

Project: Eigenfaces

Description of the data: `Math350Homework.mat`

- Matrix X that is 24138×26 (26 photos, each with 162 rows and 149 columns)
- Constants $m = 162$ and $n = 149$.

If you want to visualize the photos, you would reshape the corresponding column vector. For example, to visualize the first four faces and put them together in one figure, we would type:

```
for jj=1:4
    subplot(2,2,jj)
    imagesc(reshape(X(:,jj),m,n));
    axis off; axis equal; colormap(gray)
end
```

Our project is to use the provided code and previous example to do some analysis of this data set.

1. Compute the mean vector and represent it as a face (by plotting it).
2. Compute the first four eigenfaces (and represent them as faces). Put them together in one plot. In a second plot, show what the “photographic negatives” of the eigenfaces look like.
3. What might be a good approximation to the rank of the matrix X (if our goal is to make the faces recognizable, about 74% of the variance).
4. Plot the reconstruction of a randomly selected face using rank 2, 5, 10 and 15. Plot these (as photos) together in one figure.
5. Plot the data using the best two dimensional representation using a new figure. Plot the first 13 data points as asterisks and the remaining 13 as triangles.