

Matlab Homework: A Basis for Face Space

You'll be given a set of 30 photos, each "photo" being an array of size 294×262 , or 77,028 "pixels" - Each pixel is an integer from 0 to 255 representing the gray level for that position in the image.

The data you'll be given was originally 30 photos, but they have been converted to vectors for your convenience. Loading in the matrix given on the class website will give you an array that is 77028×30 .

On the class website, download `Eface.m` as a template m-file to work on, and the data set in `FacesNoRem.mat`.

The Problem

Given the photo data in a matrix Y that is 77028×30 , find the best four dimensional basis for the faces. Give a plot of the best two dimensional representation as well, and plot the basis vectors as "faces" (these are called the "eigenfaces").

Code Snippets for plotting

- The following sequence of commands takes in an array A , converts it to a vector v , then constructs the array A again:

```
[m,n]=size(A);          % Find what size A is (m=rows, n=cols).  
v=A(:);                 % v is now a vector with mn elements  
Atemp=reshape(v,m,n);   %Atemp is now m x n
```

- Here's a code snippet converting the first 4 columns of X into images and plotting them all in the same figure. Change the XX to whatever number you want the figure to be (figure(1), figure(2), etc).

```
figure(XX)  
colormap(gray)  
for i=1:4  
    subplot(2,2,i);  
    imagesc(reshape(X(:,i),294,262));  
    axis equal; axis off;    %Makes the axes equal (so a circle looks circular)  
    colormap(gray);         %The photos were grayscale  
end
```