

HW Mar 15: Eigenfaces

```
close all
clear
clc

load Math350Homework; % X, m, n are all loaded in.
```

1. Compute the mean, visualize as a face

```
mx=mean(X,2);
figure(1)
imagesc(reshape(mx,m,n));
axis off; axis equal; colormap(gray)

Xm=X-mx;
```



2. First 4 best basis vectors, visualized as faces (eigenfaces)

```
[U,S,V]=svd(Xm,0);
% Use the sample code:
figure(2)
for jj=1:4
    subplot(2,2,jj)
    imagesc(reshape(U(:,jj),m,n));
    axis off; axis equal; colormap(gray)
end

figure(3)
for jj=1:4
    subplot(2,2,jj)
    imagesc(reshape(-U(:,jj),m,n));
    axis off; axis equal; colormap(gray)
end
```



3. What's a good approximation to the rank for 74 percent of the variance?

```
ss=diag(S)./sum(diag(S));  
temp=cumsum(ss);  
temp(13:15)  
  
fprintf('We need 14 dimensions.\n')
```

```
ans =
```

```
0.7140  
0.7441  
0.7737
```

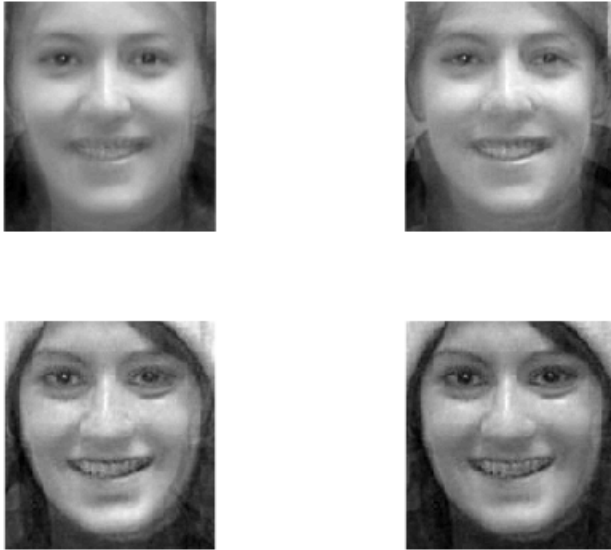
```
We need 14 dimensions.
```

4. Plot the reconstructions of a randomly selected face using ranks 2, 5, 10, 15 together

```

figure(4)
ranks=[2 5 10 15];
for jj=1:4
    subplot(2,2,jj)
    temp=U(:,1:ranks(jj))*(U(:,1:ranks(jj)))'*Xm(:,15)) + mx;
    imagesc(reshape(temp,m,n));
    axis off; axis equal; colormap(gray)
end

```

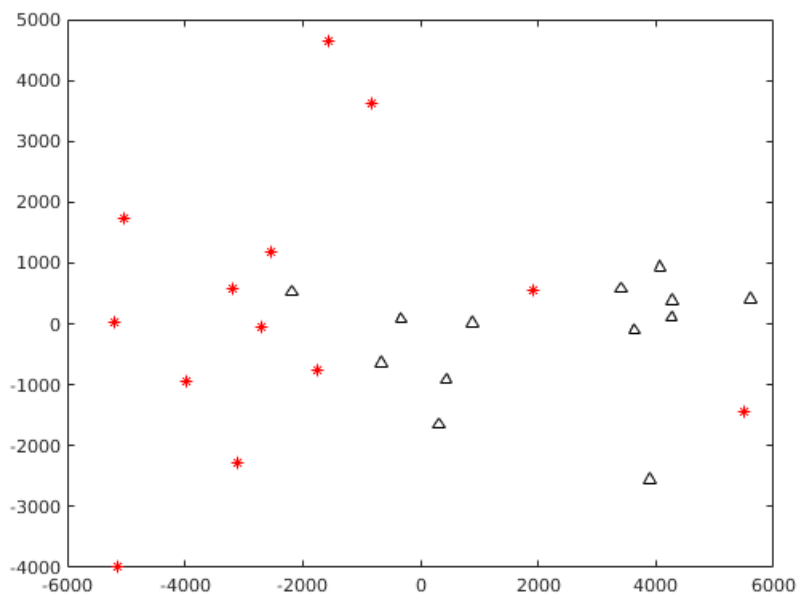


5. Plot the two dimensional representation of the data.

```

figure(5)
Coords=U(:,1:2)'*Xm;
plot(Coords(1,1:13),Coords(2,1:13),'r*',Coords(1,14:end),Coords(2,14:end),'k^');

```



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