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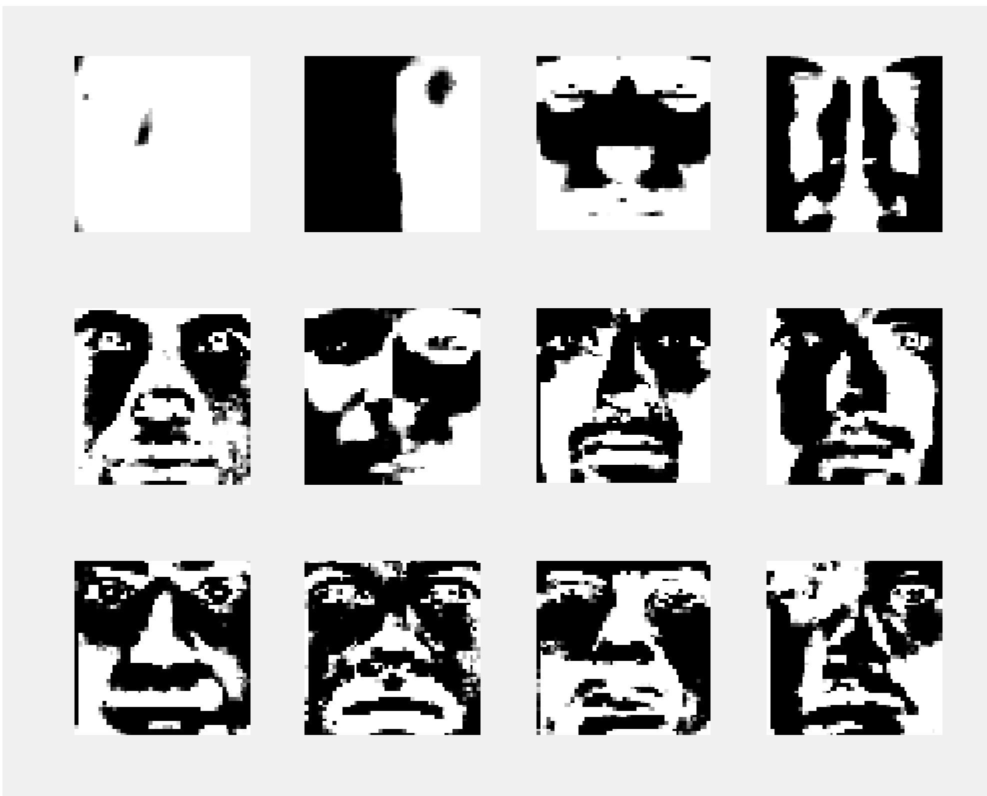
Roll# L164309

Section: Computer Vision

Submitted To: Instructor Usman Sadiq

Question#1

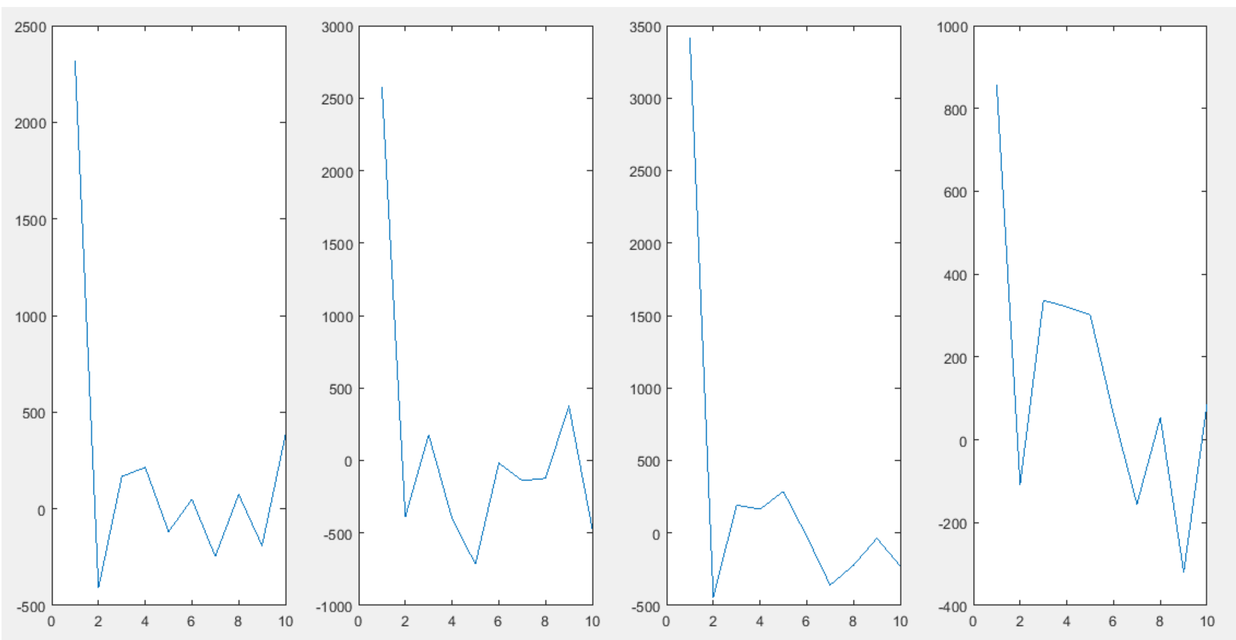
Eigen Images: First 12 Eigen images that I have found



Resynthesized versions of the original image with different m values

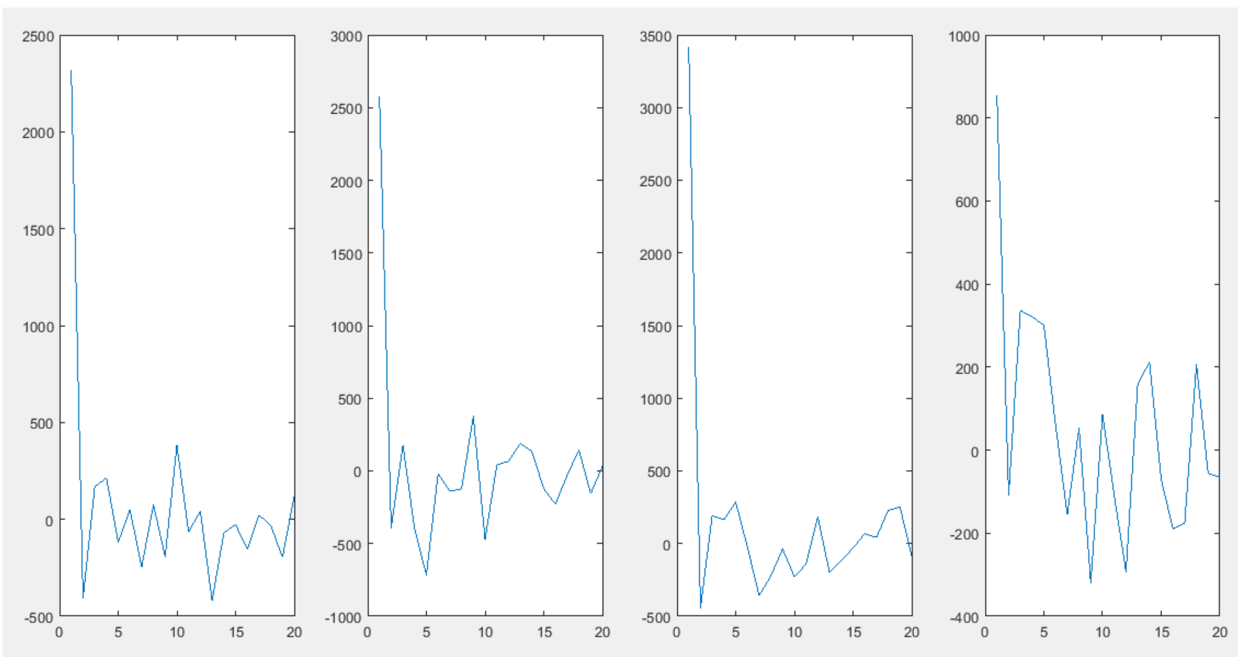
M=10

Projection Coefficient vs Eigen Vector number



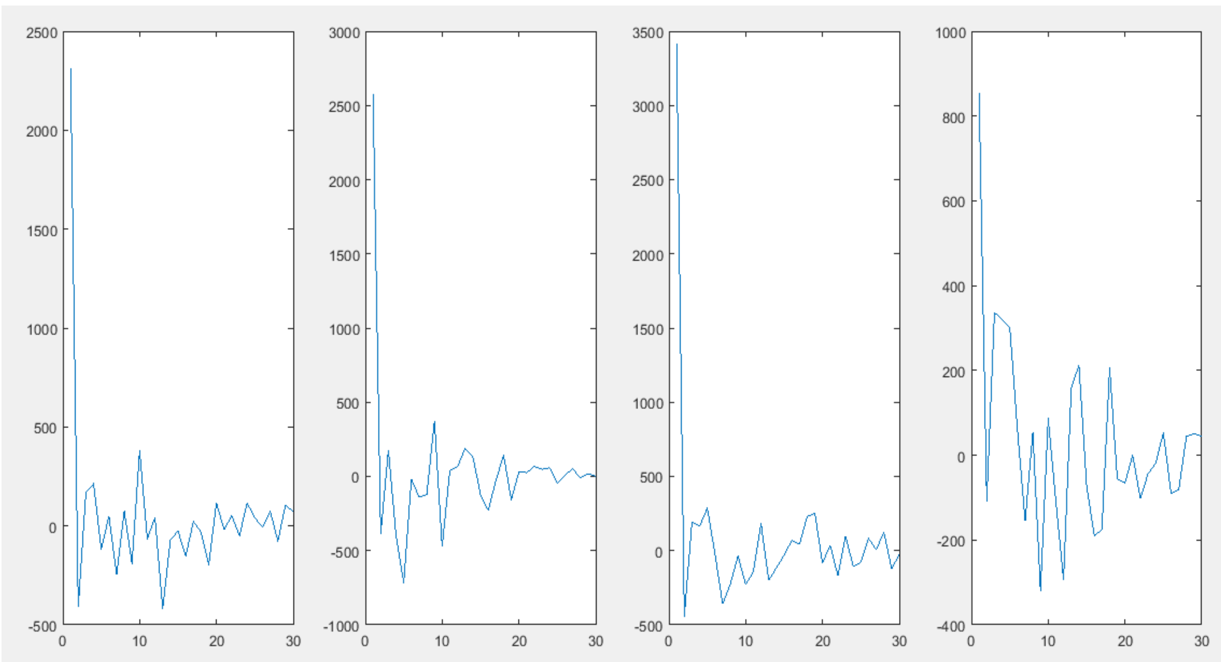
M=20

Projection Coefficient vs Eigen Vector number

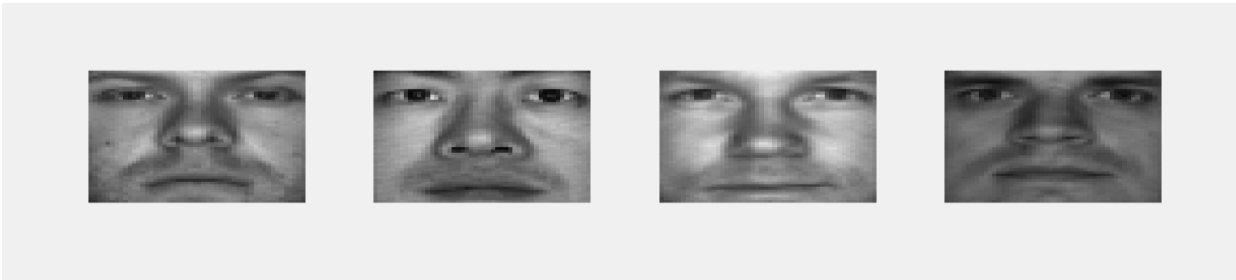


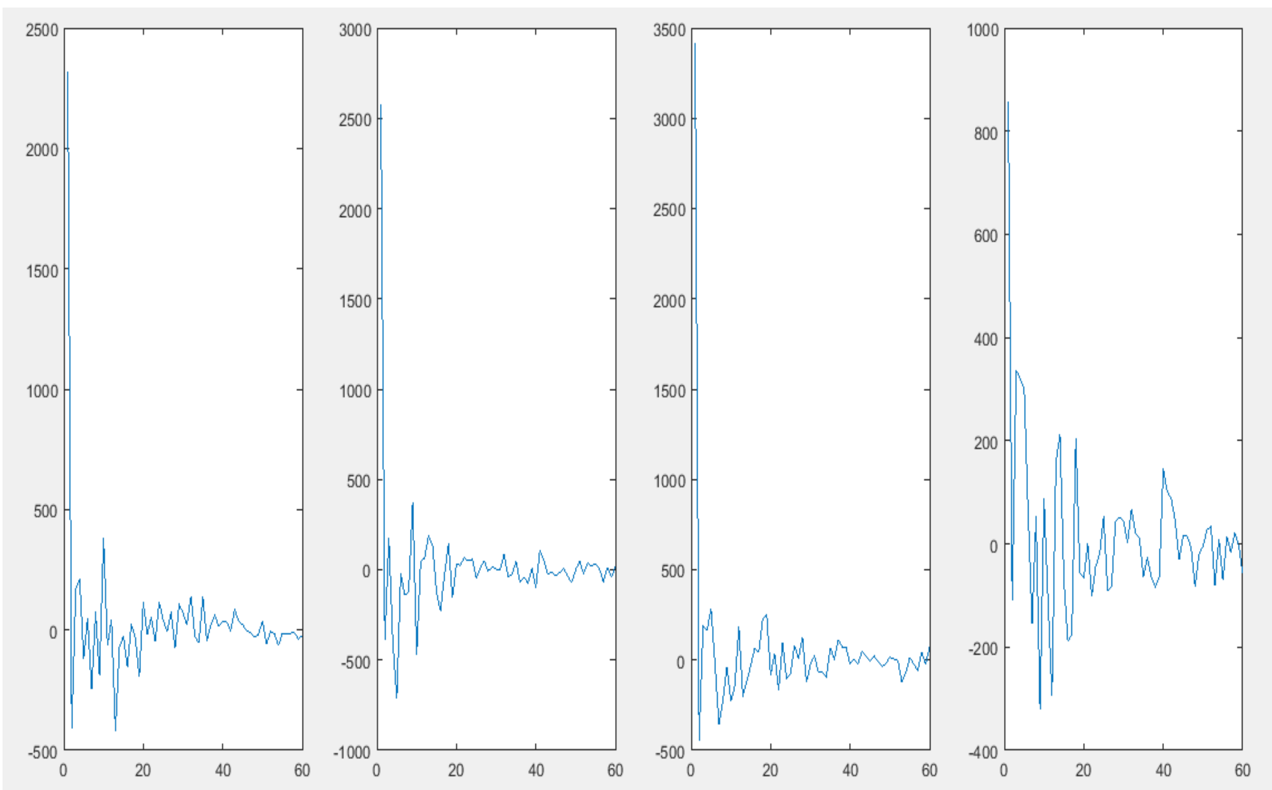
M=30

Projection Coefficient vs Eigen Vector number

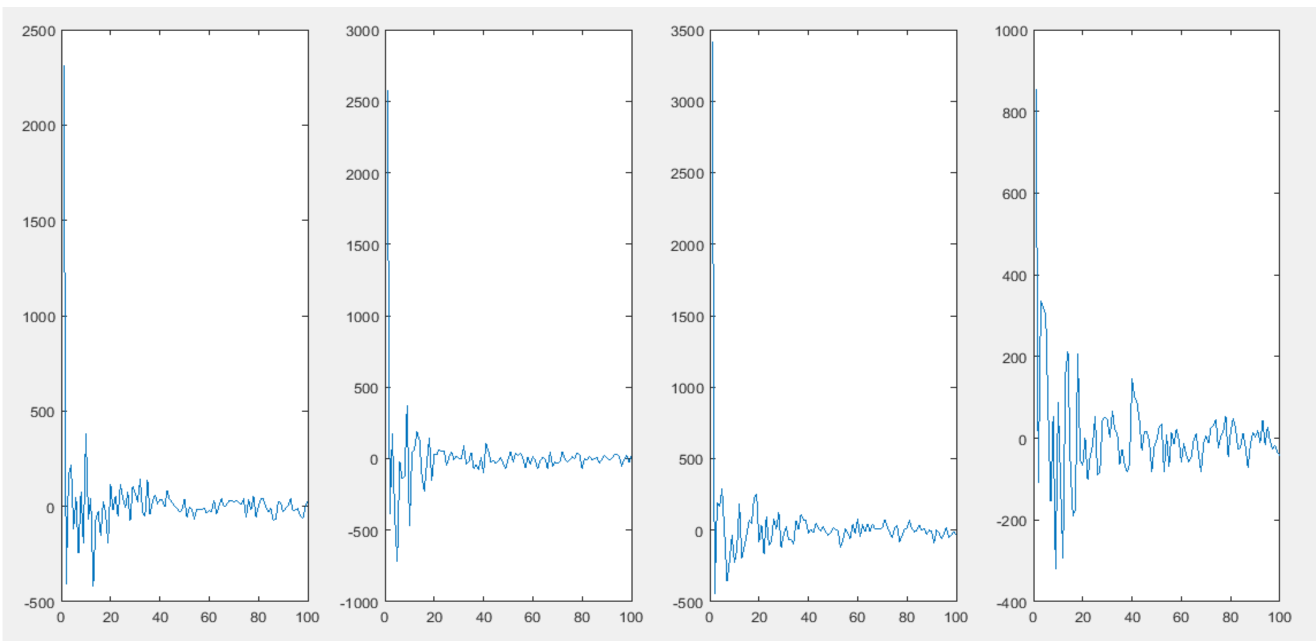


M=60




2500
2000
1500
1000
500
0
-500
0
20
40
60
3000
2500
2000
1500
1000
500
0
-500
-1000
3500
3000
2500
2000
1500
1000
500
0
-500
1000
800
600
400
200
0
-200
-400

M=100


2500
2000
1500
1000
500
0
-500
0 20 40 60 80 100
3000
2500
2000
1500
1000
500
0
-500
-1000
0 20 40 60 80 100
3500
3000
2500
2000
1500
1000
500
0
-500
0 20 40 60 80 100
1000
800
600
400
200
0
-200
-400
0 20 40 60 80 100

Question#2 Problem 2 a)

Problem 2

a)

if C_y is a diagonal matrix then we know that $C_y = \frac{1}{n}(YY^T)$

So

$$C_y = \frac{1}{n} YY^T$$

$\because Y = f(x)$

So, eigen value decomposition for C_y is

$$C_y = \frac{1}{n} PXX^T P^T$$

Now

$$C_y = PC_x P^T$$

Here $C_x = U\Lambda U^T$

We can write it as

$$C_y = P(U\Lambda U^T)P^T$$

Problem 2 b)

Problem 2

b)

As

$$\sigma_{x_1 y} = \frac{1}{n-1} \sum_i^n (x_i - \bar{x})(y_i - \bar{y})$$

Now to calculate for x_2

$$\sigma_{x_2 y} = \frac{1}{n-1} \sum_i^n (c.x_i - c.\bar{x})(y_i - \bar{y})$$

$$\sigma_{x_2 y} = \frac{c}{n-1} \sum_i^n (x_i - \bar{x})(y_i - \bar{y})$$

$$\sigma_{x_2 y} = c\left[\frac{1}{n-1} \sum_i^n (x_i - \bar{x})(y_i - \bar{y})\right]$$

$$\sigma_{x_2 y} = c\,\sigma_{x_1 y}$$

In general, c could be any nuber but in our case $c = 3$ so

$$\sigma_{x_2 y} = 3\sigma_{x_1 y}$$

Similarly, eigen vector $v_{x_2} = 3v_{x_1}$, same but scaled with a factor of 3