

```
!unzip '/content/drive/MyDrive/BirdSpecies.zip'
```

```
Archive: /content/drive/MyDrive/BirdSpecies.zip
inflating: test_data/test_data/blasti/DSC_6396.jpg
inflating: test_data/test_data/blasti/DSC_6397.jpg
inflating: test_data/test_data/blasti/DSC_6398.jpg
inflating: test_data/test_data/blasti/DSC_6399.jpg
inflating: test_data/test_data/blasti/DSC_6400.jpg
inflating: test_data/test_data/blasti/DSC_6401.jpg
inflating: test_data/test_data/blasti/DSC_6402.jpg
inflating: test_data/test_data/blasti/DSC_6403.jpg
inflating: test_data/test_data/blasti/DSC_6405.jpg
inflating: test_data/test_data/blasti/DSC_6406.jpg
inflating: test_data/test_data/blasti/DSC_6407.jpg
inflating: test_data/test_data/blasti/DSC_6408.jpg
inflating: test_data/test_data/blasti/DSC_6409.jpg
inflating: test_data/test_data/blasti/DSC_6410.jpg
inflating: test_data/test_data/blasti/DSC_6411.jpg
inflating: test_data/test_data/bonegl/DSC_4587.jpg
inflating: test_data/test_data/bonegl/DSC_4588.jpg
inflating: test_data/test_data/bonegl/DSC_4589.jpg
inflating: test_data/test_data/bonegl/DSC_4590.jpg
inflating: test_data/test_data/bonegl/DSC_4591.jpg
inflating: test_data/test_data/bonegl/DSC_4592.jpg
inflating: test_data/test_data/bonegl/DSC_4593.jpg
inflating: test_data/test_data/brhkyt/D72_0473.jpg
inflating: test_data/test_data/brhkyt/D72_0474.jpg
inflating: test_data/test_data/brhkyt/D72_0475.jpg
inflating: test_data/test_data/brhkyt/D72_0477.jpg
inflating: test_data/test_data/brhkyt/D72_0478.jpg
inflating: test_data/test_data/brhkyt/D72_0479.jpg
inflating: test_data/test_data/cbrtsh/_D32_10310.jpg
inflating: test_data/test_data/cbrtsh/_D32_10311.jpg
inflating: test_data/test_data/cbrtsh/_D32_10312.jpg
inflating: test_data/test_data/cbrtsh/_D32_10313.jpg
inflating: test_data/test_data/cbrtsh/_D32_10314.jpg
inflating: test_data/test_data/cbrtsh/_D32_10317.jpg
inflating: test_data/test_data/cbrtsh/_D32_10318.jpg
inflating: test_data/test_data/cmnmyr/DSC_2443.jpg
inflating: test_data/test_data/cmnmyr/DSC_4681.jpg
inflating: test_data/test_data/cmnmyr/DSC_5137.jpg
inflating: test_data/test_data/cmnmyr/DSC_7625.jpg
inflating: test_data/test_data/cmnmyr/P1050277.jpg
inflating: test_data/test_data/cmnmyr/_D32_12426.jpg
inflating: test_data/test_data/cmnmyr/_D32_12427.jpg
inflating: test_data/test_data/cmnmyr/_D32_12428.jpg
inflating: test_data/test_data/gretit/11620454726_31a35c26da_o.jpg
inflating: test_data/test_data/gretit/11776135285_ccf938fa2e_o.jpg
inflating: test_data/test_data/gretit/11905645146_6a5d4ff9f9_o.jpg
inflating: test_data/test_data/gretit/8537646712_0b282c4c6a_o.jpg
inflating: test_data/test_data/gretit/D72_0693.jpg
inflating: test_data/test_data/gretit/D72_0694.jpg
inflating: test_data/test_data/gretit/D72_0695.jpg
inflating: test_data/test_data/hilpig/DSC_6359.jpg
inflating: test_data/test_data/hilpig/DSC_6362.jpg
inflating: test_data/test_data/hilpig/DSC_6364.jpg
inflating: test_data/test_data/hilpig/DSC_6368.jpg
inflating: test_data/test_data/hilpig/DSC_6403.jpg
inflating: test_data/test_data/hilpig/DSC_6404.jpg
inflating: test_data/test_data/hilpig/P1000319.jpg
```

```
# Data Augmentation
```

```
from tensorflow.keras.preprocessing.image import ImageDataGenerator
```

```
train_gen = ImageDataGenerator(rescale=(1./255),horizontal_flip=True, shear_range=0.2)
test_gen = ImageDataGenerator(rescale=(1./255))
```

```
train = train_gen.flow_from_directory('/content/train_data/train_data',
                                     target_size=(120, 120),
                                     class_mode='categorical',
                                     batch_size=8)
test = test_gen.flow_from_directory('/content/test_data/test_data',
                                   target_size=(120, 120),
                                   class_mode='categorical',
                                   batch_size=8)
```

```
Found 150 images belonging to 16 classes.
Found 157 images belonging to 16 classes.
```

```
y=train.class_indices
y
```

```
{'blasti': 0,
 'bonegl': 1,
 'brhkyt': 2,
 'cbrtsh': 3,
 'cmnmyn': 4,
 'gretit': 5,
 'hilpig': 6,
 'himbul': 7,
 'himgri': 8,
 'hsparo': 9,
 'indvul': 10,
 'jglowl': 11,
 'lbicrw': 12,
 'mgprob': 13,
 'rebing': 14,
 'wcrsrt': 15}
```

```
# CNN
from tensorflow.keras.layers import Convolution2D,MaxPooling2D,Flatten,Dense
from tensorflow.keras.models import Sequential
```

```
model = Sequential()
model.add(Convolution2D(20,(3,3),activation='relu',input_shape=(120, 120, 3)))
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Flatten())
model.add(Dense(45,activation='relu'))
model.add(Dense(16,activation='softmax'))
```

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

```
model.fit(train,batch_size=16,validation_data=test,epochs=40)
```

```
Epoch 1/40
19/19 [=====] - 111s 6s/step - loss: 3.7968 - accuracy: 0.0533 - val_loss: 2.7385 - val_accuracy: 0.1146
Epoch 2/40
19/19 [=====] - 128s 7s/step - loss: 2.5789 - accuracy: 0.2067 - val_loss: 2.7725 - val_accuracy: 0.1592
Epoch 3/40
19/19 [=====] - 126s 7s/step - loss: 2.3124 - accuracy: 0.3200 - val_loss: 2.7851 - val_accuracy: 0.1720
Epoch 4/40
19/19 [=====] - 128s 7s/step - loss: 2.1588 - accuracy: 0.3267 - val_loss: 2.6799 - val_accuracy: 0.1911
Epoch 5/40
19/19 [=====] - 133s 7s/step - loss: 1.9946 - accuracy: 0.3333 - val_loss: 2.6736 - val_accuracy: 0.2102
Epoch 6/40
19/19 [=====] - 128s 7s/step - loss: 1.8944 - accuracy: 0.3867 - val_loss: 2.9363 - val_accuracy: 0.1847
Epoch 7/40
19/19 [=====] - 129s 7s/step - loss: 1.8161 - accuracy: 0.3933 - val_loss: 2.6255 - val_accuracy: 0.2420
Epoch 8/40
19/19 [=====] - 127s 7s/step - loss: 1.5706 - accuracy: 0.4600 - val_loss: 2.7808 - val_accuracy: 0.1847
Epoch 9/40
19/19 [=====] - 127s 7s/step - loss: 1.3962 - accuracy: 0.5000 - val_loss: 2.8088 - val_accuracy: 0.1975
Epoch 10/40
19/19 [=====] - 129s 7s/step - loss: 1.3787 - accuracy: 0.5333 - val_loss: 2.9288 - val_accuracy: 0.1529
Epoch 11/40
19/19 [=====] - 127s 7s/step - loss: 1.1700 - accuracy: 0.6400 - val_loss: 2.9878 - val_accuracy: 0.1783
Epoch 12/40
19/19 [=====] - 127s 7s/step - loss: 0.9816 - accuracy: 0.7333 - val_loss: 3.0882 - val_accuracy: 0.2293
Epoch 13/40
19/19 [=====] - 127s 7s/step - loss: 0.8756 - accuracy: 0.7467 - val_loss: 3.1242 - val_accuracy: 0.1847
Epoch 14/40
19/19 [=====] - 135s 7s/step - loss: 0.7373 - accuracy: 0.8133 - val_loss: 3.0593 - val_accuracy: 0.2548
Epoch 15/40
19/19 [=====] - 129s 7s/step - loss: 0.6062 - accuracy: 0.8667 - val_loss: 3.3212 - val_accuracy: 0.2357
Epoch 16/40
19/19 [=====] - 127s 7s/step - loss: 0.5624 - accuracy: 0.8400 - val_loss: 3.5665 - val_accuracy: 0.2166
Epoch 17/40
19/19 [=====] - 128s 7s/step - loss: 0.4356 - accuracy: 0.9133 - val_loss: 3.1042 - val_accuracy: 0.2229
Epoch 18/40
19/19 [=====] - 128s 7s/step - loss: 0.3318 - accuracy: 0.9533 - val_loss: 3.4509 - val_accuracy: 0.2420
Epoch 19/40
19/19 [=====] - 128s 7s/step - loss: 0.3079 - accuracy: 0.9400 - val_loss: 3.3590 - val_accuracy: 0.1975
Epoch 20/40
```

```

19/19 [=====] - 127s 7s/step - loss: 0.2610 - accuracy: 0.9467 - val_loss: 3.3527 - val_accuracy: 0.2166
Epoch 21/40
19/19 [=====] - 130s 7s/step - loss: 0.2138 - accuracy: 0.9600 - val_loss: 3.5936 - val_accuracy: 0.2293
Epoch 22/40
19/19 [=====] - 106s 6s/step - loss: 0.1844 - accuracy: 0.9733 - val_loss: 3.6263 - val_accuracy: 0.2548
Epoch 23/40
19/19 [=====] - 128s 7s/step - loss: 0.1778 - accuracy: 0.9867 - val_loss: 3.7441 - val_accuracy: 0.2611
Epoch 24/40
19/19 [=====] - 106s 6s/step - loss: 0.1305 - accuracy: 0.9867 - val_loss: 3.7603 - val_accuracy: 0.2611
Epoch 25/40
19/19 [=====] - 104s 6s/step - loss: 0.1253 - accuracy: 0.9933 - val_loss: 4.0322 - val_accuracy: 0.2611
Epoch 26/40
19/19 [=====] - 103s 6s/step - loss: 0.1146 - accuracy: 0.9933 - val_loss: 4.0695 - val_accuracy: 0.2484
Epoch 27/40
19/19 [=====] - 127s 7s/step - loss: 0.1036 - accuracy: 0.9867 - val_loss: 3.9923 - val_accuracy: 0.2293
Epoch 28/40
19/19 [=====] - 127s 7s/step - loss: 0.0931 - accuracy: 0.9933 - val_loss: 3.9556 - val_accuracy: 0.2675
Epoch 29/40
10/10 [=====] - 127s 7s/step - loss: 0.0858 - accuracy: 1.0000 - val_loss: 3.8986 - val_accuracy: 0.2420

```

```
model.save('birdspecies.h5')
```

```
# Testing
```

```
import numpy as np
from tensorflow.keras.preprocessing import image
```

```
img1 = image.load_img('/content/100_5045.JPG', target_size=(120,120))
img1
```



```

img1 = image.img_to_array(img1)
img1 = np.expand_dims(img1,axis=0)
pred = np.argmax(model.predict(img1))
print(pred)
output = ['blasti', 'bonegl', 'brhkyt', 'cbrtsh', 'cmnmyn', 'gretit', 'hilpig', 'himbul', 'himgri', 'hsparo', 'indvul', 'jglowl', 'lbicrw', 'mgprob', 'rebi']
print(output[pred])

```

```

1/1 [=====] - 0s 199ms/step
5
gretit

```

```
img2 = image.load_img('/content/100_5112.JPG', target_size=(120,120))
img2
```



```

img2 = image.img_to_array(img2)
img2 = np.expand_dims(img2,axis=0)
pred = np.argmax(model.predict(img2))
print(pred)
output = ['blasti', 'bonegl', 'brhkyt', 'cbrtsh', 'cmnmyn', 'gretit', 'hilpig', 'himbul', 'himgri', 'hsparo', 'indvul', 'jglowl', 'lbicrw', 'mgprob', 'rebi']
print(output[pred])

```

```

1/1 [=====] - 0s 26ms/step
7
himbul

```

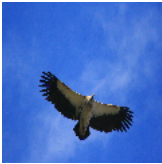
```
img3 = image.load_img('/content/100_5754.JPG',target_size=(120,120))
img3
```



```
img3 = image.img_to_array(img3)
img3 = np.expand_dims(img3,axis=0)
pred = np.argmax(model.predict(img3))
print(pred)
output = ['blasti','bonegl','brhkyt','cbrtsh','cmnmyn','gretit','hilpig','himbul','himgri','hsparo','indvul','jglowl','lbicrw','mgprob','rebi']
print(output[pred])
```

```
1/1 [=====] - 0s 25ms/step
14
rebing
```

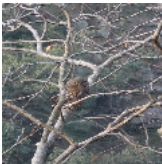
```
img4 = image.load_img('/content/12152037683_13e1556c41_o.jpg',target_size=(120,120))
img4
```



```
img4 = image.img_to_array(img4)
img4 = np.expand_dims(img4,axis=0)
pred = np.argmax(model.predict(img4))
print(pred)
output = ['blasti','bonegl','brhkyt','cbrtsh','cmnmyn','gretit','hilpig','himbul','himgri','hsparo','indvul','jglowl','lbicrw','mgprob','rebi']
print(output[pred])
```

```
1/1 [=====] - 0s 32ms/step
8
himgri
```

```
img5 = image.load_img('/content/DSC01336.jpg',target_size=(120,120))
img5
```



```
img5 = image.img_to_array(img5)
img5 = np.expand_dims(img5,axis=0)
pred = np.argmax(model.predict(img5))
print(pred)
output = ['blasti','bonegl','brhkyt','cbrtsh','cmnmyn','gretit','hilpig','himbul','himgri','hsparo','indvul','jglowl','lbicrw','mgprob','rebi']
print(output[pred])
```

```
1/1 [=====] - 0s 25ms/step
11
jglowl
```

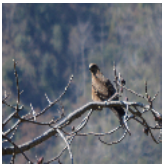
```
img6 = image.load_img('/content/DSCN5787.jpg',target_size=(120,120))
img6
```



```
img6 = image.img_to_array(img6)
img6 = np.expand_dims(img6,axis=0)
pred = np.argmax(model.predict(img6))
print(pred)
output = ['blasti','bonegl','brhkyt','cbrtsh','cmnmyn','gretit','hilpig','himbul','himgri','hsparo','indvul','jglowl','lbicrw','mgprob','rebi']
print(output[pred])
```

```
1/1 [=====] - 0s 25ms/step
4
cmnmyn
```

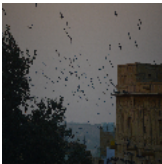
```
img7 = image.load_img('/content/DSC_4571.jpg',target_size=(120,120))
img7
```



```
img7 = image.img_to_array(img7)
img7 = np.expand_dims(img7,axis=0)
pred = np.argmax(model.predict(img7))
print(pred)
output = ['blasti','bonegl','brhkyt','cbrtsh','cmnmyn','gretit','hilpig','himbul','himgri','hsparo','indvul','jglowl','lbicrw','mgprob','rebi']
print(output[pred])
```

```
1/1 [=====] - 0s 26ms/step
1
bonegl
```

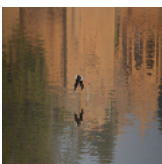
```
img8 = image.load_img('/content/DSC_6351.jpg',target_size=(120,120))
img8
```



```
img8 = image.img_to_array(img8)
img8 = np.expand_dims(img8,axis=0)
pred = np.argmax(model.predict(img5))
print(pred)
output = ['blasti','bonegl','brhkyt','cbrtsh','cmnmyn','gretit','hilpig','himbul','himgri','hsparo','indvul','jglowl','lbicrw','mgprob','rebi']
print(output[pred])
```

```
1/1 [=====] - 0s 29ms/step
11
jglowl
```

```
img9 = image.load_img('/content/DSC_6384-2.jpg',target_size=(120,120))
img9
```

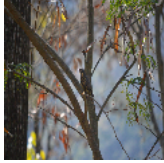


```
img9 = image.img_to_array(img9)
img9 = np.expand_dims(img9,axis=0)
pred = np.argmax(model.predict(img5))
```

```
print(pred)
output = ['blasti', 'bonegl', 'brhkyt', 'cbrtsh', 'cmnmyn', 'gretit', 'hilpig', 'himbul', 'himgri', 'hsparo', 'indvul', 'jglowl', 'lbicrw', 'mgprob', 'rebi
print(output[pred])
```

```
1/1 [=====] - 0s 28ms/step
11
jglowl
```

```
img10 = image.load_img('/content/_D32_10307.jpg', target_size=(120,120))
img10
```



```
img10 = image.img_to_array(img10)
img10 = np.expand_dims(img10,axis=0)
pred = np.argmax(model.predict(img5))
print(pred)
output = ['blasti', 'bonegl', 'brhkyt', 'cbrtsh', 'cmnmyn', 'gretit', 'hilpig', 'himbul', 'himgri', 'hsparo', 'indvul', 'jglowl', 'lbicrw', 'mgprob', 'rebi
print(output[pred])
```

```
1/1 [=====] - 0s 26ms/step
11
jglowl
```