________________________________________
conv4_block28_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block28_1_relu[0][0]
__________________________________________________________________________________________________
conv4_block28_concat (Concatena (None, 14, 14, 1152) 0           conv4_block27_concat[0][0]
                                                                 conv4_block28_2_conv[0][0]
__________________________________________________________________________________________________
conv4_block29_0_bn (BatchNormal (None, 14, 14, 1152) 4608        conv4_block28_concat[0][0]
__________________________________________________________________________________________________
conv4_block29_0_relu (Activatio (None, 14, 14, 1152) 0           conv4_block29_0_bn[0][0]
__________________________________________________________________________________________________
conv4_block29_1_conv (Conv2D)   (None, 14, 14, 128)  147456      conv4_block29_0_relu[0][0]
__________________________________________________________________________________________________
conv4_block29_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block29_1_conv[0][0]
__________________________________________________________________________________________________
conv4_block29_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block29_1_bn[0][0]
__________________________________________________________________________________________________
conv4_block29_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block29_1_relu[0][0]
__________________________________________________________________________________________________
conv4_block29_concat (Concatena (None, 14, 14, 1184) 0           conv4_block28_concat[0][0]
                                                                 conv4_block29_2_conv[0][0]
__________________________________________________________________________________________________
conv4_block30_0_bn (BatchNormal (None, 14, 14, 1184) 4736        conv4_block29_concat[0][0]
__________________________________________________________________________________________________
conv4_block30_0_relu (Activatio (None, 14, 14, 1184) 0           conv4_block30_0_bn[0][0]
__________________________________________________________________________________________________
conv4_block30_1_conv (Conv2D)   (None, 14, 14, 128)  151552      conv4_block30_0_relu[0][0]
__________________________________________________________________________________________________
conv4_block30_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block30_1_conv[0][0]
__________________________________________________________________________________________________
conv4_block30_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block30_1_bn[0][0]
__________________________________________________________________________________________________
conv4_block30_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block30_1_relu[0][0]
__________________________________________________________________________________________________
conv4_block30_concat (Concatena (None, 14, 14, 1216) 0           conv4_block29_concat[0][0]
                                                                 conv4_block30_2_conv[0][0]
__________________________________________________________________________________________________
conv4_block31_0_bn (BatchNormal (None, 14, 14, 1216) 4864        conv4_block30_concat[0][0]
__________________________________________________________________________________________________
conv4_block31_0_relu (Activatio (None, 14, 14, 1216) 0           conv4_block31_0_bn[0][0]
__________________________________________________________________________________________________
conv4_block31_1_conv (Conv2D)   (None, 14, 14, 128)  155648      conv4_block31_0_relu[0][0]
__________________________________________________________________________________________________
conv4_block31_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block31_1_conv[0][0]
__________________________________________________________________________________________________
conv4_block31_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block31_1_bn[0][0]
__________________________________________________________________________________________________
conv4_block31_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block31_1_relu[0][0]
__________________________________________________________________________________________________
conv4_block31_concat (Concatena (None, 14, 14, 1248) 0           conv4_block30_concat[0][0]
                                                                 conv4_block31_2_conv[0][0]
__________________________________________________________________________________________________
conv4_block32_0_bn (BatchNormal (None, 14, 14, 1248) 4992        conv4_block31_concat[0][0]
__________________________________________________________________________________________________
conv4_block32_0_relu (Activatio (None, 14, 14, 1248) 0           conv4_block32_0_bn[0][0]
__________________________________________________________________________________________________
conv4_block32_1_conv (Conv2D)   (None, 14, 14, 128)  159744      conv4_block32_0_relu[0][0]
__________________________________________________________________________________________________
conv4_block32_1_bn (BatchNormal (None, 14, 14, 128)  512         conv4_block32_1_conv[0][0]
__________________________________________________________________________________________________
conv4_block32_1_relu (Activatio (None, 14, 14, 128)  0           conv4_block32_1_bn[0][0]
__________________________________________________________________________________________________
conv4_block32_2_conv (Conv2D)   (None, 14, 14, 32)   36864       conv4_block32_1_relu[0][0]
__________________________________________________________________________________________________
conv4_block32_concat (Concatena (None, 14, 14, 1280) 0           conv4_block31_concat[0][0]
                                                                 conv4_block32_2_conv[0][0]
__________________________________________________________________________________________________
pool4_bn (BatchNormalization)   (None, 14, 14, 1280) 5120        conv4_block32_concat[0][0]
__________________________________________________________________________________________________
pool4_relu (Activation)         (None, 14, 14, 1280) 0           pool4_bn[0][0]
__________________________________________________________________________________________________
pool4_conv (Conv2D)             (None, 14, 14, 640)  819200      pool4_relu[0][0]
__________________________________________________________________________________________________
pool4_pool (AveragePooling2D)   (None, 7, 7, 640)    0           pool4_conv[0][0]
__________________________________________________________________________________________________
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conv5_block1_0_bn (BatchNormali (None, 7, 7, 640)    2560        pool4_pool[0][0]
__________________________________________________________________________________________________
conv5_block1_0_relu (Activation (None, 7, 7, 640)    0           conv5_block1_0_bn[0][0]
__________________________________________________________________________________________________
conv5_block1_1_conv (Conv2D)    (None, 7, 7, 128)    81920       conv5_block1_0_relu[0][0]
__________________________________________________________________________________________________
conv5_block1_1_bn (BatchNormali (None, 7, 7, 128)    512         conv5_block1_1_conv[0][0]
__________________________________________________________________________________________________
conv5_block1_1_relu (Activation (None, 7, 7, 128)    0           conv5_block1_1_bn[0][0]
__________________________________________________________________________________________________
conv5_block1_2_conv (Conv2D)    (None, 7, 7, 32)     36864       conv5_block1_1_relu[0][0]
__________________________________________________________________________________________________
conv5_block1_concat (Concatenat (None, 7, 7, 672)    0           pool4_pool[0][0]
                                                                 conv5_block1_2_conv[0][0]
__________________________________________________________________________________________________
conv5_block2_0_bn (BatchNormali (None, 7, 7, 672)    2688        conv5_block1_concat[0][0]
__________________________________________________________________________________________________
conv5_block2_0_relu (Activation (None, 7, 7, 672)    0           conv5_block2_0_bn[0][0]
__________________________________________________________________________________________________
conv5_block2_1_conv (Conv2D)    (None, 7, 7, 128)    86016       conv5_block2_0_relu[0][0]
__________________________________________________________________________________________________
conv5_block2_1_bn (BatchNormali (None, 7, 7, 128)    512         conv5_block2_1_conv[0][0]
__________________________________________________________________________________________________
conv5_block2_1_relu (Activation (None, 7, 7, 128)    0           conv5_block2_1_bn[0][0]
__________________________________________________________________________________________________
conv5_block2_2_conv (Conv2D)    (None, 7, 7, 32)     36864       conv5_block2_1_relu[0][0]
__________________________________________________________________________________________________
conv5_block2_concat (Concatenat (None, 7, 7, 704)    0           conv5_block1_concat[0][0]
                                                                 conv5_block2_2_conv[0][0]
__________________________________________________________________________________________________
conv5_block3_0_bn (BatchNormali (None, 7, 7, 704)    2816        conv5_block2_concat[0][0]
__________________________________________________________________________________________________
conv5_block3_0_relu (Activation (None, 7, 7, 704)    0           conv5_block3_0_bn[0][0]
__________________________________________________________________________________________________
conv5_block3_1_conv (Conv2D)    (None, 7, 7, 128)    90112       conv5_block3_0_relu[0][0]
__________________________________________________________________________________________________
conv5_block3_1_bn (BatchNormali (None, 7, 7, 128)    512         conv5_block3_1_conv[0][0]
__________________________________________________________________________________________________
conv5_block3_1_relu (Activation (None, 7, 7, 128)    0           conv5_block3_1_bn[0][0]
__________________________________________________________________________________________________
conv5_block3_2_conv (Conv2D)    (None, 7, 7, 32)     36864       conv5_block3_1_relu[0][0]
__________________________________________________________________________________________________
conv5_block3_concat (Concatenat (None, 7, 7, 736)    0           conv5_block2_concat[0][0]
                                                                 conv5_block3_2_conv[0][0]
__________________________________________________________________________________________________
conv5_block4_0_bn (BatchNormali (None, 7, 7, 736)    2944        conv5_block3_concat[0][0]
__________________________________________________________________________________________________
conv5_block4_0_relu (Activation (None, 7, 7, 736)    0           conv5_block4_0_bn[0][0]
__________________________________________________________________________________________________
conv5_block4_1_conv (Conv2D)    (None, 7, 7, 128)    94208       conv5_block4_0_relu[0][0]
__________________________________________________________________________________________________
conv5_block4_1_bn (BatchNormali (None, 7, 7, 128)    512         conv5_block4_1_conv[0][0]
__________________________________________________________________________________________________
conv5_block4_1_relu (Activation (None, 7, 7, 128)    0           conv5_block4_1_bn[0][0]
__________________________________________________________________________________________________
conv5_block4_2_conv (Conv2D)    (None, 7, 7, 32)     36864       conv5_block4_1_relu[0][0]
__________________________________________________________________________________________________
conv5_block4_concat (Concatenat (None, 7, 7, 768)    0           conv5_block3_concat[0][0]
                                                                 conv5_block4_2_conv[0][0]
__________________________________________________________________________________________________
conv5_block5_0_bn (BatchNormali (None, 7, 7, 768)    3072        conv5_block4_concat[0][0]
__________________________________________________________________________________________________
conv5_block5_0_relu (Activation (None, 7, 7, 768)    0           conv5_block5_0_bn[0][0]
__________________________________________________________________________________________________
conv5_block5_1_conv (Conv2D)    (None, 7, 7, 128)    98304       conv5_block5_0_relu[0][0]
__________________________________________________________________________________________________
conv5_block5_1_bn (BatchNormali (None, 7, 7, 128)    512         conv5_block5_1_conv[0][0]
__________________________________________________________________________________________________
conv5_block5_1_relu (Activation (None, 7, 7, 128)    0           conv5_block5_1_bn[0][0]
__________________________________________________________________________________________________
conv5_block5_2_conv (Conv2D)    (None, 7, 7, 32)     36864       conv5_block5_1_relu[0][0]
__________________________________________________________________________________________________
conv5_block5_concat (Concatenat (None, 7, 7, 800)    0           conv5_block4_concat[0][0]
                                                                 conv5_block5_2_conv[0][0]
__________________________________________________________________________________________________
conv5_block6_0_bn (BatchNormali (None, 7, 7, 800)    3200        conv5_block5_concat[0][0]
__________________________________________________________________________________________________
conv5_block6_0_relu (Activation (None, 7, 7, 800)    0           conv5_block6_0_bn[0][0]
__________________________________________________________________________________________________
conv5_block6_1_conv (Conv2D)    (None, 7, 7, 128)    102400      conv5_block6_0_relu[0][0]
__________________________________________________________________________________________________
conv5_block6_1_bn (BatchNormali (None, 7, 7, 128)    512         conv5_block6_1_conv[0][0]
__________________________________________________________________________________________________
conv5_block6_1_relu (Activation (None, 7, 7, 128)    0           conv5_block6_1_bn[0][0]
__________________________________________________________________________________________________
conv5_block6_2_conv (Conv2D)    (None, 7, 7, 32)     36864       conv5_block6_1_relu[0][0]
__________________________________________________________________________________________________
conv5_block6_concat (Concatenat (None, 7, 7, 832)    0           conv5_block5_concat[0][0]
                                                                 conv5_block6_2_conv[0][0]
__________________________________________________________________________________________________
conv5_block7_0_bn (BatchNormali (None, 7, 7, 832)    3328        conv5_block6_concat[0][0]
__________________________________________________________________________________________________
conv5_block7_0_relu (Activation (None, 7, 7, 832)    0           conv5_block7_0_bn[0][0]
__________________________________________________________________________________________________
conv5_block7_1_conv (Conv2D)    (None, 7, 7, 128)    106496      conv5_block7_0_relu[0][0]
__________________________________________________________________________________________________
conv5_block7_1_bn (BatchNormali (None, 7, 7, 128)    512         conv5_block7_1_conv[0][0]
__________________________________________________________________________________________________
conv5_block7_1_relu (Activation (None, 7, 7, 128)    0           conv5_block7_1_bn[0][0]
__________________________________________________________________________________________________
conv5_block7_2_conv (Conv2D)    (None, 7, 7, 32)     36864       conv5_block7_1_relu[0][0]
__________________________________________________________________________________________________
conv5_block7_concat (Concatenat (None, 7, 7, 864)    0           conv5_block6_concat[0][0]
                                                                 conv5_block7_2_conv[0][0]
__________________________________________________________________________________________________
conv5_block8_0_bn (BatchNormali (None, 7, 7, 864)    3456        conv5_block7_concat[0][0]
__________________________________________________________________________________________________
conv5_block8_0_relu (Activation (None, 7, 7, 864)    0           conv5_block8_0_bn[0][0]
__________________________________________________________________________________________________
conv5_block8_1_conv (Conv2D)    (None, 7, 7, 128)    110592      conv5_block8_0_relu[0][0]
__________________________________________________________________________________________________
conv5_block8_1_bn (BatchNormali (None, 7, 7, 128)    512         conv5_block8_1_conv[0][0]
__________________________________________________________________________________________________
conv5_block8_1_relu (Activation (None, 7, 7, 128)    0           conv5_block8_1_bn[0][0]
__________________________________________________________________________________________________
conv5_block8_2_conv (Conv2D)    (None, 7, 7, 32)     36864       conv5_block8_1_relu[0][0]
__________________________________________________________________________________________________
conv5_block8_concat (Concatenat (None, 7, 7, 896)    0           conv5_block7_concat[0][0]
                                                                 conv5_block8_2_conv[0][0]
__________________________________________________________________________________________________
conv5_block9_0_bn (BatchNormali (None, 7, 7, 896)    3584        conv5_block8_concat[0][0]
__________________________________________________________________________________________________
conv5_block9_0_relu (Activation (None, 7, 7, 896)    0           conv5_block9_0_bn[0][0]
__________________________________________________________________________________________________
conv5_block9_1_conv (Conv2D)    (None, 7, 7, 128)    114688      conv5_block9_0_relu[0][0]
__________________________________________________________________________________________________
conv5_block9_1_bn (BatchNormali (None, 7, 7, 128)    512         conv5_block9_1_conv[0][0]
__________________________________________________________________________________________________
conv5_block9_1_relu (Activation (None, 7, 7, 128)    0           conv5_block9_1_bn[0][0]
__________________________________________________________________________________________________
conv5_block9_2_conv (Conv2D)    (None, 7, 7, 32)     36864       conv5_block9_1_relu[0][0]
__________________________________________________________________________________________________
conv5_block9_concat (Concatenat (None, 7, 7, 928)    0           conv5_block8_concat[0][0]
                                                                 conv5_block9_2_conv[0][0]
__________________________________________________________________________________________________
conv5_block10_0_bn (BatchNormal (None, 7, 7, 928)    3712        conv5_block9_concat[0][0]
__________________________________________________________________________________________________
conv5_block10_0_relu (Activatio (None, 7, 7, 928)    0           conv5_block10_0_bn[0][0]
__________________________________________________________________________________________________
conv5_block10_1_conv (Conv2D)   (None, 7, 7, 128)    118784      conv5_block10_0_relu[0][0]
__________________________________________________________________________________________________
conv5_block10_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block10_1_conv[0][0]
__________________________________________________________________________________________________
conv5_block10_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block10_1_bn[0][0]
__________________________________________________________________________________________________
conv5_block10_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block10_1_relu[0][0]
__________________________________________________________________________________________________
conv5_block10_concat (Concatena (None, 7, 7, 960)    0           conv5_block9_concat[0][0]
                                                                 conv5_block10_2_conv[0][0]
__________________________________________________________________________________________________
conv5_block11_0_bn (BatchNormal (None, 7, 7, 960)    3840        conv5_block10_concat[0][0]
__________________________________________________________________________________________________
conv5_block11_0_relu (Activatio (None, 7, 7, 960)    0           conv5_block11_0_bn[0][0]
__________________________________________________________________________________________________
conv5_block11_1_conv (Conv2D)   (None, 7, 7, 128)    122880      conv5_block11_0_relu[0][0]
__________________________________________________________________________________________________
conv5_block11_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block11_1_conv[0][0]
__________________________________________________________________________________________________
conv5_block11_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block11_1_bn[0][0]
__________________________________________________________________________________________________
conv5_block11_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block11_1_relu[0][0]
__________________________________________________________________________________________________
conv5_block11_concat (Concatena (None, 7, 7, 992)    0           conv5_block10_concat[0][0]
                                                                 conv5_block11_2_conv[0][0]
__________________________________________________________________________________________________
conv5_block12_0_bn (BatchNormal (None, 7, 7, 992)    3968        conv5_block11_concat[0][0]
__________________________________________________________________________________________________
conv5_block12_0_relu (Activatio (None, 7, 7, 992)    0           conv5_block12_0_bn[0][0]
__________________________________________________________________________________________________
conv5_block12_1_conv (Conv2D)   (None, 7, 7, 128)    126976      conv5_block12_0_relu[0][0]
__________________________________________________________________________________________________
conv5_block12_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block12_1_conv[0][0]
__________________________________________________________________________________________________
conv5_block12_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block12_1_bn[0][0]
__________________________________________________________________________________________________
conv5_block12_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block12_1_relu[0][0]
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conv5_block12_concat (Concatena (None, 7, 7, 1024)   0           conv5_block11_concat[0][0]
                                                                 conv5_block12_2_conv[0][0]
conv5_block13_0_bn (BatchNormal (None, 7, 7, 1024)   4096        conv5_block12_concat[0][0]
conv5_block13_0_relu (Activatio (None, 7, 7, 1024)   0           conv5_block13_0_bn[0][0]
conv5_block13_1_conv (Conv2D)   (None, 7, 7, 128)    131072      conv5_block13_0_relu[0][0]
conv5_block13_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block13_1_conv[0][0]
conv5_block13_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block13_1_bn[0][0]
conv5_block13_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block13_1_relu[0][0]
conv5_block13_concat (Concatena (None, 7, 7, 1056)   0           conv5_block12_concat[0][0]
                                                                 conv5_block13_2_conv[0][0]
conv5_block14_0_bn (BatchNormal (None, 7, 7, 1056)   4224        conv5_block13_concat[0][0]
conv5_block14_0_relu (Activatio (None, 7, 7, 1056)   0           conv5_block14_0_bn[0][0]
conv5_block14_1_conv (Conv2D)   (None, 7, 7, 128)    135168      conv5_block14_0_relu[0][0]
conv5_block14_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block14_1_conv[0][0]
conv5_block14_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block14_1_bn[0][0]
conv5_block14_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block14_1_relu[0][0]
conv5_block14_concat (Concatena (None, 7, 7, 1088)   0           conv5_block13_concat[0][0]
                                                                 conv5_block14_2_conv[0][0]
conv5_block15_0_bn (BatchNormal (None, 7, 7, 1088)   4352        conv5_block14_concat[0][0]
conv5_block15_0_relu (Activatio (None, 7, 7, 1088)   0           conv5_block15_0_bn[0][0]
conv5_block15_1_conv (Conv2D)   (None, 7, 7, 128)    139264      conv5_block15_0_relu[0][0]
conv5_block15_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block15_1_conv[0][0]
conv5_block15_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block15_1_bn[0][0]
conv5_block15_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block15_1_relu[0][0]
conv5_block15_concat (Concatena (None, 7, 7, 1120)   0           conv5_block14_concat[0][0]
                                                                 conv5_block15_2_conv[0][0]
conv5_block16_0_bn (BatchNormal (None, 7, 7, 1120)   4480        conv5_block15_concat[0][0]
conv5_block16_0_relu (Activatio (None, 7, 7, 1120)   0           conv5_block16_0_bn[0][0]
conv5_block16_1_conv (Conv2D)   (None, 7, 7, 128)    143360      conv5_block16_0_relu[0][0]
conv5_block16_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block16_1_conv[0][0]
conv5_block16_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block16_1_bn[0][0]
conv5_block16_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block16_1_relu[0][0]
conv5_block16_concat (Concatena (None, 7, 7, 1152)   0           conv5_block15_concat[0][0]
                                                                 conv5_block16_2_conv[0][0]
conv5_block17_0_bn (BatchNormal (None, 7, 7, 1152)   4608        conv5_block16_concat[0][0]
conv5_block17_0_relu (Activatio (None, 7, 7, 1152)   0           conv5_block17_0_bn[0][0]
conv5_block17_1_conv (Conv2D)   (None, 7, 7, 128)    147456      conv5_block17_0_relu[0][0]
conv5_block17_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block17_1_conv[0][0]
conv5_block17_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block17_1_bn[0][0]
conv5_block17_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block17_1_relu[0][0]
conv5_block17_concat (Concatena (None, 7, 7, 1184)   0           conv5_block16_concat[0][0]
                                                                 conv5_block17_2_conv[0][0]
conv5_block18_0_bn (BatchNormal (None, 7, 7, 1184)   4736        conv5_block17_concat[0][0]
conv5_block18_0_relu (Activatio (None, 7, 7, 1184)   0           conv5_block18_0_bn[0][0]
conv5_block18_1_conv (Conv2D)   (None, 7, 7, 128)    151552      conv5_block18_0_relu[0][0]
conv5_block18_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block18_1_conv[0][0]
conv5_block18_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block18_1_bn[0][0]
conv5_block18_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block18_1_relu[0][0]

conv5_block18_concat (Concatena (None, 7, 7, 1216)   0           conv5_block17_concat[0][0]
                                                                 conv5_block18_2_conv[0][0]

conv5_block19_0_bn (BatchNormal (None, 7, 7, 1216)   4864        conv5_block18_concat[0][0]

conv5_block19_0_relu (Activatio (None, 7, 7, 1216)   0           conv5_block19_0_bn[0][0]

conv5_block19_1_conv (Conv2D)   (None, 7, 7, 128)    155648      conv5_block19_0_relu[0][0]

conv5_block19_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block19_1_conv[0][0]

conv5_block19_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block19_1_bn[0][0]

conv5_block19_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block19_1_relu[0][0]

conv5_block19_concat (Concatena (None, 7, 7, 1248)   0           conv5_block18_concat[0][0]
                                                                 conv5_block19_2_conv[0][0]

conv5_block20_0_bn (BatchNormal (None, 7, 7, 1248)   4992        conv5_block19_concat[0][0]

conv5_block20_0_relu (Activatio (None, 7, 7, 1248)   0           conv5_block20_0_bn[0][0]

conv5_block20_1_conv (Conv2D)   (None, 7, 7, 128)    159744      conv5_block20_0_relu[0][0]

conv5_block20_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block20_1_conv[0][0]

conv5_block20_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block20_1_bn[0][0]

conv5_block20_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block20_1_relu[0][0]

conv5_block20_concat (Concatena (None, 7, 7, 1280)   0           conv5_block19_concat[0][0]
                                                                 conv5_block20_2_conv[0][0]

conv5_block21_0_bn (BatchNormal (None, 7, 7, 1280)   5120        conv5_block20_concat[0][0]

conv5_block21_0_relu (Activatio (None, 7, 7, 1280)   0           conv5_block21_0_bn[0][0]

conv5_block21_1_conv (Conv2D)   (None, 7, 7, 128)    163840      conv5_block21_0_relu[0][0]

conv5_block21_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block21_1_conv[0][0]

conv5_block21_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block21_1_bn[0][0]

conv5_block21_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block21_1_relu[0][0]

conv5_block21_concat (Concatena (None, 7, 7, 1312)   0           conv5_block20_concat[0][0]
                                                                 conv5_block21_2_conv[0][0]

conv5_block22_0_bn (BatchNormal (None, 7, 7, 1312)   5248        conv5_block21_concat[0][0]

conv5_block22_0_relu (Activatio (None, 7, 7, 1312)   0           conv5_block22_0_bn[0][0]

conv5_block22_1_conv (Conv2D)   (None, 7, 7, 128)    167936      conv5_block22_0_relu[0][0]

conv5_block22_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block22_1_conv[0][0]

conv5_block22_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block22_1_bn[0][0]

conv5_block22_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block22_1_relu[0][0]

conv5_block22_concat (Concatena (None, 7, 7, 1344)   0           conv5_block21_concat[0][0]
                                                                 conv5_block22_2_conv[0][0]

conv5_block23_0_bn (BatchNormal (None, 7, 7, 1344)   5376        conv5_block22_concat[0][0]

conv5_block23_0_relu (Activatio (None, 7, 7, 1344)   0           conv5_block23_0_bn[0][0]

conv5_block23_1_conv (Conv2D)   (None, 7, 7, 128)    172032      conv5_block23_0_relu[0][0]

conv5_block23_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block23_1_conv[0][0]

conv5_block23_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block23_1_bn[0][0]

conv5_block23_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block23_1_relu[0][0]

conv5_block23_concat (Concatena (None, 7, 7, 1376)   0           conv5_block22_concat[0][0]
                                                                 conv5_block23_2_conv[0][0]

conv5_block24_0_bn (BatchNormal (None, 7, 7, 1376)   5504        conv5_block23_concat[0][0]

conv5_block24_0_relu (Activatio (None, 7, 7, 1376)   0           conv5_block24_0_bn[0][0]

conv5_block24_1_conv (Conv2D)   (None, 7, 7, 128)    176128      conv5_block24_0_relu[0][0]

conv5_block24_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block24_1_conv[0][0]
conv5_block24_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block24_1_bn[0][0]

conv5_block24_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block24_1_relu[0][0]

conv5_block24_concat (Concatena (None, 7, 7, 1408)   0           conv5_block23_concat[0][0]
                                                                 conv5_block24_2_conv[0][0]

conv5_block25_0_bn (BatchNormal (None, 7, 7, 1408)   5632        conv5_block24_concat[0][0]

conv5_block25_0_relu (Activatio (None, 7, 7, 1408)   0           conv5_block25_0_bn[0][0]

conv5_block25_1_conv (Conv2D)   (None, 7, 7, 128)    180224      conv5_block25_0_relu[0][0]

conv5_block25_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block25_1_conv[0][0]

conv5_block25_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block25_1_bn[0][0]

conv5_block25_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block25_1_relu[0][0]

conv5_block25_concat (Concatena (None, 7, 7, 1440)   0           conv5_block24_concat[0][0]
                                                                 conv5_block25_2_conv[0][0]

conv5_block26_0_bn (BatchNormal (None, 7, 7, 1440)   5760        conv5_block25_concat[0][0]

conv5_block26_0_relu (Activatio (None, 7, 7, 1440)   0           conv5_block26_0_bn[0][0]

conv5_block26_1_conv (Conv2D)   (None, 7, 7, 128)    184320      conv5_block26_0_relu[0][0]

conv5_block26_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block26_1_conv[0][0]

conv5_block26_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block26_1_bn[0][0]

conv5_block26_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block26_1_relu[0][0]

conv5_block26_concat (Concatena (None, 7, 7, 1472)   0           conv5_block25_concat[0][0]
                                                                 conv5_block26_2_conv[0][0]

conv5_block27_0_bn (BatchNormal (None, 7, 7, 1472)   5888        conv5_block26_concat[0][0]

conv5_block27_0_relu (Activatio (None, 7, 7, 1472)   0           conv5_block27_0_bn[0][0]

conv5_block27_1_conv (Conv2D)   (None, 7, 7, 128)    188416      conv5_block27_0_relu[0][0]

conv5_block27_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block27_1_conv[0][0]

conv5_block27_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block27_1_bn[0][0]

conv5_block27_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block27_1_relu[0][0]

conv5_block27_concat (Concatena (None, 7, 7, 1504)   0           conv5_block26_concat[0][0]
                                                                 conv5_block27_2_conv[0][0]

conv5_block28_0_bn (BatchNormal (None, 7, 7, 1504)   6016        conv5_block27_concat[0][0]

conv5_block28_0_relu (Activatio (None, 7, 7, 1504)   0           conv5_block28_0_bn[0][0]

conv5_block28_1_conv (Conv2D)   (None, 7, 7, 128)    192512      conv5_block28_0_relu[0][0]

conv5_block28_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block28_1_conv[0][0]

conv5_block28_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block28_1_bn[0][0]

conv5_block28_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block28_1_relu[0][0]

conv5_block28_concat (Concatena (None, 7, 7, 1536)   0           conv5_block27_concat[0][0]
                                                                 conv5_block28_2_conv[0][0]

conv5_block29_0_bn (BatchNormal (None, 7, 7, 1536)   6144        conv5_block28_concat[0][0]

conv5_block29_0_relu (Activatio (None, 7, 7, 1536)   0           conv5_block29_0_bn[0][0]

conv5_block29_1_conv (Conv2D)   (None, 7, 7, 128)    196608      conv5_block29_0_relu[0][0]

conv5_block29_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block29_1_conv[0][0]

conv5_block29_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block29_1_bn[0][0]

conv5_block29_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block29_1_relu[0][0]

conv5_block29_concat (Concatena (None, 7, 7, 1568)   0           conv5_block28_concat[0][0]
                                                                 conv5_block29_2_conv[0][0]

conv5_block30_0_bn (BatchNormal (None, 7, 7, 1568)   6272        conv5_block29_concat[0][0]

conv5_block30_0_relu (Activatio (None, 7, 7, 1568)   0           conv5_block30_0_bn[0][0]

conv5_block30_1_conv (Conv2D)   (None, 7, 7, 128)    200704      conv5_block30_0_relu[0][0]
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__________________________________________________________________________________________________
conv5_block30_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block30_1_conv[0][0]
__________________________________________________________________________________________________
conv5_block30_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block30_1_bn[0][0]
__________________________________________________________________________________________________
conv5_block30_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block30_1_relu[0][0]
__________________________________________________________________________________________________
conv5_block30_concat (Concatena (None, 7, 7, 1600)   0           conv5_block29_concat[0][0]
                                                                 conv5_block30_2_conv[0][0]
__________________________________________________________________________________________________
conv5_block31_0_bn (BatchNormal (None, 7, 7, 1600)   6400        conv5_block30_concat[0][0]
__________________________________________________________________________________________________
conv5_block31_0_relu (Activatio (None, 7, 7, 1600)   0           conv5_block31_0_bn[0][0]
__________________________________________________________________________________________________
conv5_block31_1_conv (Conv2D)   (None, 7, 7, 128)    204800      conv5_block31_0_relu[0][0]
__________________________________________________________________________________________________
conv5_block31_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block31_1_conv[0][0]
__________________________________________________________________________________________________
conv5_block31_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block31_1_bn[0][0]
__________________________________________________________________________________________________
conv5_block31_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block31_1_relu[0][0]
__________________________________________________________________________________________________
conv5_block31_concat (Concatena (None, 7, 7, 1632)   0           conv5_block30_concat[0][0]
                                                                 conv5_block31_2_conv[0][0]
__________________________________________________________________________________________________
conv5_block32_0_bn (BatchNormal (None, 7, 7, 1632)   6528        conv5_block31_concat[0][0]
__________________________________________________________________________________________________
conv5_block32_0_relu (Activatio (None, 7, 7, 1632)   0           conv5_block32_0_bn[0][0]
__________________________________________________________________________________________________
conv5_block32_1_conv (Conv2D)   (None, 7, 7, 128)    208896      conv5_block32_0_relu[0][0]
__________________________________________________________________________________________________
conv5_block32_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block32_1_conv[0][0]
__________________________________________________________________________________________________
conv5_block32_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block32_1_bn[0][0]
__________________________________________________________________________________________________
conv5_block32_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block32_1_relu[0][0]
__________________________________________________________________________________________________
conv5_block32_concat (Concatena (None, 7, 7, 1664)   0           conv5_block31_concat[0][0]
                                                                 conv5_block32_2_conv[0][0]
__________________________________________________________________________________________________
bn (BatchNormalization)         (None, 7, 7, 1664)   6656        conv5_block32_concat[0][0]
__________________________________________________________________________________________________
relu (Activation)               (None, 7, 7, 1664)   0           bn[0][0]
__________________________________________________________________________________________________
reshape_4 (Reshape)             (None, 49, 1664)     0           relu[0][0]
__________________________________________________________________________________________________
lstm_4 (LSTM)                   (None, 49, 1664)     22157824    reshape_4[0][0]
__________________________________________________________________________________________________
batch_normalization_12 (BatchNo (None, 49, 1664)     6656        lstm_4[0][0]
__________________________________________________________________________________________________
flatten (Flatten)               (None, 81536)        0           batch_normalization_12[0][0]
__________________________________________________________________________________________________
dense_12 (Dense)                (None, 4096)         333975552   flatten[0][0]
__________________________________________________________________________________________________
batch_normalization_13 (BatchNo (None, 4096)         16384       dense_12[0][0]
__________________________________________________________________________________________________
dense_13 (Dense)                (None, 4096)         16781312    batch_normalization_13[0][0]
__________________________________________________________________________________________________
batch_normalization_14 (BatchNo (None, 4096)         16384       dense_13[0][0]
__________________________________________________________________________________________________
dense_14 (Dense)                (None, 4)            16388       batch_normalization_14[0][0]
==================================================================================================
Total params: 385,613,380
Trainable params: 350,792,964
Non-trainable params: 34,820,416
__________________________________________________________________________________________________
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