INTERNSHIP STUDIO TRAINING AND INTERNSHIP

DOMAIN:(ARTIFICIAL INTELLIGENCE)

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IMPLEMENTATION OF PCA WITH ANN ALGORITHM FOR FACE RECOGINITION

CODE:

https://colab.research.google.com/drive/1RzojdIt5gi5yjhuyV5JNFKOvQkJJjEtC#scrollTo=3cd6d0ef&line=9&uniqifier=1

!pip install opencv-python

```
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.datasets import fetch_lfw_people
from sklearn.decomposition import PCA
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis
from sklearn.neural_network import MLPClassifier
import numpy as np
import os,cv2
def plot_gallery(images, titles, h, w, n_row=3, n_col=4):
    """Helper function to plot a gallery of portraits"""
    plt.figure(figsize=(1.8 * n_col, 2.4 * n_row))
    plt.subplots_adjust(bottom=0, left=.01, right=.99, top=.90, hspace=.35)
    for i in range(n_row * n_col):
        plt.subplot(n_row, n_col, i + 1)
        plt.imshow(images[i].reshape((h, w)), cmap=plt.cm.gray)
        plt.title(titles[i], size=12)
        plt.xticks(())
```

```
        plt.yticks(())
dir_name= "/dataset/faces"
y=[];X=[];target_names=[]
person_id=0;h=w=300
n_samples=0
class_names=[]
for person_name in os.listdir(dir_name):
    # print(person_name)
    dir_path = dir_name+person_name+"/"
    class_names.append(person_name)
    for image_name in os.listdir(dir_path):
        # formulate the image path
        image_path = dir_path+image_name
        # Read the input image
        img = cv2.imread(image_path)
        # Convert into grayscale
        gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
        # resize image to 300*300 dimension
        resized_image= cv2.resize(gray,(h,w))
        # convert matrix to vector
        v = resized_image.flatten()
        X.append(v)
        # increase the number of samples
        n_samples =n_samples+1
        # Addinng th categorical label
        y.append(person_id)
        # adding the person name
```

```
        target_names.append(person_name)
    # Increase the person id by 1
    person_id=person_id+1
#
# transform list to numpy array
y=np.array(y)
X=np.array(X)
target_names =np.array(target_names)
n_features = X.shape[1]
print(y.shape,X.shape,target_names.shape)
print("Number of sampels:",n_samples)
# Download the data, if not already on disk and load it as numpy arrays

# lfw_people = fetch_lfw_people(min_faces_per_person=70, resize=0.4)

# # introspect the images arrays to find the shapes (for plotting)
# n_samples, h, w = lfw_people.images.shape
# print(n_samples, h, w)
# # for machine learning we use the 2 data directly (as relative pixel
# # positions info is ignored by this model)
# X = lfw_people.data
# n_features = X.shape[1]

# print(X.shape)
# # the label to predict is the id of the person
# y = lfw_people.target
# print(y)
```

```
# if 0 in y:
#     print("yes")
# target_names = lfw_people.target_names
# print(target_names)
n_classes = target_names.shape[0]

print("Total dataset size:")
print("n_samples: %d" % n_samples)
print("n_features: %d" % n_features)
print("n_classes: %d" % n_classes)
```

OUTPUT:

(463,) (463, 90000) (463,)

Number of sampels: 463

Total dataset size:

n_samples: 463

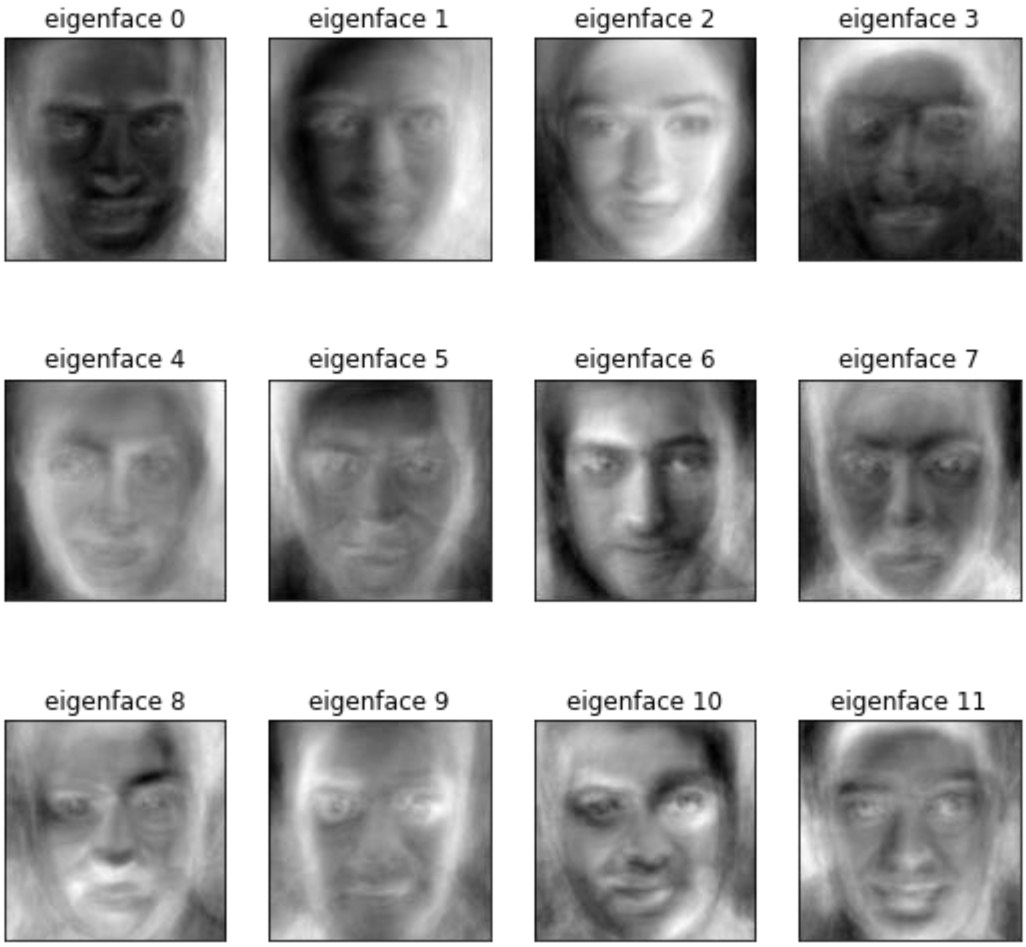
n_features: 90000

n_classes: 463

```
# Split into a training set and a test set using a stratified k fold

# split into a training and testing set
X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.25, random_state=42)



#
```

```
# Compute a PCA (eigenfaces) on the face dataset (treated as unlabeled
# dataset): unsupervised feature extraction / dimensionality reduction
n_components = 150

print("Extracting the top %d eigenfaces from %d faces"% (n_components,
X_train.shape[0]))

# Applying PCA
pca = PCA(n_components=n_components, svd_solver='randomized',
whiten=True).fit(X_train)

# Generating eigenfaces
eigenfaces = pca.components_.reshape((n_components, h, w))

# plot the gallery of the most significative eigenfaces

eigenface_titles = ["eigenface %d" % i for i in range(eigenfaces.shape[0])]
plot_gallery(eigenfaces, eigenface_titles, h, w)

plt.show()

print("Projecting the input data on the eigenfaces orthonormal basis")
X_train_pca = pca.transform(X_train)
X_test_pca = pca.transform(X_test)
print(X_train_pca.shape,X_test_pca.shape)

# %%Compute Fisherfaces
lda = LinearDiscriminantAnalysis()
```

```
#Compute LDA of reduced data
lda.fit(X_train_pca, y_train)

X_train_lda = lda.transform(X_train_pca)
X_test_lda = lda.transform(X_test_pca)
print("Project done SUCESSFULLY...")
```



Projecting the input data on the eigenfaces orthonormal basis

(347, 150) (116, 150)

Project done SUCESSFULLY...

Iteration 1, loss = 2.81319740

Iteration 2, loss = 2.76742366

Iteration 3, loss = 2.72234448

Iteration 4, loss = 2.67995822

Iteration 5, loss = 2.63803956

Iteration 6, loss = 2.59783662

Iteration 7, loss = 2.55952291

Iteration 8, loss = 2.52207617

Iteration 9, loss = 2.48723798

Iteration 10, loss = 2.45301112

Iteration 11, loss = 2.41991120

Iteration 12, loss = 2.38863906

Iteration 13, loss = 2.35823897

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Iteration 16, loss = 2.27436854

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Iteration 18, loss = 2.22335978

Iteration 19, loss = 2.19847177

Iteration 20, loss = 2.17451329

Iteration 21, loss = 2.15182038

Iteration 22, loss = 2.12953742

Iteration 23, loss = 2.10747895

Iteration 24, loss = 2.08586882

Iteration 25, loss = 2.06516549

Iteration 26, loss = 2.04457175

Iteration 27, loss = 2.02425192

Iteration 28, loss = 2.00447801

Iteration 29, loss = 1.98500344

Iteration 30, loss = 1.96599729

Iteration 31, loss = 1.94694743

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Iteration 472, loss = 0.02870607

Iteration 473, loss = 0.02856289

Iteration 474, loss = 0.02841349

Iteration 475, loss = 0.02825634

Iteration 476, loss = 0.02810862

Iteration 477, loss = 0.02796399

Iteration 478, loss = 0.02781585

Iteration 479, loss = 0.02768414

Iteration 480, loss = 0.02753358

Iteration 481, loss = 0.02738188

Iteration 482, loss = 0.02724513

Iteration 483, loss = 0.02708949

Iteration 484, loss = 0.02695758

Iteration 485, loss = 0.02681307

Iteration 486, loss = 0.02668384

Iteration 487, loss = 0.02653856

Iteration 488, loss = 0.02640072

Iteration 489, loss = 0.02626679

Iteration 490, loss = 0.02613012

Iteration 491, loss = 0.02599938

Iteration 492, loss = 0.02587395

Iteration 493, loss = 0.02572792

Iteration 494, loss = 0.02560445

Iteration 495, loss = 0.02545826

Iteration 496, loss = 0.02533640

Iteration 497, loss = 0.02520856

Iteration 498, loss = 0.02508469

Iteration 499, loss = 0.02496328

Iteration 500, loss = 0.02483322

Iteration 501, loss = 0.02470211

Iteration 502, loss = 0.02457548

Iteration 503, loss = 0.02444331

Iteration 504, loss = 0.02432756

Iteration 505, loss = 0.02419577

Iteration 506, loss = 0.02406536

Iteration 507, loss = 0.02395399

Iteration 508, loss = 0.02381383

Iteration 509, loss = 0.02371545

Iteration 510, loss = 0.02358057

Iteration 511, loss = 0.02346010

Iteration 512, loss = 0.02332960

Iteration 513, loss = 0.02322699

Iteration 514, loss = 0.02310160

Iteration 515, loss = 0.02298387

Iteration 516, loss = 0.02287020

Iteration 517, loss = 0.02276060

Iteration 518, loss = 0.02265121

Iteration 519, loss = 0.02253039

Iteration 520, loss = 0.02241725

Iteration 521, loss = 0.02230558

Iteration 522, loss = 0.02219262

Iteration 523, loss = 0.02208288

Iteration 524, loss = 0.02195613

Iteration 525, loss = 0.02187422

Iteration 526, loss = 0.02175719

Iteration 527, loss = 0.02163709

Iteration 528, loss = 0.02153218

Iteration 529, loss = 0.02142490

Iteration 530, loss = 0.02132744

Iteration 531, loss = 0.02123132

Iteration 532, loss = 0.02111407

Iteration 533, loss = 0.02102968

Iteration 534, loss = 0.02090158

Iteration 535, loss = 0.02081800

Iteration 536, loss = 0.02070123

Iteration 537, loss = 0.02060770

Iteration 538, loss = 0.02051741

Iteration 539, loss = 0.02041041

Iteration 540, loss = 0.02031025

Iteration 541, loss = 0.02020838

Iteration 542, loss = 0.02012444

Iteration 543, loss = 0.02002556

Iteration 544, loss = 0.01991838

Iteration 545, loss = 0.01983134

Iteration 546, loss = 0.01973029

Iteration 547, loss = 0.01965025

Iteration 548, loss = 0.01954647

Iteration 549, loss = 0.01944774

Iteration 550, loss = 0.01936264

Iteration 551, loss = 0.01926989

Iteration 552, loss = 0.01917658

Iteration 553, loss = 0.01908253

Iteration 554, loss = 0.01899711

Iteration 555, loss = 0.01890794

Iteration 556, loss = 0.01882094

Iteration 557, loss = 0.01872905

Iteration 558, loss = 0.01863732

Iteration 559, loss = 0.01855573

Training loss did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Model Weights:

[(9, 10), (10, 10), (10, 10)]

```
y_pred=[];y_prob=[]
for test_face in X_test_lda:
    prob = clf.predict_proba([test_face])[0]
    # print(prob,np.max(prob))
    class_id = np.where(prob == np.max(prob))[0][0]
    # print(class_index)
```

```
    # Find the label of the mathed face
    y_pred.append(class_id)
    y_prob.append(np.max(prob))

# Transform the data
y_pred = np.array(y_pred)



prediction_titles=[]
true_positive = 0
for i in range(y_pred.shape[0]):
    # print(y_test[i],y_pred[i])
    # true_name = target_names[y_test[i]].rsplit(' ', 1)[-1]
    # pred_name = target_names[y_pred[i]].rsplit(' ', 1)[-1]
    true_name = class_names[y_test[i]]
    pred_name = class_names[y_pred[i]]
    result = 'pred: %s, pr: %s \ntrue: %s' % (pred_name, str(y_prob[i])[0:3],
true_name)
    # result = 'prediction: %s \ntrue:      %s' % (pred_name, true_name)
    prediction_titles.append(result)
    if true_name==pred_name:
        true_positive =true_positive+1

print("Accuracy:",true_positive*100/y_pred.shape[0])



# # Plot results
plot_gallery(X_test, prediction_titles, h, w)
```

plt.show()

Accuracy: 69.82758620689656