

PCA

Problem 10.4

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Setup

```
clear;  
load('faces.mat');
```

Estimation

```
X = faces';  
mu = mean(X);  
[N, ~] = size(X);  
R = rank(X);  
X = X - mu;  
[U, Sigma, V] = svd(X);  
U = U(:, 1:R);  
Sigma = Sigma(1:R, 1:R);  
r = 16;  
Q = U(:, 1:r);  
Theta = U(:, 1:r)'*X;
```

Part a

```
Xest = mu + Q*Theta;  
plotFaces(Xest', 4, 4);
```

Part b

```
plotFaces((Q*Theta)', 4, 4);
```

Part c

```
err = zeros(R, 1);  
for rind = 1:R  
    rind  
    Xr = mu + U(:, 1:rind)*(U(:, 1:rind)'*X);  
    err(rind) = ((norm(Xr-faces', 'fro')) / norm(faces')) * 100;
```

```
end  
plot([1:R], err);
```

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