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## Eigen Faces

### **Part 1: Store the new low-dimensional representation of each of the 40 training images**

Followed the below steps to implement the Eigenfaces for face recognition.

1. Processing the training images.
2. Compute the mean face.
3. Calculate the covariance matrix.
4. Compute the eigenvectors and eigenvalues of the covariance matrix.
5. Select a subset of eigenvectors corresponding to the largest eigenvalues to form the eigenspace.
6. Project the training images onto the eigenspace to obtain the low dimensional representation.

The resulting low-dimensional representations of the training images are saved in eigenfaces\_representation.npz file.

### **Part 2: Finding the closest match from the training set constructed**

Followed the below steps to find the closest match from the training set.

1. Load the low-dimensional representation of the training images and the mean face from the file saved in the previous step.
2. Project the new image onto the low-dimensional space using the previously calculated eigenvectors.
3. Calculate the Euclidean distance between the projected new image and each of the training images in the low-dimensional space.
4. Identify the closest match by finding the training image with the minimum distance.
5. Repeat the process for both the original training images and test images.

**Below is the output:**

```
Test recognition on the additional training images
Matched s1.1.tif with testing image 1
Matched s10.1.tif with testing image 10
Matched s11.1.tif with testing image 11
Matched s12.1.tif with testing image 12
Matched s13.1.tif with testing image 13
Matched s14.1.tif with testing image 14
Matched s15.1.tif with testing image 15
Matched s16.1.tif with testing image 16
Matched s17.1.tif with testing image 17
Matched s18.1.tif with testing image 18
Matched s19.1.tif with testing image 19
Matched s2.1.tif with testing image 2
Matched s20.1.tif with testing image 20
Matched s21.1.tif with testing image 21
Matched s22.1.tif with testing image 22
```

Matched s23.1.tif with testing image 23  
Matched s24.1.tif with testing image 24  
Matched s25.1.tif with testing image 25  
Matched s26.1.tif with testing image 26  
Matched s27.1.tif with testing image 27  
Matched s28.1.tif with testing image 28  
Matched s29.1.tif with testing image 29  
Matched s3.1.tif with testing image 3  
Matched s30.1.tif with testing image 30  
Matched s31.1.tif with testing image 31  
Matched s32.1.tif with testing image 32  
Matched s33.1.tif with testing image 33  
Matched s34.1.tif with testing image 34  
Matched s35.1.tif with testing image 35  
Matched s36.1.tif with testing image 36  
Matched s37.1.tif with testing image 37  
Matched s38.1.tif with testing image 38  
Matched s39.1.tif with testing image 39  
Matched s4.1.tif with testing image 4  
Matched s40.1.tif with testing image 40  
Matched s5.1.tif with testing image 5  
Matched s6.1.tif with testing image 6  
Matched s7.1.tif with testing image 7  
Matched s8.1.tif with testing image 8  
Matched s9.1.tif with testing image 9  
Test recognition on the additional test images  
Matched s1.2.tif with testing image 1  
Matched s10.2.tif with testing image 10  
Matched s11.2.tif with testing image 11  
Matched s12.2.tif with testing image 12  
Matched s13.2.tif with testing image 13  
Matched s14.2.tif with testing image 14  
Matched s15.2.tif with testing image 15  
Matched s16.2.tif with testing image 18  
Matched s17.2.tif with testing image 17  
Matched s18.2.tif with testing image 18  
Matched s19.2.tif with testing image 19  
Matched s2.2.tif with testing image 2  
Matched s20.2.tif with testing image 20  
Matched s21.2.tif with testing image 21  
Matched s22.2.tif with testing image 22  
Matched s23.2.tif with testing image 21  
Matched s24.2.tif with testing image 24  
Matched s25.2.tif with testing image 25  
Matched s26.2.tif with testing image 26  
Matched s27.2.tif with testing image 27  
Matched s28.2.tif with testing image 28  
Matched s29.2.tif with testing image 29  
Matched s3.2.tif with testing image 3  
Matched s30.2.tif with testing image 30  
Matched s31.2.tif with testing image 31  
Matched s32.2.tif with testing image 32  
Matched s33.2.tif with testing image 33  
Matched s34.2.tif with testing image 34

Matched s35.2.tif with testing image 4  
Matched s36.2.tif with testing image 7  
Matched s37.2.tif with testing image 37  
Matched s38.2.tif with testing image 38  
Matched s39.2.tif with testing image 29  
Matched s4.2.tif with testing image 4  
Matched s40.2.tif with testing image 40  
Matched s5.2.tif with testing image 5  
Matched s6.2.tif with testing image 6  
Matched s7.2.tif with testing image 7  
Matched s8.2.tif with testing image 8  
Matched s9.2.tif with testing image 9