Assignment 1

Weiqi Luo 03697059

July 2, 2019

Exercise 1

Exercise 1.a - 1.b

k=2

(1) Optimal value of p1, p2 :

p1	p2
5	3

(2) Learned parameter values :

| par{1,1}	par{1,2}	par{1,3}
2.2063e-03	-2.6949e-03	-5.9515e-04
9.2173e-01	-1.3581e-03	-1.7107e-04
6.5735e-03	-1.1538e-02	9.9971e-01
-1.6266e-03	4.7304e-01	8.3936e-04
-9.9158e-04	2.4454e-04	1.2687e-04
2.4849e-03	-8.2673e-03	1.7827e-03
2.3136e-03	7.4693e-05	-1.4105e-04
-1.1665e-05	4.3810e-05	-4.5223e-06
-1.3006e-02	1.6437e-02	-6.2224e-04
1.2268e-04	-9.7700e-04	-1.3221e-05
1.2836e-05	-5.2889e-06	
-4.4566e-03	4.2985e-03	
-4.3099e-05	-4.4187e-06	
1.6696e-06	-2.6911e-07	
2.5977e-03	-3.8127e-03	
-4.0239e-07	2.1016e-06	

k=5

(1) Optimal value of p1, p2 :

p1	p2
4	1

(2) Learned parameter values :

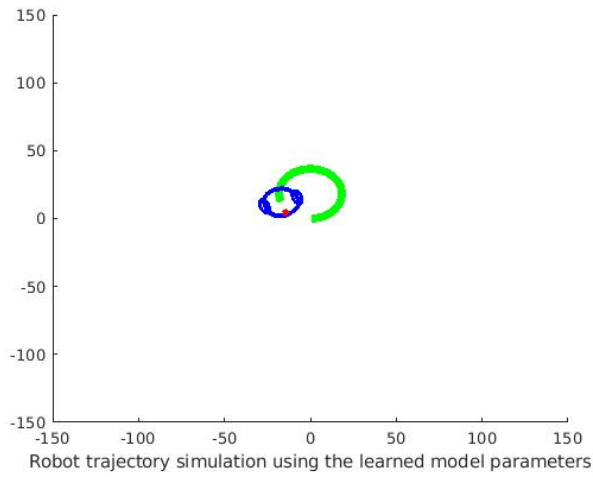| par{1,1}	par{1,2}	par{1,3}
2.5044e-03	-4.3238e-03	8.0784e-04
9.1976e-01	-1.0015e-03	-3.1902e-04
-2.8554e-03	1.4480e-03	9.9870e-01
-7.4385e-04	4.6798e-01	3.2142e-04
-1.0342e-03	5.6850e-04	
1.3743e-03	-2.5277e-03	
2.4869e-03	-1.0251e-03	
1.3601e-04	1.9246e-05	
-2.6908e-04	-1.6742e-03	
6.6926e-05	-6.7254e-04	
1.3061e-05	-7.8462e-06	
-4.2816e-03	3.4766e-03	
-4.5174e-05	8.7155e-06	

Exercise 1.c
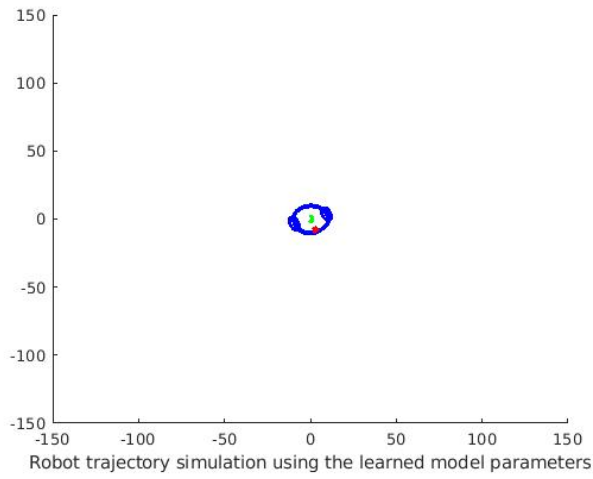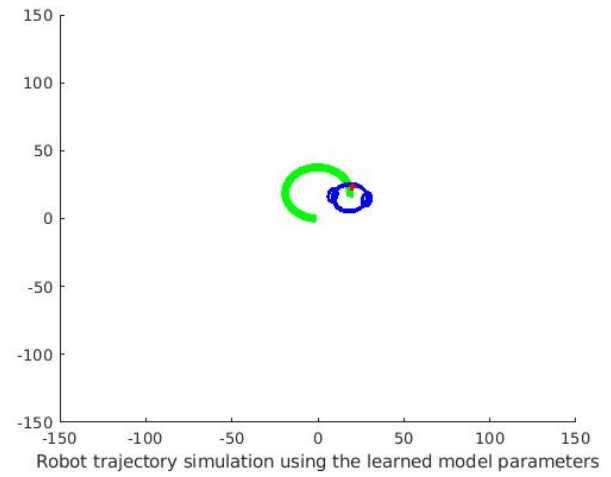

(a) Simulation (v, w) = (0, 0.05)
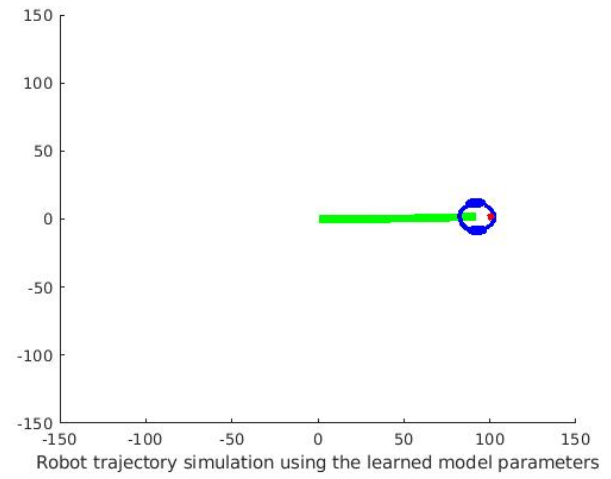
(b) Simulation (v, w) = (1, 0)

(c) Simulation (v, w) = (1, 0.05)

(d) Simulation (v, w) = (-1, -0.05)

4

Exercise 2

(1) The optimized number of principal components and respective classification error:

d_{opt}	err_{min}
48	3.620%

(2) confusion matrix:

True Class \ Predicted Class	1	2	3	4	5	6	7	8	9	10
1	970		1			2	1	1	5	
2		1098	11	1	2	1	1		21	
3	3		1001	3	3		2	1	18	1
4	2		8	972		5		2	17	4
5	1		3		964		3	2	3	6
6	2		1	18		859	2		10	
7	8	1	1		3	13	924		8	
8	1	2	31	1	2	3		956	13	19
9	3		7	10	1	5	1	1	941	5
10	5	1	10	7	10	2		6	15	953

```
digit  | 0       1       2       3       4       5       6       7       8       9
-------------------------------------------------------------------------------------
0      | 0.99    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.01    0.00
1      | 0.00    0.97    0.01    0.00    0.00    0.00    0.00    0.00    0.02    0.00
2      | 0.00    0.00    0.97    0.00    0.00    0.00    0.00    0.00    0.02    0.00
3      | 0.00    0.00    0.01    0.96    0.00    0.00    0.00    0.00    0.02    0.00
4      | 0.00    0.00    0.00    0.00    0.98    0.00    0.00    0.00    0.00    0.01
5      | 0.00    0.00    0.00    0.02    0.00    0.96    0.00    0.00    0.01    0.00
6      | 0.01    0.00    0.00    0.00    0.00    0.01    0.96    0.00    0.01    0.00
7      | 0.00    0.00    0.03    0.00    0.00    0.00    0.00    0.93    0.01    0.02
8      | 0.00    0.00    0.01    0.01    0.00    0.01    0.00    0.00    0.97    0.01
9      | 0.00    0.00    0.01    0.01    0.01    0.00    0.00    0.01    0.01    0.94
```
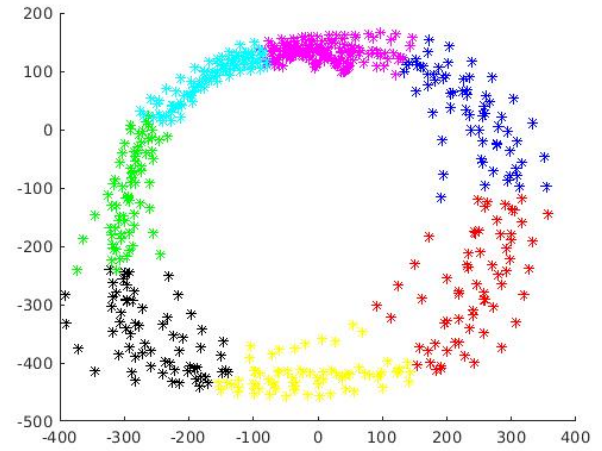
(3) plot of classification error:

Classification Error Plot

y-axis: classification error (%)

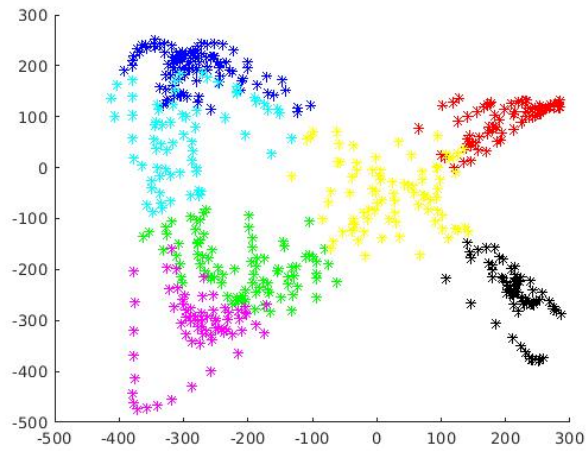*x-axis:* number of principle components d
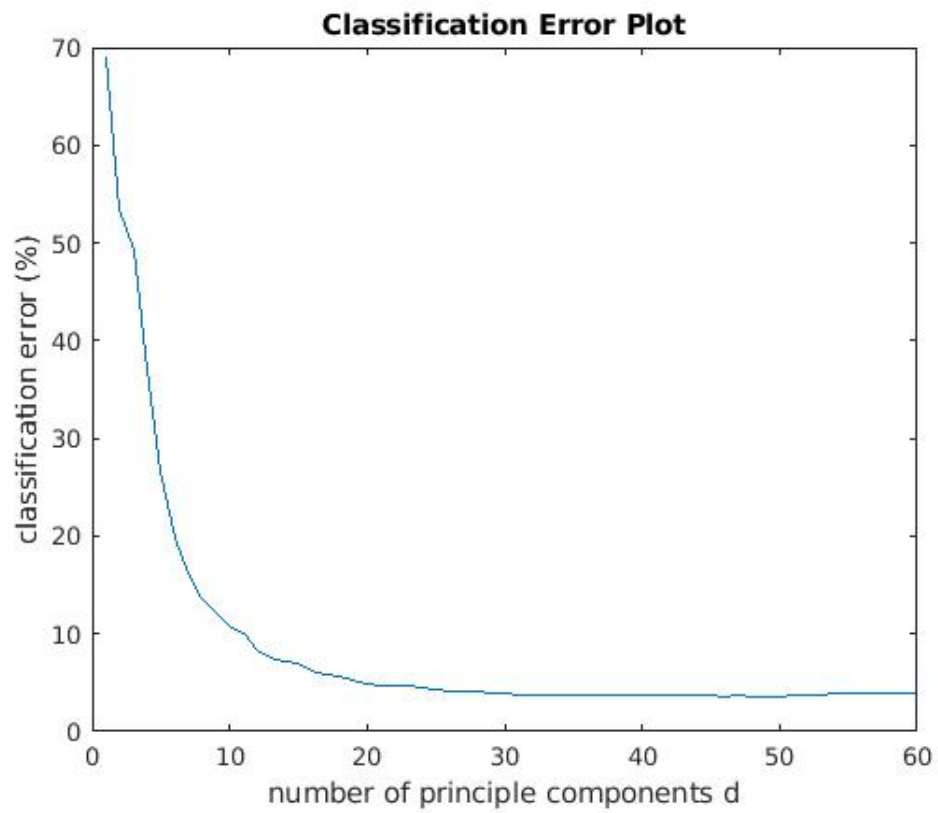
Exercise 3
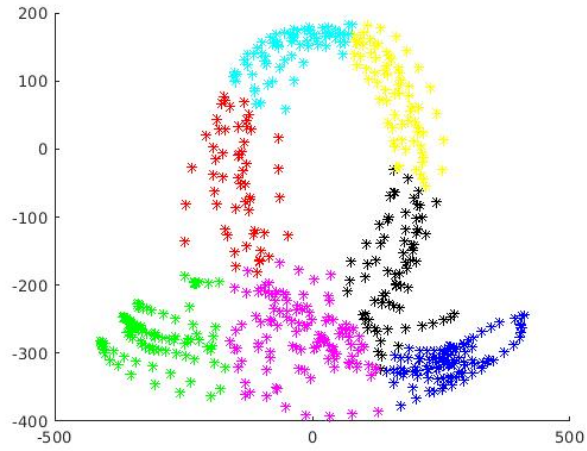
(a) gesture l clustering using kmeans

(b) gesture o clustering using kmeans

(c) gesture x clustering using kmeans