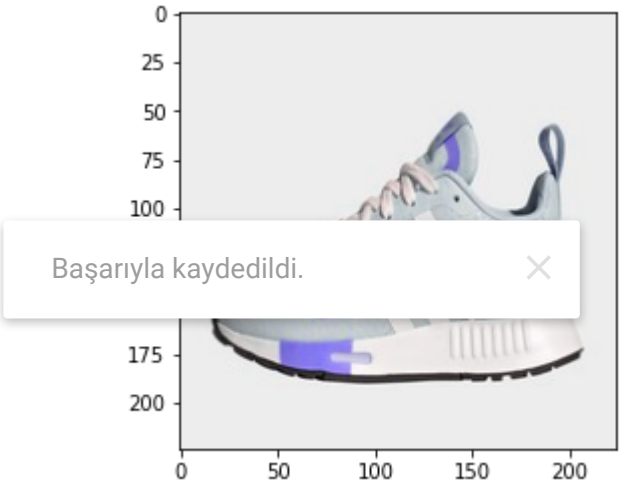
```
import time
start = time.time()
```

```
import os
import cv2
import random
import seaborn as sns
import numpy as np
import matplotlib.pyplot as plt
import tensorflow as tf
import keras
import keras.metrics
from keras.models import Sequential
from keras.layers import Flatten, MaxPooling2D, Conv2D, Dense
from sklearn.metrics import f1_score, confusion_matrix, ConfusionMatrixDisplay
from sklearn.pipeline import Pipeline, make_pipeline
from keras.callbacks import EarlyStopping, ModelCheckpoint, ReduceLROnPlateau
```

```
img_array = cv2.imread('/content/drive/MyDrive/archive (1)/test/adidas/Adidas (18).jpg')
# img_array = cv2.cvtColor(img_array,cv2.COLOR_BGR2RGB)
plt.imshow(img_array)
plt.show()
```




```
data = '/content/drive/MyDrive/archive (1)/train'
categories = ['adidas','nike']
# For test our create_data function will be work
for ct in categories:
  path = os.path.join(data,ct)
  for img in os.listdir(path):
    img_array = cv2.imread(os.path.join(path,img))
    # img_array = cv2.cvtColor(img_array,cv2.COLOR_BGR2RGB)
    plt.imshow(img_array)
    plt.show()
    break
  break
```

```
print(img_array.shape)
```

```
(224, 224, 3)
```

```
IMG_Size = 150
new_array = cv2.resize(img_array, (IMG_Size,IMG_Size))
plt.imshow(new_array)
plt.show()
```

Başarıyla kaydedildi.

```
training_data = []
test_data = []
val_data = []

def create_data(my_data_path,my_data):
    for ct in categories:
      path = os.path.join(my_data_path,ct)
      class_num = categories.index(ct)
      for img in os.listdir(path):
        datagen = tf.keras.preprocessing.image.ImageDataGenerator(rescale=1./225)
        generator = datagen.flow_from_directory(my_data_path, shuffle=True, batch_size=32)
        try:
          img_array = cv2.imread(os.path.join(path,img))
          # img_array = cv2.cvtColor(img_array,cv2.COLOR_GRAY2RGB)
          new_array = cv2.resize(img_array, (IMG_Size,IMG_Size))
          my_data.append([new_array,class_num])
```

```
        except Exception as e:
          pass

test_data_path = '/content/drive/MyDrive/archive (1)/test'
train_data_path = '/content/drive/MyDrive/archive (1)/test'
val_data_path = '/content/drive/MyDrive/archive (1)/validation'
create_data(train_data_path,training_data)
create_data(test_data_path,test_data)
create_data(val_data_path,val_data)


random.shuffle(training_data)
random.shuffle(test_data)

for sample in training_data[:10]:  # For test shuflle
  print(sample[1])
```

```
1
0
1
0
0
1
1
0
1
0
```

```
x = []
y = []

for features, label in training_data:
  x.append(features)
```

Başarıyla kaydedildi.

```
x_test = []
y_test = []

for features, label in test_data:
  x_test.append(features)
  y_test.append(label)

x_val = []
y_val = []

for features, label in val_data:
  x_val.append(features)
  y_val.append(label)


x = np.array(x)
x_test = np.array(x_test)
x_val = np.array(x_val)
y = np.array(y)
y_test = np.array(y_test)
y_val = np.array(y_val)
```

```
x.shape,y.shape,x_test.shape,y_test.shape,x_val.shape,y_val.shape
```

```
((60, 150, 150, 3), (60,), (60, 150, 150, 3), (60,), (55, 150, 150, 3), (55,))
```

```
x = np.array(x).reshape(-1, IMG_Size, IMG_Size, 3)
x_test = np.array(x_test).reshape(-1, IMG_Size, IMG_Size, 3)
x_val = np.array(x_val).reshape(-1, IMG_Size, IMG_Size, 3)
```

```
x.shape,y.shape,x_test.shape,y_test.shape,x_val.shape,y_val.shape
```

```
((60, 150, 150, 3), (60,), (60, 150, 150, 3), (60,), (55, 150, 150, 3), (55,))
```

```
y = y.reshape(-1,1)
y_test = y_test.reshape(-1,1)
y_val = y_val.reshape(-1,1)
```

```
from sklearn.preprocessing import OneHotEncoder

enc = OneHotEncoder(handle_unknown='ignore')
enc.fit(y)
enc.fit(y_test)
enc.fit(y_val)
```

```
x.shape,y.shape,x_test.shape,y_test.shape,x_val.shape,y_val.shape
```

```
((60, 150, 150, 3),
 (60, 1),
 (60, 150, 150, 3),
 (55, 1))
```

Başarıyla kaydedildi.

```
best_model = ModelCheckpoint('/content/drive/MyDrive/bestmodel.hdf5', monitor='accuracy',
best_val_acc = ModelCheckpoint('/content/drive/MyDrive/best_val_acc.hdf5', monitor='val_ac
```

```
model = Sequential()

model.add(Conv2D(128, (3,3), input_shape=(150, 150, 3) , activation='relu'))
model.add(MaxPooling2D(2,2))
model.add(Conv2D(256, (3,3), activation='relu'))
model.add(MaxPooling2D(2,2))
model.add(Conv2D(256, (3,3), activation='relu'))
model.add(Flatten())
model.add(Dense(256, activation='relu'))
model.add(Dense(128, activation='relu'))
model.add(tf.keras.layers.Dropout(.2))
model.add(Dense(6, activation='softmax'))

opt = tf.keras.optimizers.Adam(learning_rate=0.001, decay=1e-6)
```

```
# Compile model
model.compile(
    loss='sparse_categorical_crossentropy', # binary_crossentropy, sparse_categorical_cros
    optimizer=opt,
    run_eagerly=True,
    metrics=['accuracy']
)

hist = model.fit(x, y, validation_data=(x_val,y_val), verbose=2, epochs=20, shuffle=True,
```

```
Epoch 1/20
2/2 - 35s - loss: 575.5352 - accuracy: 0.2500 - val_loss: 1714.5830 - val_accuracy:
Epoch 2/20
2/2 - 32s - loss: 954.5818 - accuracy: 0.5000 - val_loss: 45.8089 - val_accuracy: 0.
Epoch 3/20
2/2 - 35s - loss: 33.4230 - accuracy: 0.5167 - val_loss: 6.2965 - val_accuracy: 0.50
Epoch 4/20
2/2 - 34s - loss: 3.0799 - accuracy: 0.6667 - val_loss: 0.8517 - val_accuracy: 0.454
Epoch 5/20
2/2 - 46s - loss: 1.1580 - accuracy: 0.7333 - val_loss: 1.1766 - val_accuracy: 0.672
Epoch 6/20
2/2 - 37s - loss: 0.7841 - accuracy: 0.8167 - val_loss: 3.7669 - val_accuracy: 0.545
Epoch 7/20
2/2 - 28s - loss: 1.1789 - accuracy: 0.7667 - val_loss: 3.3433 - val_accuracy: 0.490
Epoch 8/20
2/2 - 32s - loss: 2.0127 - accuracy: 0.8000 - val_loss: 2.1312 - val_accuracy: 0.618
Epoch 9/20
2/2 - 34s - loss: 0.3079 - accuracy: 0.9167 - val_loss: 2.9074 - val_accuracy: 0.490
Epoch 10/20
2/2 - 37s - loss: 0.2324 - accuracy: 0.9500 - val_loss: 1.9650 - val_accuracy: 0.563
Epoch 11/20
2/2 - 35s - loss: 0.1417 - accuracy: 0.9667 - val_loss: 2.0513 - val_accuracy: 0.600
Epoch 12/20
                                    uracy: 0.9167 - val_loss: 4.1698 - val_accuracy: 0.545
                                    uracy: 0.9167 - val_loss: 1.9645 - val_accuracy: 0.581
Epoch 14/20
2/2 - 31s - loss: 0.2179 - accuracy: 0.9833 - val_loss: 2.4311 - val_accuracy: 0.527
Epoch 15/20
2/2 - 29s - loss: 0.3749 - accuracy: 0.9167 - val_loss: 1.9064 - val_accuracy: 0.563
Epoch 16/20
2/2 - 24s - loss: 0.2024 - accuracy: 0.9667 - val_loss: 1.9749 - val_accuracy: 0.563
Epoch 17/20
2/2 - 30s - loss: 0.0680 - accuracy: 1.0000 - val_loss: 2.3094 - val_accuracy: 0.563
Epoch 18/20
2/2 - 27s - loss: 0.0367 - accuracy: 1.0000 - val_loss: 3.1910 - val_accuracy: 0.600
Epoch 19/20
2/2 - 25s - loss: 0.0444 - accuracy: 0.9833 - val_loss: 5.2440 - val_accuracy: 0.545
Epoch 20/20
2/2 - 25s - loss: 0.5225 - accuracy: 0.9167 - val_loss: 2.6957 - val_accuracy: 0.618
```

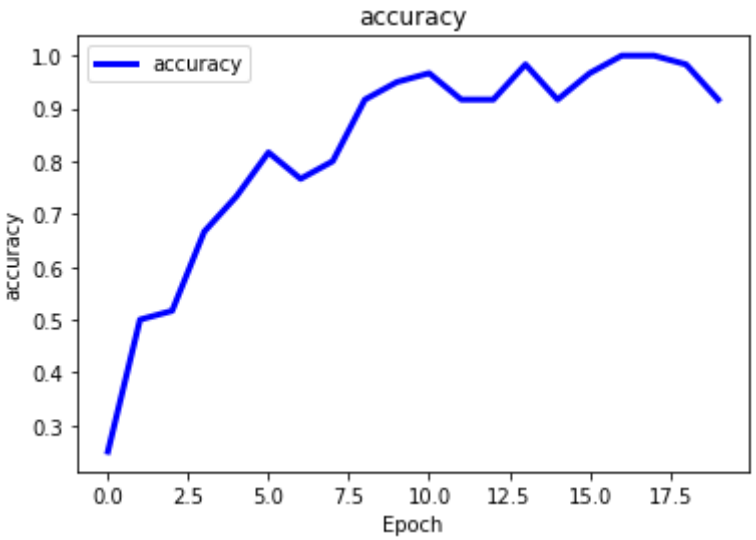
Başarıyla kaydedildi.

```
hist.history??
```

```
def visualization(name,h,color):
  t = h.history[name]
```

```
    my_max = max(t)
    my_min = min(t)
    print(f'Name : {name:10} max : {my_max:10} min : {my_min:10}')
    plt.plot(t,color=color,linewidth=3.0)
    plt.title(name)
    plt.ylabel(name)
    plt.xlabel('Epoch')
    plt.legend([name],loc='upper left')
    plt.show()


visualization('accuracy',hist,'Blue')
visualization('loss',hist,'Red')
visualization('val_accuracy',hist,'Green')
visualization('val_loss',hist,'Black')
```

```
Name : accuracy   max :        1.0 min :       0.25
```




```
Name : loss       max : 954.581787109375 min : 0.03665284439921379
```


```
model.load_weights('/content/drive/MyDrive/bestmodel.hdf5')
res = model.evaluate(x_test, y_test)
print("test loss, test acc:", res)
```

```
2/2 [==============================] - 5s 2s/step - loss: 0.0461 - accuracy: 1.0000
test loss, test acc: [0.04606626182794571, 1.0]
```

Epoch

```
yDrive/best_val_acc.hdf5')
)
```

Başarıyla kaydedildi.

```
2/2 [==============================] - 5s 2s/step - loss: 0.6011 - accuracy: 0.9500
test loss, test acc: [0.6010614633560181, 0.949999988079071]
```

```
def my_predict(my_model,my_x_test):
  y_pred = my_model.predict(my_x_test)
  return y_pred

def my_f1_score(my_y_test,my_y_pred):
  f1 = f1_score(my_y_test, my_y_pred, average="micro")
  return f1

def my_conf_matrix(my_y_test,my_y_pred):
  cm = confusion_matrix(my_y_test, my_y_pred)
  cm_norm = np.round(cm/np.sum(cm,axis=1).reshape(-1,1),2)
  sns.heatmap(cm_norm,cmap='Greens',annot=True,
              cbar_kws={'orientation' : 'vertical','label' : 'Color bar'},
              fmt='.2f'
              )
```

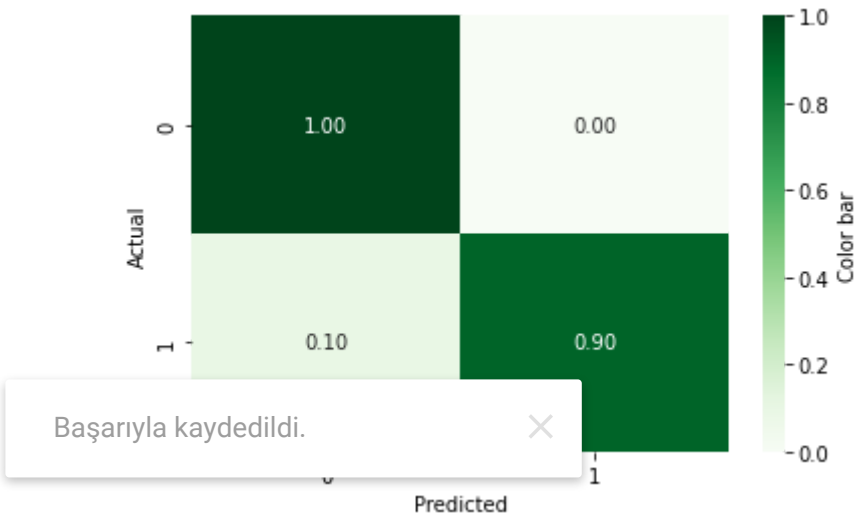
```
  plt.xlabel('Predicted')
  plt.ylabel('Actual')
  plt.show()
  # cm_display = ConfusionMatrixDisplay(cm)
  # cm_display.plot()
  # plt.show()

y_pred_res = my_predict(model,x_test)
y_pred_res = np.argmax(y_pred_res, axis=-1)


y_pred_res.shape,y_test.shape
```

```
((60,), (60, 1))
```

```
print(my_f1_score(y_test,y_pred_res))
```

```
0.9500000000000001
```

```
my_conf_matrix(y_test,y_pred_res)
```



Başarıyla kaydedildi.

```
newpath = r'/content/drive/MyDrive/Model'
if not os.path.exists(newpath):
    os.makedirs(newpath)


import pickle
# To save model  || You can use tensorflow model.save
pickle_out = open('/content/drive/MyDrive/Model/model.pickle','wb')
pickle.dump(model,pickle_out)
pickle_out.close()


model.summary()
```

```
Model: "sequential_9"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
```

```
 conv2d_27 (Conv2D)          (None, 148, 148, 128)     3584

 max_pooling2d_18 (MaxPoolin  (None, 74, 74, 128)      0
 g2D)

 conv2d_28 (Conv2D)          (None, 72, 72, 256)       295168

 max_pooling2d_19 (MaxPoolin  (None, 36, 36, 256)      0
 g2D)

 conv2d_29 (Conv2D)          (None, 34, 34, 256)       590080

 flatten_9 (Flatten)         (None, 295936)            0

 dense_23 (Dense)            (None, 256)               75759872

 dense_24 (Dense)            (None, 128)               32896

 dropout_9 (Dropout)         (None, 128)               0

 dense_25 (Dense)            (None, 6)                 774

=================================================================
Total params: 76,682,374
Trainable params: 76,682,374
Non-trainable params: 0
_________________________________________________________________
```

```
end = time.time()
print((end - start)/60)
```

```
30.865265921751657
```

Başarıyla kaydedildi.

```
Drive/Model/model.pickle','rb')
model = pickle.load(pickle_in)
```