Machine Learning in Robotics Assignment 1

[redacted]

● Exercise 1

(a) When k = 5 : Optimal P1 = 4, Optimal P2 = 1;
When k = 2 : Optimal P1 = 5, Optimal P2 = 3;

(b) When k = 5:

Parameter 1

	par{1, 1}
	1
1	0.0025
2	0.9198
3	-0.0029
4	-7.4385e-04
5	-0.0010
6	0.0014
7	0.0025
8	1.3601e-04
9	-2.6908e-04
10	6.6926e-05
11	1.3061e-05
12	-0.0043
13	-4.5174e-05

Parameter 2

	par{1, 2}
	1
1	-0.0043
2	-0.0010
3	0.0014
4	0.4680
5	5.6850e-04
6	-0.0025
7	-0.0010
8	1.9246e-05
9	-0.0017
10	-6.7254e-04
11	-7.8462e-06
12	0.0035
13	8.7155e-06

Parameter 3

	par{1, 3}
	1
1	8.0784e-04
2	-3.1902e-04
3	0.9987
4	3.2142e-04

When k = 2:

Parameter 1

	par{1, 1}
	1
1	0.0022
2	0.9217
3	0.0066
4	-0.0016
5	-9.9158e-04
6	0.0025
7	0.0023
8	-1.1665e-05
9	-0.0130
10	1.2268e-04
11	1.2836e-05
12	-0.0045
13	-4.3099e-05
14	1.6696e-06
15	0.0026
16	-4.0239e-07

Parameter 2

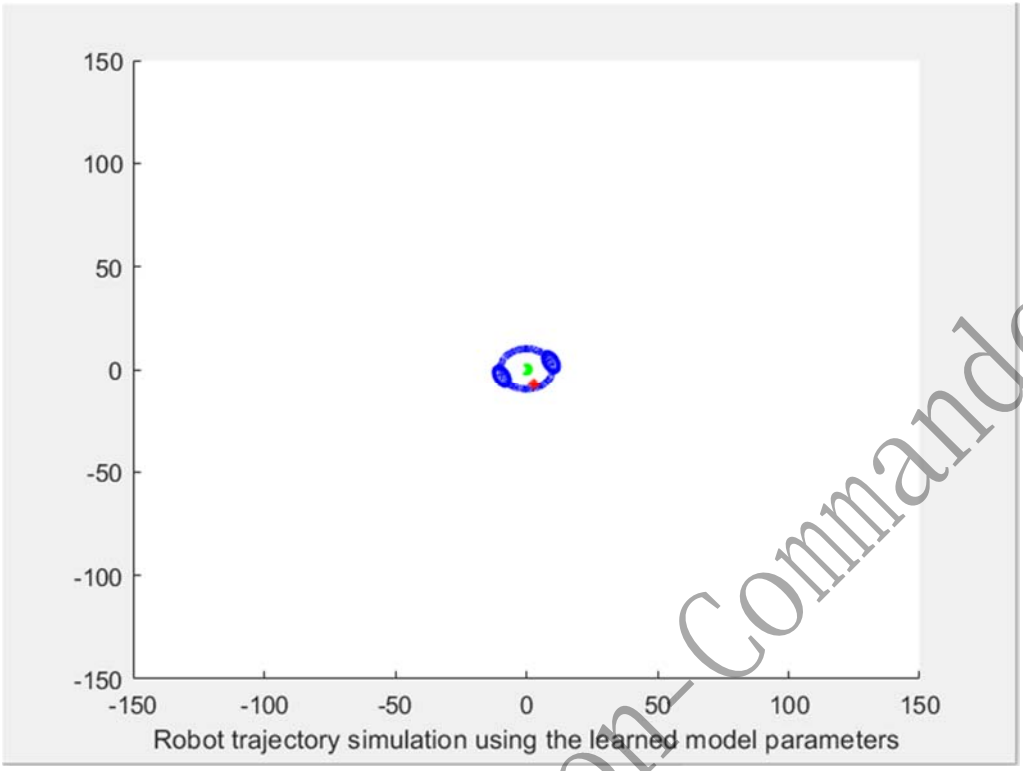
	par{1, 2}
	1
1	-0.0027
2	-0.0014
3	-0.0115
4	0.4730
5	2.4454e-04
6	-0.0083
7	7.4693e-05
8	4.3810e-05
9	0.0164
10	-9.7700e-04
11	-5.2889e-06
12	0.0043
13	-4.4187e-06
14	-2.6911e-07
15	-0.0038
16	2.1016e-06

Parameter 3

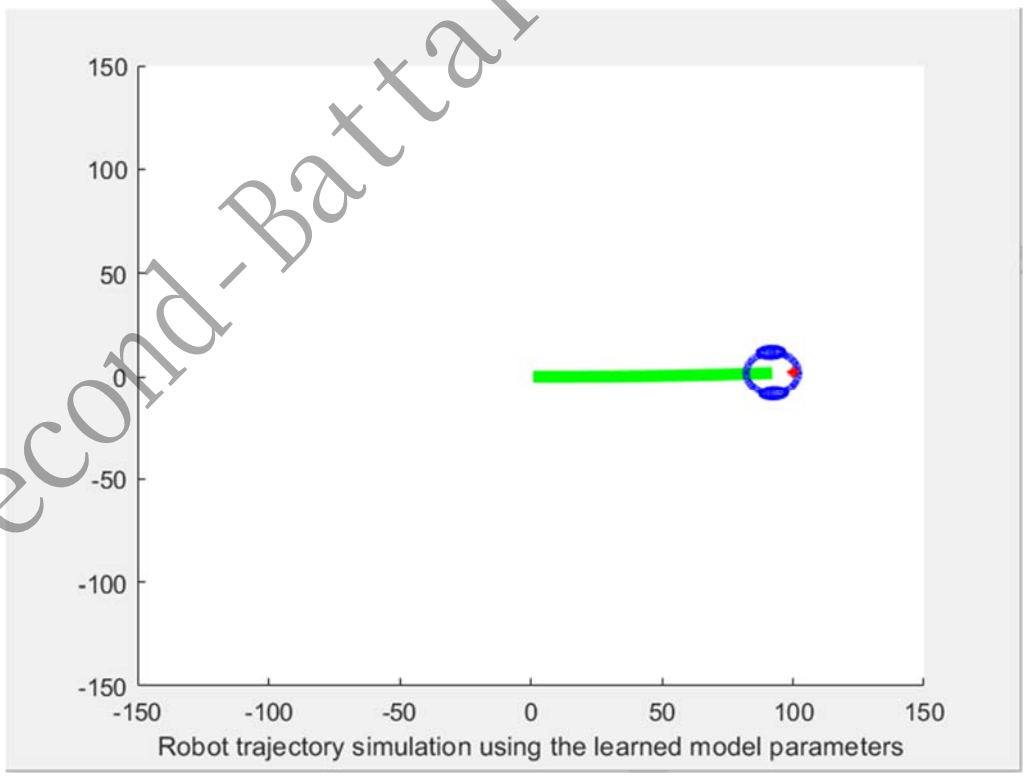
	par{1, 3}
	1
1	-5.9515e-04
2	-1.7107e-04
3	0.9997
4	8.3936e-04
5	1.2687e-04
6	0.0018
7	-1.4105e-04
8	-4.5223e-06
9	-6.2224e-04
10	-1.3221e-05

(c) When k=5:

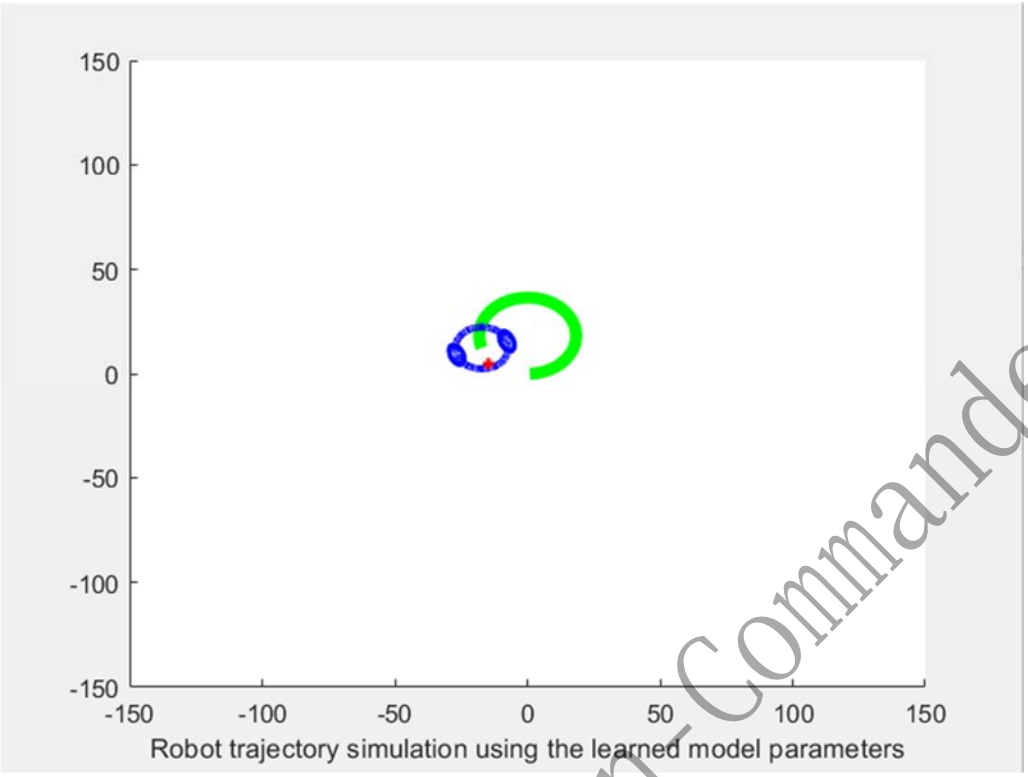
(v,w) = (0,0.05): (k=5)



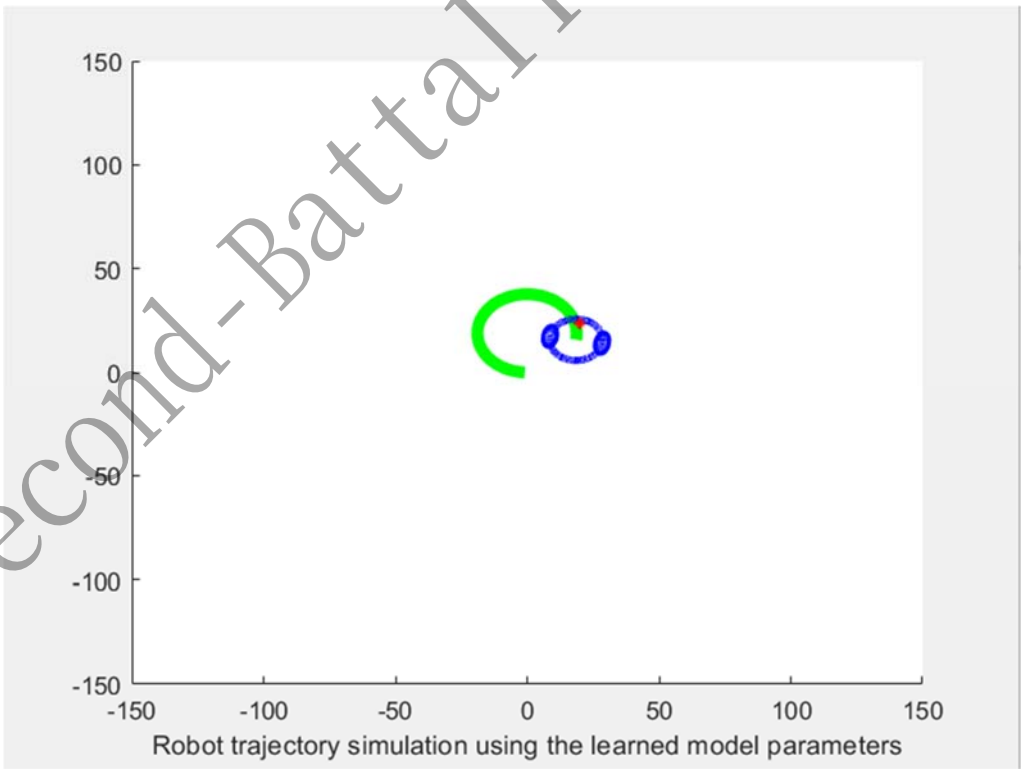
(v,w) =(1,0): (k=5)



(v,w) = (1,0.05): (k=5)

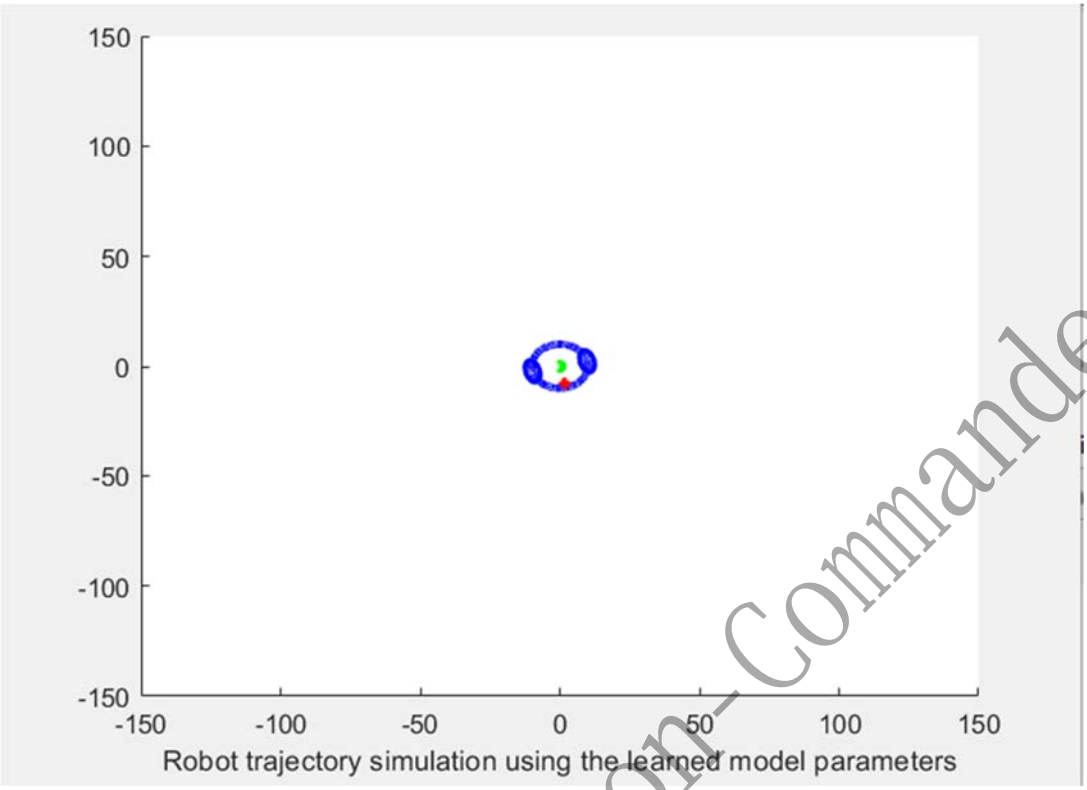


(v,w) = (-1,-0.05): (k=5)

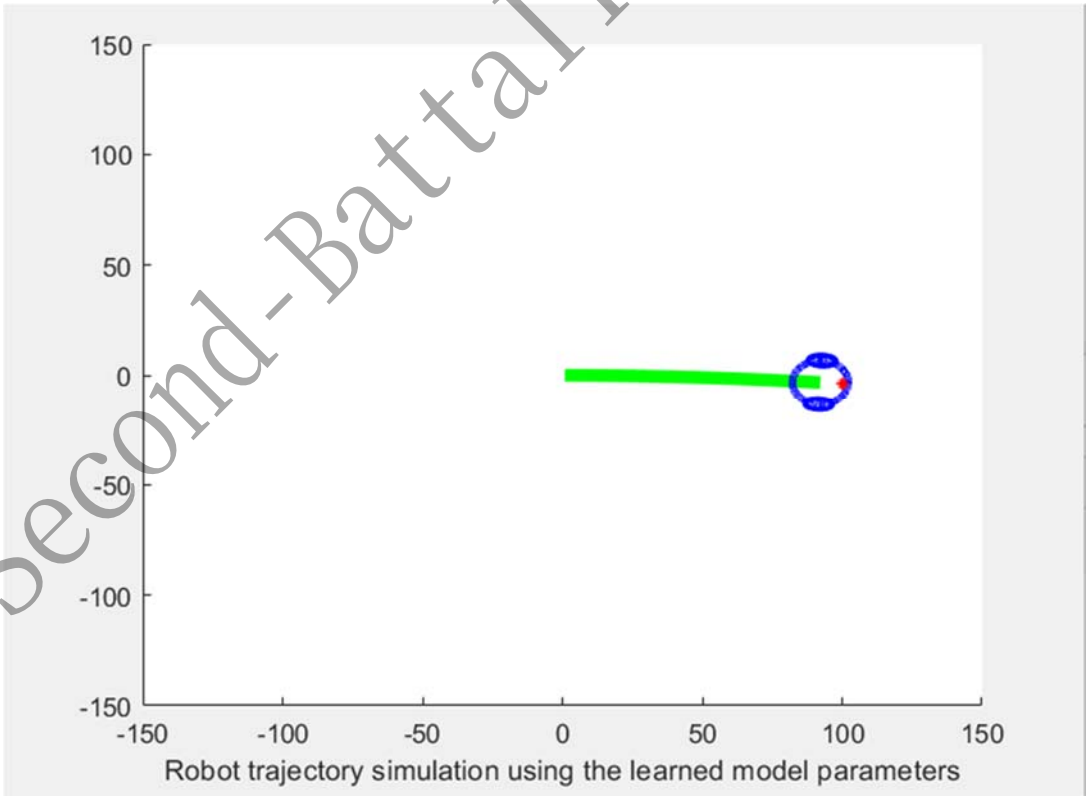


When k=2:

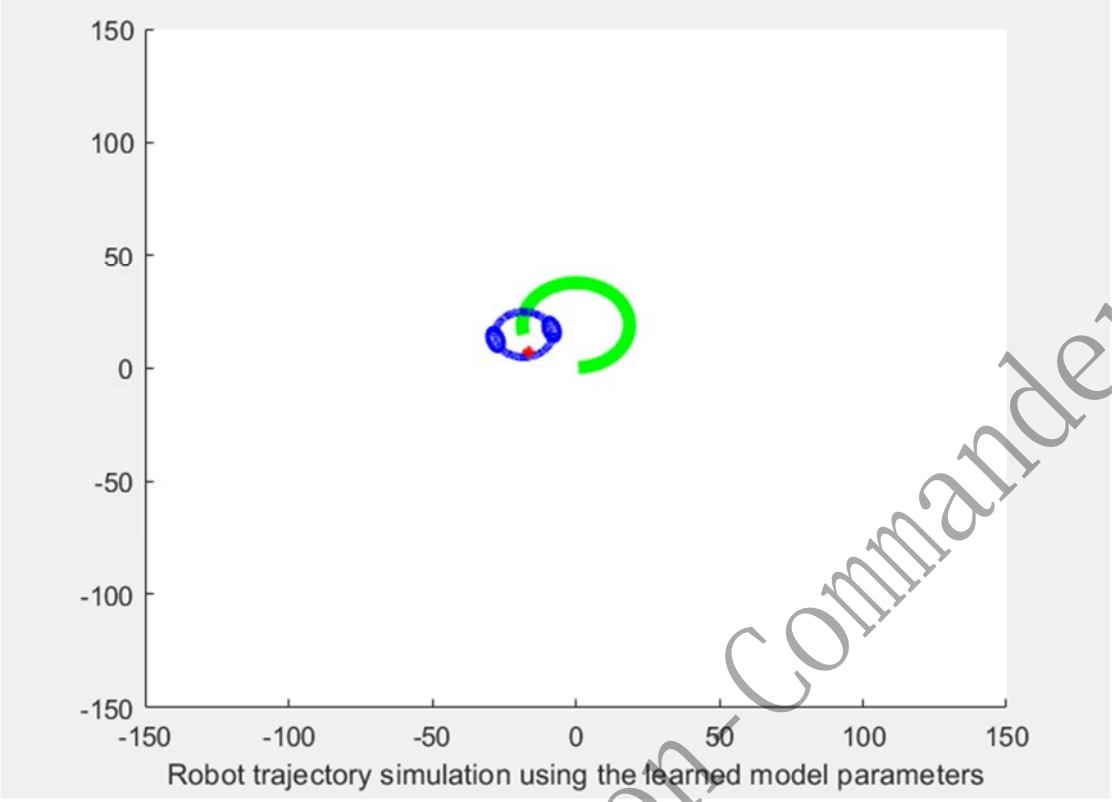
(v,w) = (0,0.05): (k=2)



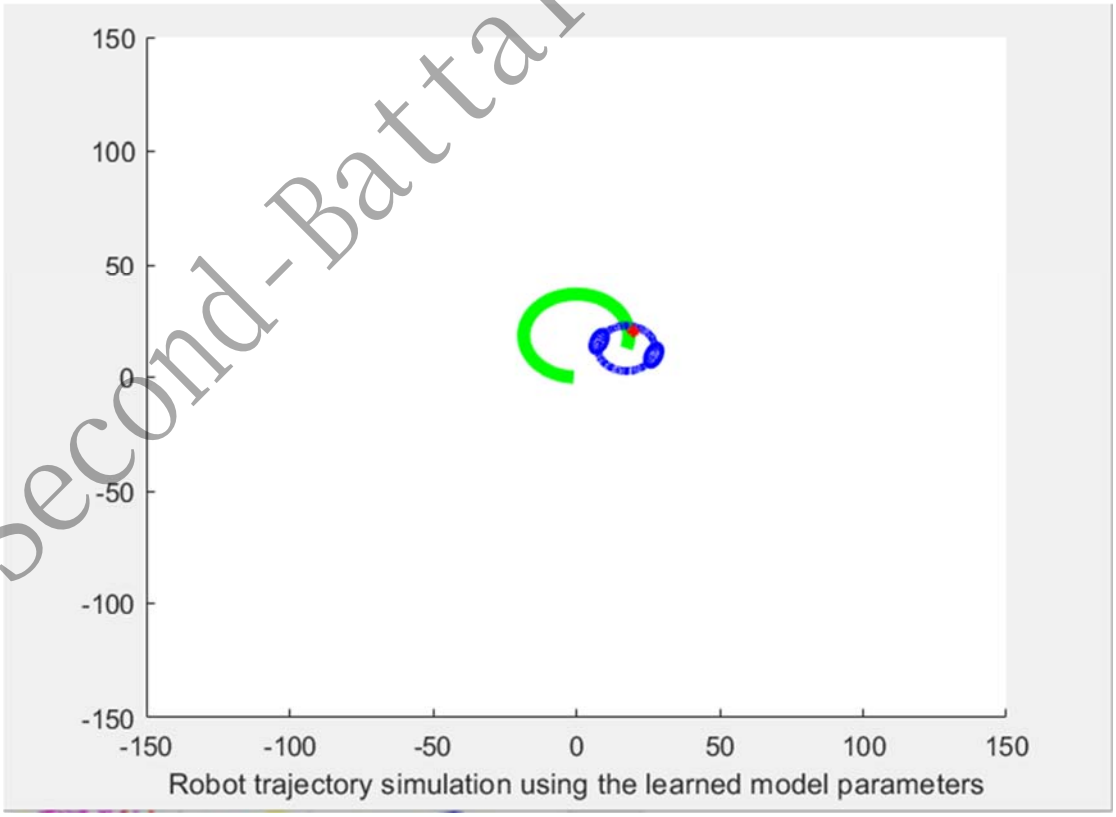
(v,w) = (1,0): (k=2)



(v,w) = (1,0.05): (k=2)



(v,w) = (-1,-0.05): (k=2)



● **Exercise 2**

The optimal d value is 48
The minimum classification error is 3.62% (when d = 48)

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The optimal value of d is 48
The minimum classification error is 3.62%
The confusion matrix for d = 48:
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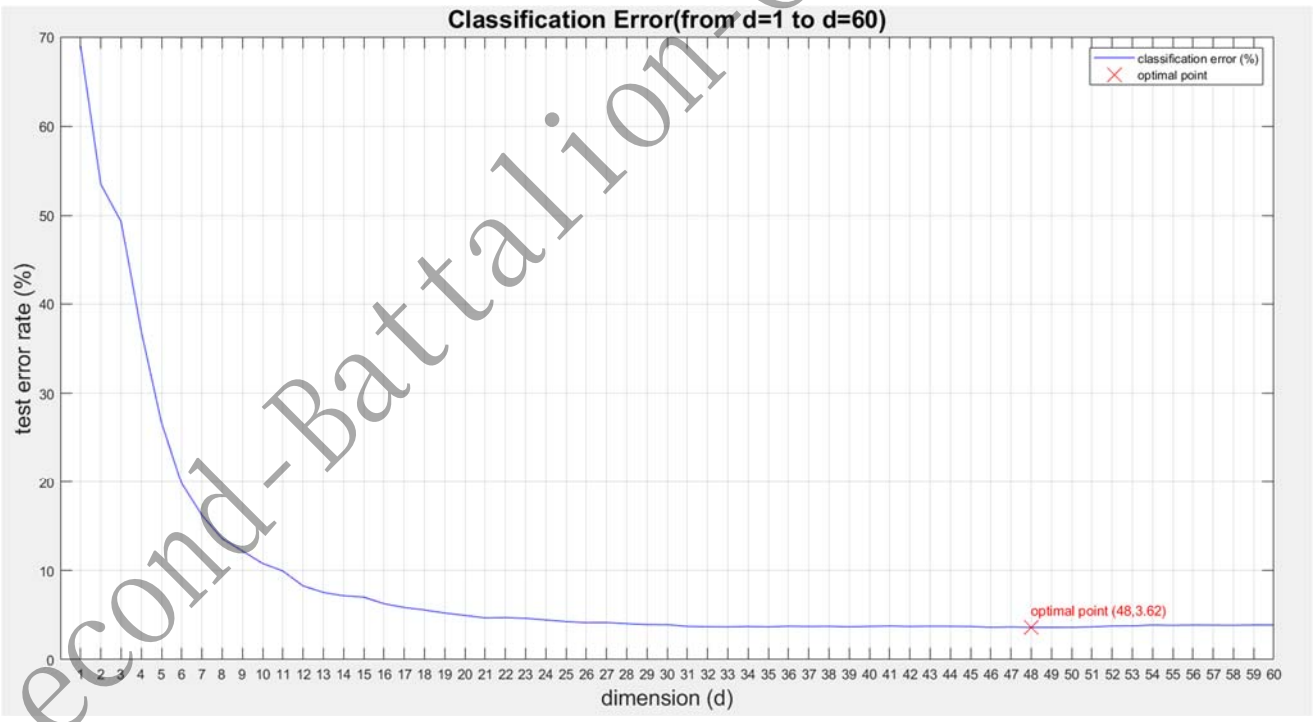
digit	0	1	2	3	4	5	6	7	8	9
0	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
1	0.00	0.97	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00
2	0.00	0.00	0.97	0.00	0.00	0.00	0.00	0.00	0.02	0.00
3	0.00	0.00	0.01	0.96	0.00	0.00	0.00	0.00	0.02	0.00
4	0.00	0.00	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.01
5	0.00	0.00	0.00	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

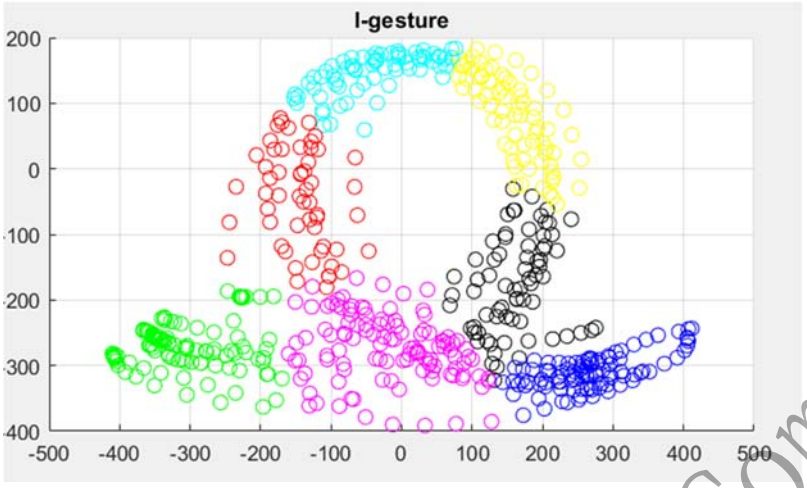
Plot of classification errors (from d = 1 to 60):



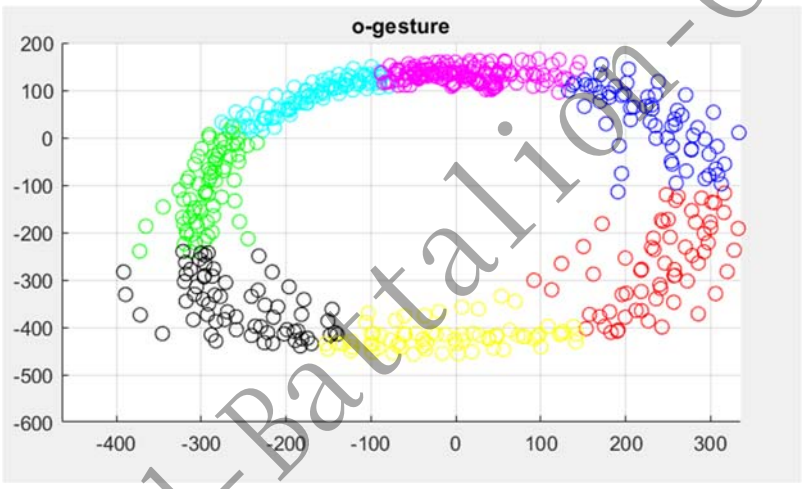
● **Exercise 3**

(a) K-means:

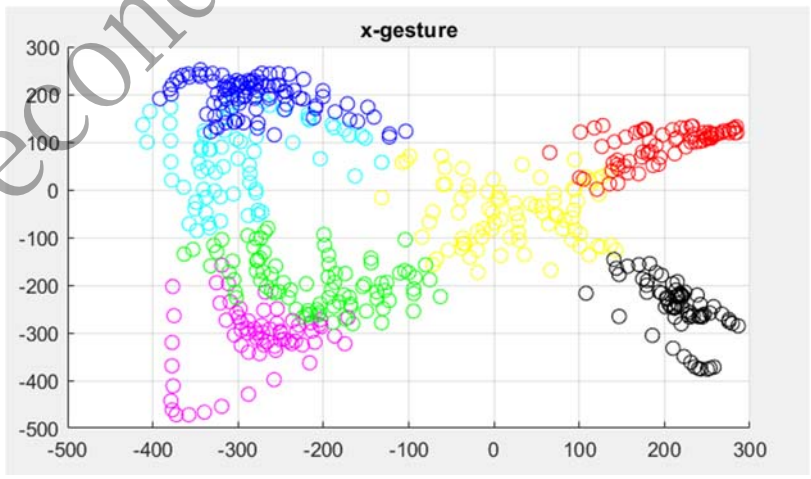
gesture l:



gesture o:

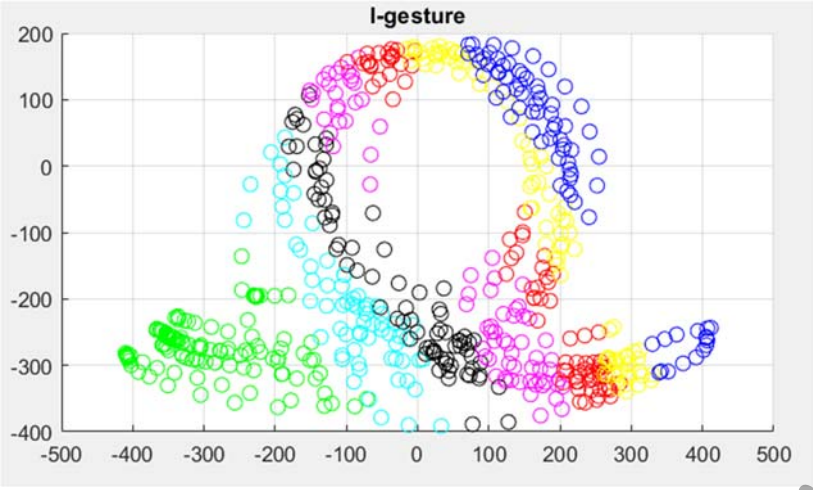


gesture x:

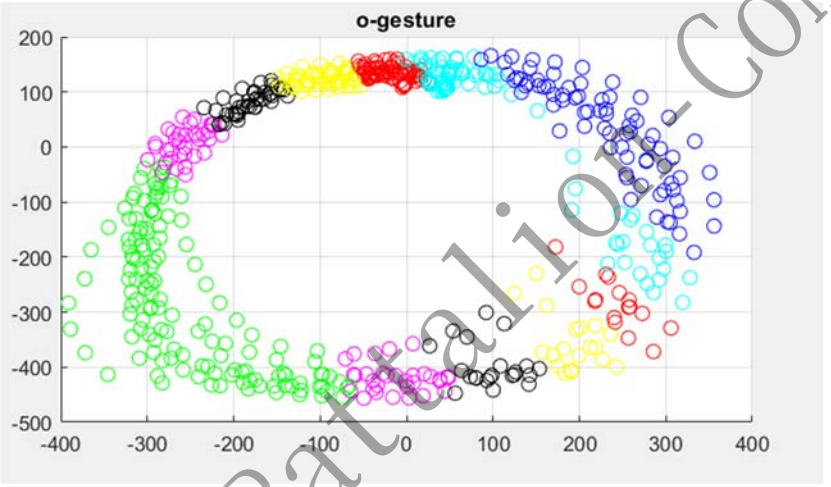


(b) Non-Uniform Binary Split:

gesture l:



gesture o:



gesture x: