

```
model = Model( inputs= X_input, outputs = Y, name = 'Resnet18')
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model.summary()
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Model: "Resnet18"			
Layer (type)	Output Shape	Param #	Connected to
=====			
input_1 (InputLayer)	(None, 256, 256, 3)	0	[]
=====			
zero_padding2d (ZeroPadding2D)	(None, 262, 262, 3)	0	['input_1[0][0]']
conv1 (Conv2D)	(None, 128, 128, 64)	9472	['zero_padding2d[0][0]']
bn_conv1 (BatchNormalization)	(None, 128, 128, 64)	256	['conv1[0][0]']
activation (Activation)	(None, 128, 128, 64)	0	['bn_conv1[0][0]']
max_pooling2d (MaxPooling2D)	(None, 63, 63, 64)	0	['activation[0][0]']
res_2_conv_a (Conv2D)	(None, 63, 63, 64)	4160	['max_pooling2d[0][0]']
max_pooling2d_1 (MaxPooling2D)	(None, 31, 31, 64)	0	['res_2_conv_a[0][0]']
bn_2_conv_a (BatchNormalization)	(None, 31, 31, 64)	256	['max_pooling2d_1[0][0]']
activation_1 (Activation)	(None, 31, 31, 64)	0	['bn_2_conv_a[0][0]']
res_2_conv_b (Conv2D)	(None, 31, 31, 64)	36928	['activation_1[0][0]']
bn_2_conv_b (BatchNormalization)	(None, 31, 31, 64)	256	['res_2_conv_b[0][0]']
activation_2 (Activation)	(None, 31, 31, 64)	0	['bn_2_conv_b[0][0]']
res_2_conv_copy (Conv2D)	(None, 63, 63, 256)	16640	['max_pooling2d[0][0]']
res_2_conv_c (Conv2D)	(None, 31, 31, 256)	16640	['activation_2[0][0]']
max_pooling2d_2 (MaxPooling2D)	(None, 31, 31, 256)	0	['res_2_conv_copy[0][0]']
bn_2_conv_c (BatchNormalization)	(None, 31, 31, 256)	1024	['res_2_conv_c[0][0]']
bn_2_conv_copy (BatchNormalization)	(None, 31, 31, 256)	1024	['max_pooling2d_2[0][0]']
add (Add)	(None, 31, 31, 256)	0	['bn_2_conv_c[0][0]', 'bn_2_conv_copy[0][0]']
activation_3 (Activation)	(None, 31, 31, 256)	0	['add[0][0]']
res_2_identity_1_a (Conv2D)	(None, 31, 31, 64)	16448	['activation_3[0][0]']
bn_2_identity_1_a (BatchNormalization)	(None, 31, 31, 64)	256	['res_2_identity_1_a[0][0]']
activation_4 (Activation)	(None, 31, 31, 64)	0	['bn_2_identity_1_a[0][0]']
res_2_identity_1_b (Conv2D)	(None, 31, 31, 64)	36928	['activation_4[0][0]']
bn_2_identity_1_b (BatchNormalization)	(None, 31, 31, 64)	256	['res_2_identity_1_b[0][0]']
activation_5 (Activation)	(None, 31, 31, 64)	0	['bn_2_identity_1_b[0][0]']
res_2_identity_1_c (Conv2D)	(None, 31, 31, 256)	16640	['activation_5[0][0]']
bn_2_identity_1_c (BatchNormalization)	(None, 31, 31, 256)	1024	['res_2_identity_1_c[0][0]']
add_1 (Add)	(None, 31, 31, 256)	0	['bn_2_identity_1_c[0][0]', 'activation_3[0][0]']
activation_6 (Activation)	(None, 31, 31, 256)	0	['add_1[0][0]']
res_2_identity_2_a (Conv2D)	(None, 31, 31, 64)	16448	['activation_6[0][0]']
bn_2_identity_2_a (BatchNormalization)	(None, 31, 31, 64)	256	['res_2_identity_2_a[0][0]']
activation_7 (Activation)	(None, 31, 31, 64)	0	['bn_2_identity_2_a[0][0]']
res_2_identity_2_b (Conv2D)	(None, 31, 31, 64)	36928	['activation_7[0][0]']
bn_2_identity_2_b (BatchNormalization)	(None, 31, 31, 64)	256	['res_2_identity_2_b[0][0]']
activation_8 (Activation)	(None, 31, 31, 64)	0	['bn_2_identity_2_b[0][0]']
res_2_identity_2_c (Conv2D)	(None, 31, 31, 256)	16640	['activation_8[0][0]']
bn_2_identity_2_c (BatchNormalization)	(None, 31, 31, 256)	1024	['res_2_identity_2_c[0][0]']
add_2 (Add)	(None, 31, 31, 256)	0	['bn_2_identity_2_c[0][0]', 'activation_6[0][0]']
activation_9 (Activation)	(None, 31, 31, 256)	0	['add_2[0][0]']
res_3_conv_a (Conv2D)	(None, 31, 31, 128)	32896	['activation_9[0][0]']
max_pooling2d_3 (MaxPooling2D)	(None, 15, 15, 128)	0	['res_3_conv_a[0][0]']
bn_3_conv_a (BatchNormalization)	(None, 15, 15, 128)	512	['max_pooling2d_3[0][0]']
activation_10 (Activation)	(None, 15, 15, 128)	0	['bn_3_conv_a[0][0]']
res_3_conv_b (Conv2D)	(None, 15, 15, 128)	147584	['activation_10[0][0]']
bn_3_conv_b (BatchNormalization)	(None, 15, 15, 128)	512	['res_3_conv_b[0][0]']
activation_11 (Activation)	(None, 15, 15, 128)	0	['bn_3_conv_b[0][0]']
res_3_conv_copy (Conv2D)	(None, 31, 31, 512)	131584	['activation_9[0][0]']
res_3_conv_c (Conv2D)	(None, 15, 15, 512)	66048	['activation_11[0][0]']
max_pooling2d_4 (MaxPooling2D)	(None, 15, 15, 512)	0	['res_3_conv_copy[0][0]']
bn_3_conv_c (BatchNormalization)	(None, 15, 15, 512)	2048	['res_3_conv_c[0][0]']
bn_3_conv_copy (BatchNormalization)	(None, 15, 15, 512)	2048	['max_pooling2d_4[0][0]']
add_3 (Add)	(None, 15, 15, 512)	0	['bn_3_conv_c[0][0]', 'bn_3_conv_copy[0][0]']
activation_12 (Activation)	(None, 15, 15, 512)	0	['add_3[0][0]']
res_3_identity_1_a (Conv2D)	(None, 15, 15, 128)	65664	['activation_12[0][0]']
bn_3_identity_1_a (BatchNormalization)	(None, 15, 15, 128)	512	['res_3_identity_1_a[0][0]']
activation_13 (Activation)	(None, 15, 15, 128)	0	['bn_3_identity_1_a[0][0]']
res_3_identity_1_b (Conv2D)	(None, 15, 15, 128)	147584	['activation_13[0][0]']
bn_3_identity_1_b (BatchNormalization)	(None, 15, 15, 128)	512	['res_3_identity_1_b[0][0]']
activation_14 (Activation)	(None, 15, 15, 128)	0	['bn_3_identity_1_b[0][0]']
res_3_identity_1_c (Conv2D)	(None, 15, 15, 512)	66048	['activation_14[0][0]']
bn_3_identity_1_c (BatchNormalization)	(None, 15, 15, 512)	2048	['res_3_identity_1_c[0][0]']
add_4 (Add)	(None, 15, 15, 512)	0	['bn_3_identity_1_c[0][0]', 'activation_12[0][0]']
activation_15 (Activation)	(None, 15, 15, 512)	0	['add_4[0][0]']
res_3_identity_2_a (Conv2D)	(None, 15, 15, 128)	65664	['activation_15[0][0]']
bn_3_identity_2_a (BatchNormalization)	(None, 15, 15, 128)	512	['res_3_identity_2_a[0][0]']
activation_16 (Activation)	(None, 15, 15, 128)	0	['bn_3_identity_2_a[0][0]']
res_3_identity_2_b (Conv2D)	(None, 15, 15, 128)	147584	['activation_16[0][0]']
bn_3_identity_2_b (BatchNormalization)	(None, 15, 15, 128)	512	['res_3_identity_2_b[0][0]']
activation_17 (Activation)	(None, 15, 15, 128)	0	['bn_3_identity_2_b[0][0]']
res_3_identity_2_c (Conv2D)	(None, 15, 15, 512)	66048	['activation_17[0][0]']
bn_3_identity_2_c (BatchNormalization)	(None, 15, 15, 512)	2048	['res_3_identity_2_c[0][0]']
add_5 (Add)	(None, 15, 15, 512)	0	['bn_3_identity_2_c[0][0]', 'activation_15[0][0]']
activation_18 (Activation)	(None, 15, 15, 512)	0	['add_5[0][0]']
res_4_conv_a (Conv2D)	(None, 15, 15, 256)	131328	['activation_18[0][0]']
max_pooling2d_5 (MaxPooling2D)	(None, 7, 7, 256)	0	['res_4_conv_a[0][0]']
bn_4_conv_a (BatchNormalization)	(None, 7, 7, 256)	1024	['max_pooling2d_5[0][0]']
activation_19 (Activation)	(None, 7, 7, 256)	0	['bn_4_conv_a[0][0]']
res_4_conv_b (Conv2D)	(None, 7, 7, 256)	590080	['activation_19[0][0]']
bn_4_conv_b (BatchNormalization)	(None, 7, 7, 256)	1024	['res_4_conv_b[0][0]']
activation_20 (Activation)	(None, 7, 7, 256)	0	['bn_4_conv_b[0][0]']
res_4_conv_copy (Conv2D)	(None, 15, 15, 1024)	525312	['activation_18[0][0]']
res_4_conv_c (Conv2D)	(None, 7, 7, 1024)	263168	['activation_20[0][0]']
max_pooling2d_6 (MaxPooling2D)	(None, 7, 7, 1024)	0	['res_4_conv_copy[0][0]']
bn_4_conv_c (BatchNormalization)	(None, 7, 7, 1024)	4096	['res_4_conv_c[0][0]']
bn_4_conv_copy (BatchNormalization)	(None, 7, 7, 1024)	4096	['max_pooling2d_6[0][0]']
add_6 (Add)	(None, 7, 7, 1024)	0	['bn_4_conv_c[0][0]', 'bn_4_conv_copy[0][0]']
activation_21 (Activation)	(None, 7, 7, 1024)	0	['add_6[0][0]']
res_4_identity_1_a (Conv2D)	(None, 7, 7, 256)	262400	['activation_21[0][0]']
bn_4_identity_1_a (BatchNormalization)	(None, 7, 7, 256)	1024	['res_4_identity_1_a[0][0]']
activation_22 (Activation)	(None, 7, 7, 256)	0	['bn_4_identity_1_a[0][0]']
res_4_identity_1_b (Conv2D)	(None, 7, 7, 256)	590080	['activation_22[0][0]']
bn_4_identity_1_b (BatchNormalization)	(None, 7, 7, 256)	1024	['res_4_identity_1_b[0][0]']
activation_23 (Activation)	(None, 7, 7, 256)	0	['bn_4_identity_1_b[0][0]']
res_4_identity_1_c (Conv2D)	(None, 7, 7, 1024)	263168	['activation_23[0][0]']
bn_4_identity_1_c (BatchNormalization)	(None, 7, 7, 1024)	4096	['res_4_identity_1_c[0][0]']
add_7 (Add)	(None, 7, 7, 1024)	0	['bn_4_identity_1_c[0][0]', 'activation_21[0][0]']
activation_24 (Activation)	(None, 7, 7, 1024)	0	['add_7[0][0]']
res_4_identity_2_a (Conv2D)	(None, 7, 7, 256)	262400	['activation_24[0][0]']
bn_4_identity_2_a (BatchNormalization)	(None, 7, 7, 256)	1024	['res_4_identity_2_a[0][0]']
activation_25 (Activation)	(None, 7, 7, 256)	0	['bn_4_identity_2_a[0][0]']
res_4_identity_2_b (Conv2D)	(None, 7, 7, 256)	590080	['activation_25[0][0]']
bn_4_identity_2_b (BatchNormalization)	(None, 7, 7, 256)	1024	['res_4_identity_2_b[0][0]']
activation_26 (Activation)	(None, 7, 7, 256)	0	['bn_4_identity_2_b[0][0]']
res_4_identity_2_c (Conv2D)	(None, 7, 7, 1024)	263168	['activation_26[0][0]']
bn_4_identity_2_c (BatchNormalization)	(None, 7, 7, 1024)	4096	['res_4_identity_2_c[0][0]']
add_8 (Add)	(None, 7, 7, 1024)	0	['bn_4_identity_2_c[0][0]', 'activation_24[0][0]']
activation_27 (Activation)	(None, 7, 7, 1024)	0	['add_8[0][0]']
Averagea_Pooling (AveragePooling2D)	(None, 3, 3, 1024)	0	['activation_27[0][0]']
flatten (Flatten)	(None, 9216)	0	['Averagea_Pooling[0][0]']
Dense_final (Dense)	(None, 5)	46085	['flatten[0][0]']
=====			
Total params: 4,987,525			
Trainable params: 4,967,685			
Non-trainable params: 19,840			
=====			

Training Model

```
model.compile(optimizer = 'adam', loss = 'categorical_crossentropy', metrics= ['accuracy'])

#using early stopping to exit training if validation loss is not decreasing even after certain epochs (patience)
#15
earlystopping = EarlyStopping(monitor='val_loss', mode='min', verbose=1, patience=40)

#save the best model with lower validation loss
checkpointer = ModelCheckpoint(filepath="/content/drive/MyDrive/project/diabetic retinopathy/retina_weights.hdf5", verbose=1, save_best_only=True)

--INSERT--

history = model.fit(train_generator, steps_per_epoch = train_generator.n // 32, epochs = 50, validation_data= validation_generator, validation_steps= validation_generator.n // 32, cal
```

performance

```
model.load_weights("/content/drive/MyDrive/project/diabetic retinopathy/retina_weights.hdf5")

# Evaluate the performance of the model
evaluate = model.evaluate(test_generator, steps = test_generator.n // 32, verbose=1)

print('Accuracy Test : {}'.format(evaluate[1]))

22/22 [=====] - 135s 6s/step - loss: 0.4880 - accuracy: 0.8168
Accuracy Test : 0.8167613744735718
```