Lab2

February 9, 2022 11:56 AM

1.1

```
x = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14];
y = [3.32, 1.48, 5.21, 7.82, 6, 9.72, 10.12, 12.22, 13.55, 11.99, 17.18, 18.12, 18.59, 19.91, 19.46];
```

1.2

```
% 1.2
for i = 1:length(x)
    x(i) = x(i)-mean(x);
end
for i = 1:length(y)
    y(i) = y(i)-mean(y);
end
```

Question 1: What assumption would you make about the dimensionality of the data?
The dimension should be 1 even though the data is 2 dimension

1.3

```
% 1.3
C = cov(x,y);
% 1.4
eVal = eig(C);
[eVec1, eVec2] = eig(C);
```

C =

	1	2
1	34.1417	48.1868
2	48.1868	69.7042

eVal =

	1
1	0.5601
2	103.2858

eVa1

	1	2
1	-0.8204	0.5718
2	0.5718	0.8204

eVec2

	1	2
1	0.5601	0
2	0	103.2858

Question 2:
The higher eigen value is the second one. Since both values of the vectors are positive, it is trending up right, the same as the data points

1.5

```
x1 = rand([1 100]);
y1 = rand([1 100]);

for i = 1:length(x1)
    x1(i) = x1(i)-mean(x1);
end
for i = 1:length(y1)
    y1(i) = y1(i)-mean(y1);
end
plot(x1,y1)
C1 = cov(x1,y1);
eVal1 = eig(C1);
[eVec11, eVec12] = eig(C1);
```

Covariance

0.0911	0.0029
0.0029	0.0920

Eigen Value

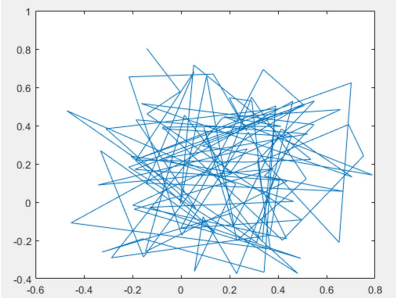
1
0.0886
0.0944

Eigen vectors

-0.7586	0.6516
0.6516	0.7586

0.0886	0
0	0.0944

Plot

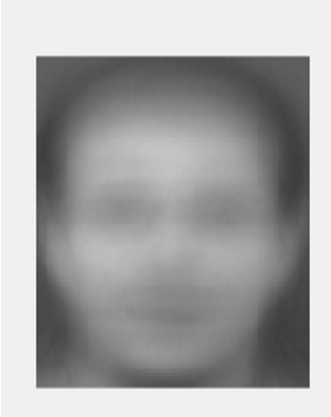


Question 3:

The trend is positive, since the eigen values are small, the data plots are scattered, The true dimensionality of the data is 1.

Part 2 code:

Question 4:



X form code

```
for i = 1:320
    X(:,i) =  X(:,i) - X_mean;
end
```

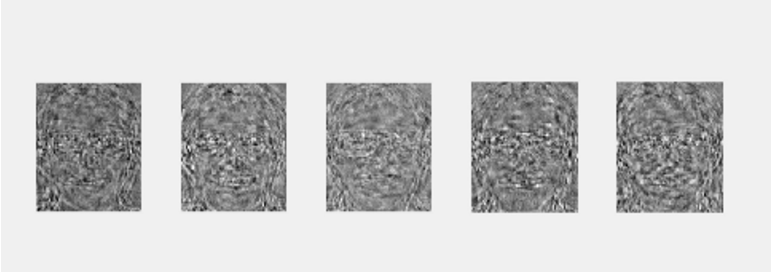
T matrix , and eigen values code:

```
T = 1/320*transpose(X)*X;

eValT = eig(T);
[eValT1,eValT2] =eig(T);
eigenvectors = X*eValT1;
```

Question 5

From 1 to 5
Question 6:
From 315 to 320



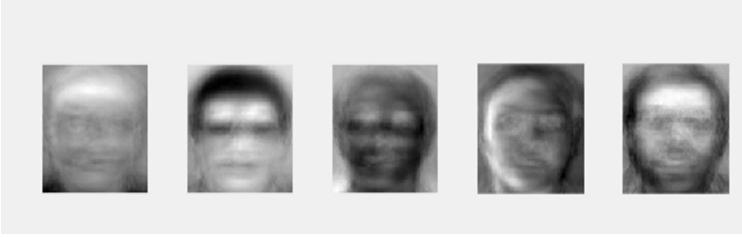
These faces have the shape of a face image. The information of these gives the shape of the face, and possibly where the face features are.

Question 7:
Code:

```
saveas(fig, "Q6_1thEigen.bmp")
%% Part 3: SVD composition
[U,D,V] = svd(X);

%imshow(eigface_1,[])
D2 = 1/320*transpose(D)*D;

%Question 7
fig = figure();
for i = 1:5
    subplot(1,5,i)
    eigface_1 = [reshape(U(:,i),[112,92])];
    imshow(eigface_1,[]);
end
```



Question 8:
Code:

```
fig = figure();
W = U(:,1:50)'*X(:,9);
im = U(:,1:50)*W + X_mean ;
imshow(reshape(im,[112,92]),[])
saveas(fig, "Q8rec.bmp")
fig = figure();
imshow(reshape(X(:,9),[112,92]),[])
saveas(fig, "Q8org.bmp")
```

Question 9 code:

```
fig = figure();
for i = 1:100
    subplot(10,10,i)
    W = U(:,1:50)'*X(:,i);
    im = U(:,1:50)*W + X_mean ;
    imshow(reshape(im,[112,92]),[])
end
saveas(fig, "Q9rec.bmp")
```