Machine Learning in Robotics

Assignment 1

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Matriculation Number :

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Exercise 1

a – b). when k=2,

call the function: `par_2 = Exercise1(2);`

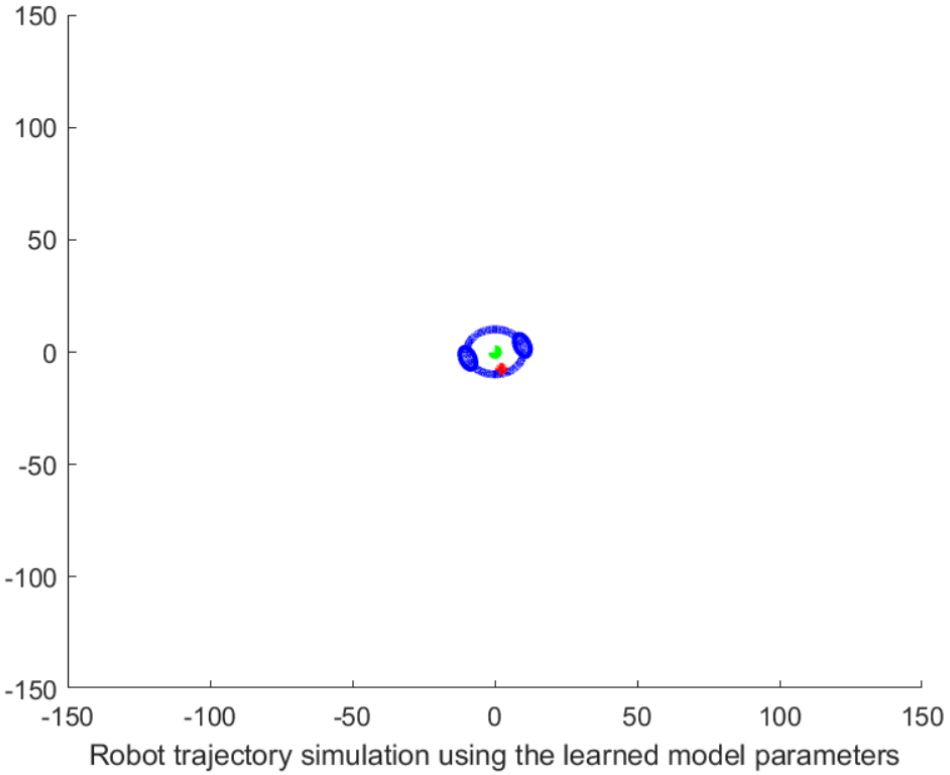
p1=5, p2=3

	par_2{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

	par_2{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-...
11	-5.2889e-...
12	0.0043
13	-4.4187e-...
14	-2.6911e-...
15	-0.0038
16	2.1016e-06

	par_2{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

with the learned parameter, plot (v, w) for (0, 0.05), (1, 0), (1, 0.05), (-1, -0.05)


150
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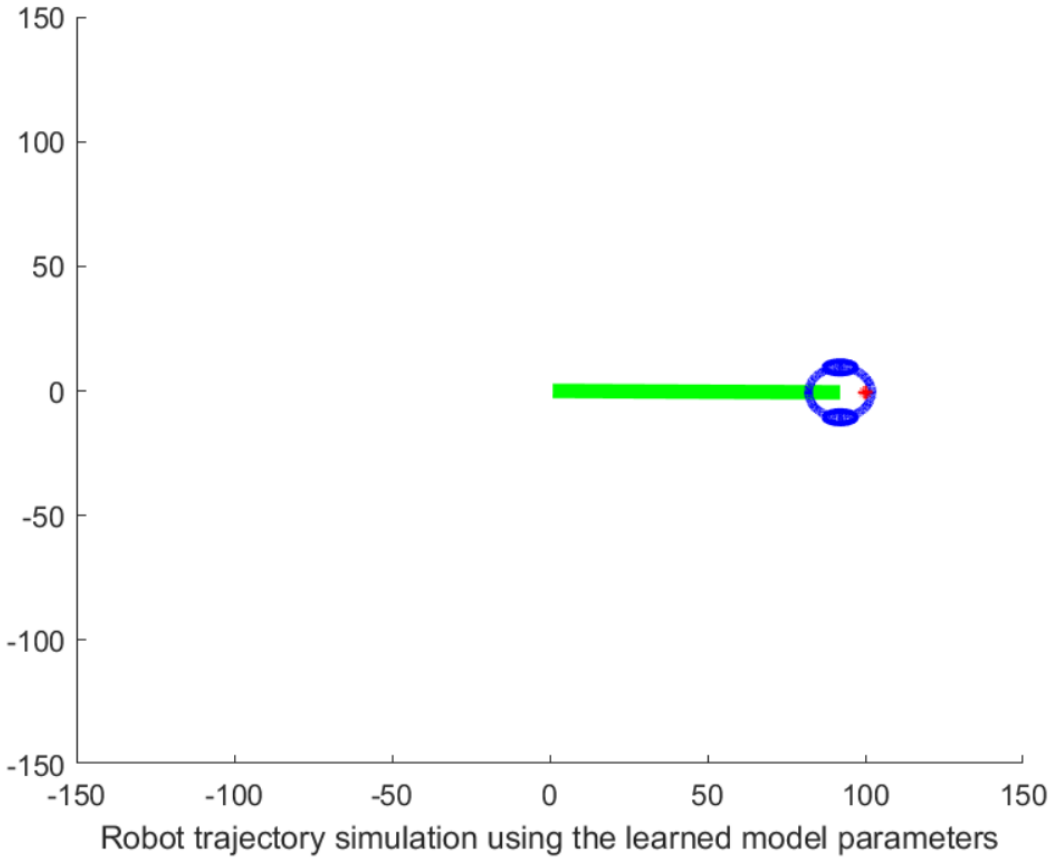
-150
-150
-100
-50
0
50
100
150
Robot trajectory simulation using the learned model parameters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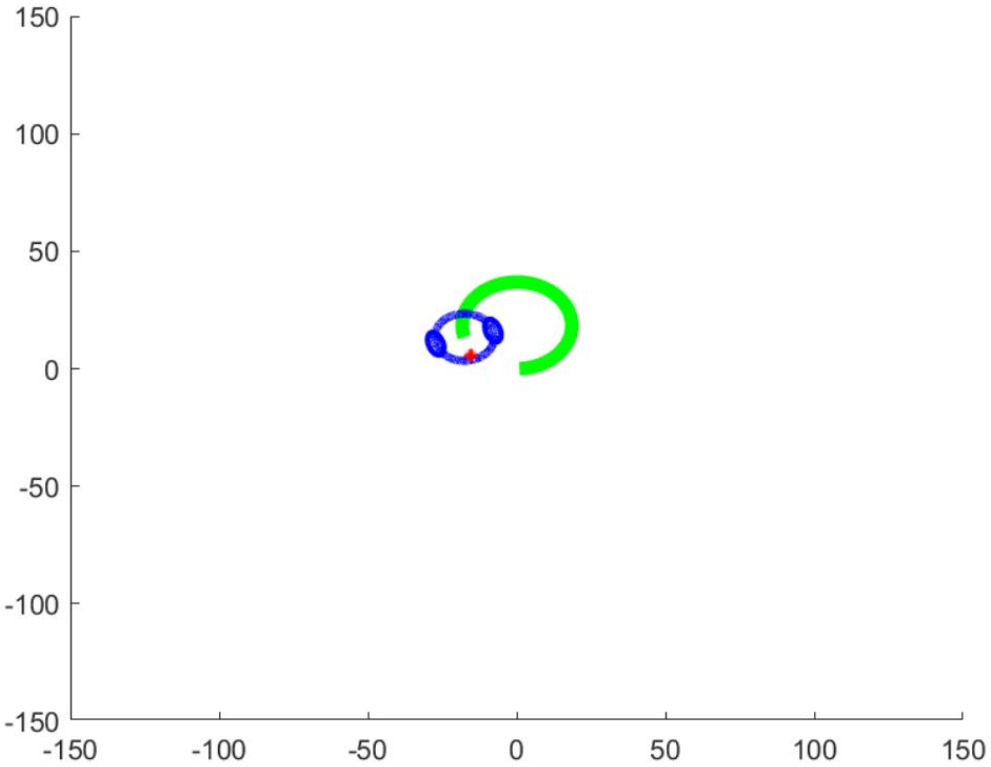
-100
-50
0
50
100
150
Robot trajectory simulation using the learned model parameters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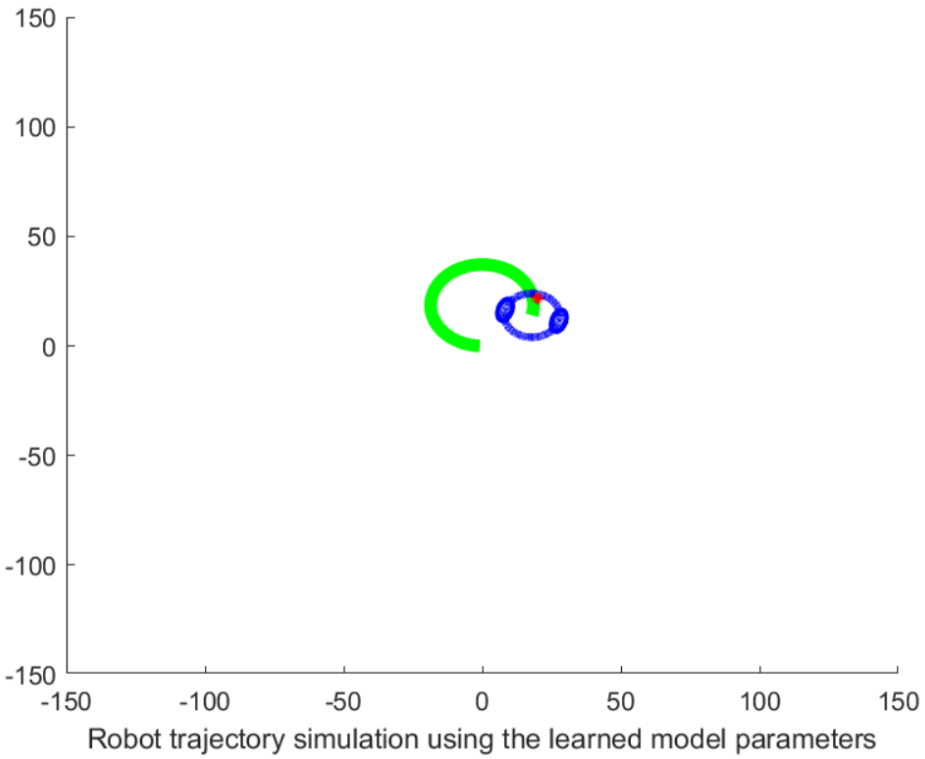
-100
-50
0
50
100
150
Robot trajectory simulation using the learned model parameters


150
100
50
0
-50
-100
-150
-150
-100
-50
0
50
100
150
Robot trajectory simulation using the learned model parameters

when k=5,

call the function: `par_5 = Exercise1(5);`

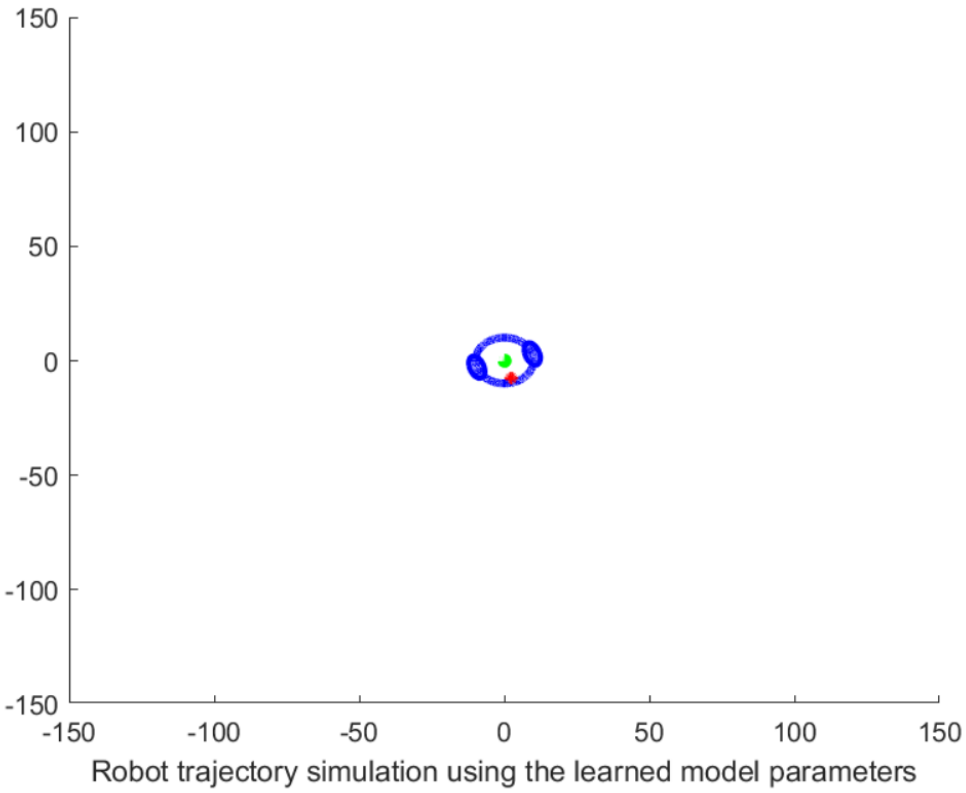
p1=4, p2=1

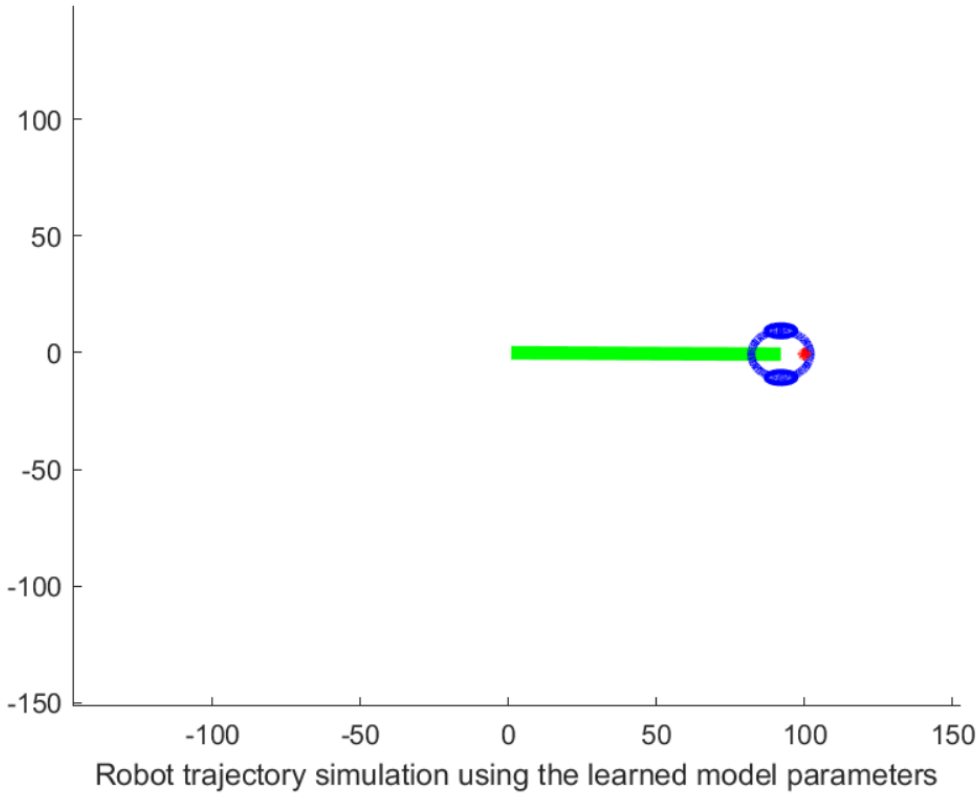
	par_5{1, 1}
	1
1	0.0025
2	0.9198
3	-0.0029
4	-7.4385e-04
5	-0.0010
6	0.0014
7	0.0025
8	1.3601e-04
9	-2.6908e-04
10	6.6926e-05
11	1.3061e-05
12	-0.0043
13	-4.5174e-05

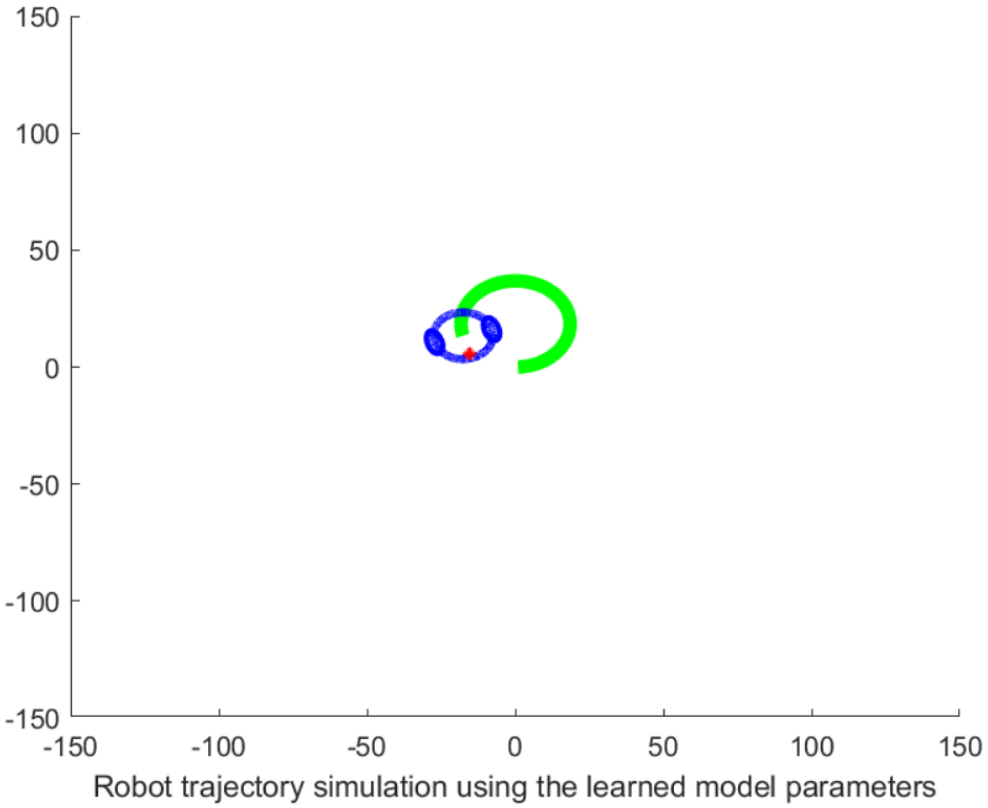
	par_5{1, 2}
	1
1	-0.0043
2	-0.0010
3	0.0014
4	0.4680
5	5.6850e-04
6	-0.0025
7	-0.0010
8	1.9246e-05
9	-0.0017
10	-6.7254e-04
11	-7.8462e-06
12	0.0035
13	8.7155e-06

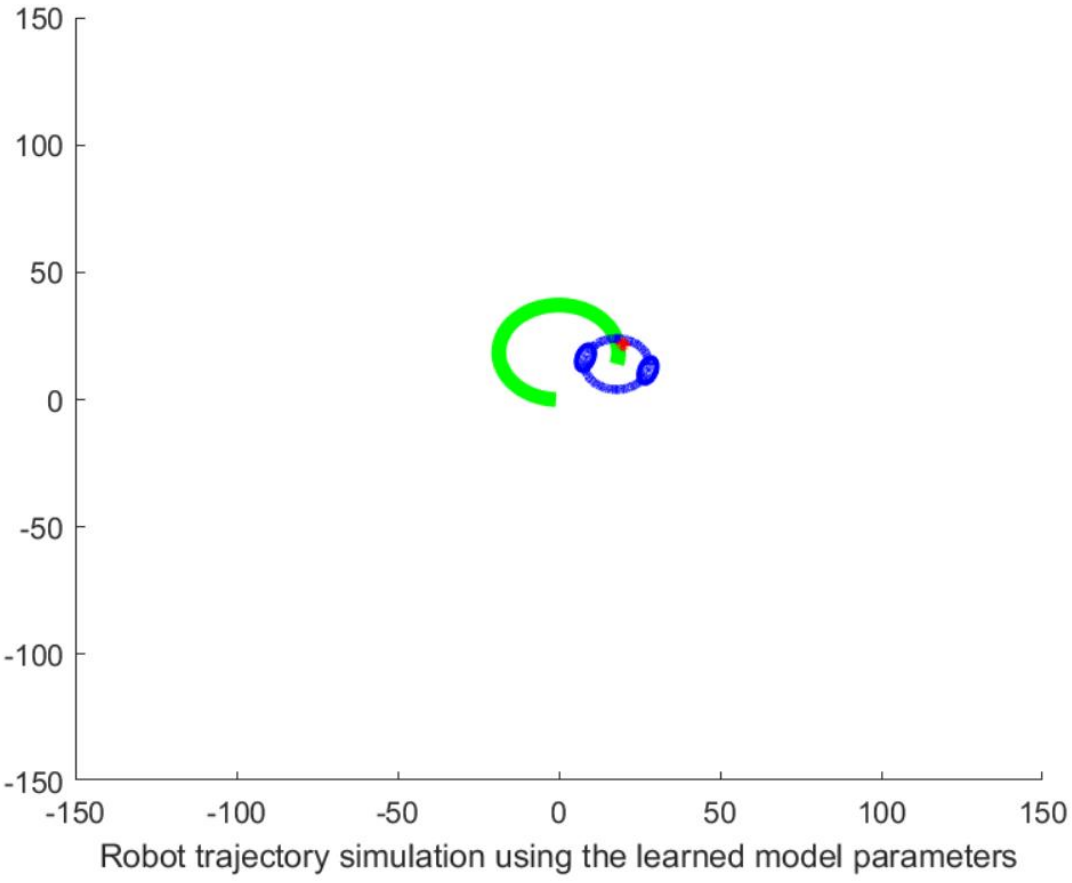
	par_5{1, 3}
	1
1	8.0784e-04
2	-3.1902e-04
3	0.9987
4	3.2142e-04

with the learned parameter, plot (v, w) for (0, 0.05), (1, 0), (1, 0.05), (-1, -0.05)


150
100
50
0
-50
-100
-150
-150
-100
-50
0
50
100
150
Robot trajectory simulation using the learned model parameters


100
50
0
-50
-100
-150
-100
-50
0
50
100
150
Robot trajectory simulation using the learned model parameters


150
100
50
0
-50
-100
-150
-150
-100
-50
0
50
100
150
Robot trajectory simulation using the learned model parameters


150
100
50
0
-50
-100
-150
-150
-100
-50
0
50
100
150
Robot trajectory simulation using the learned model parameters

Exercise 2

call the function: `[d_best, error_best, confMat] = Exercise2(60)`

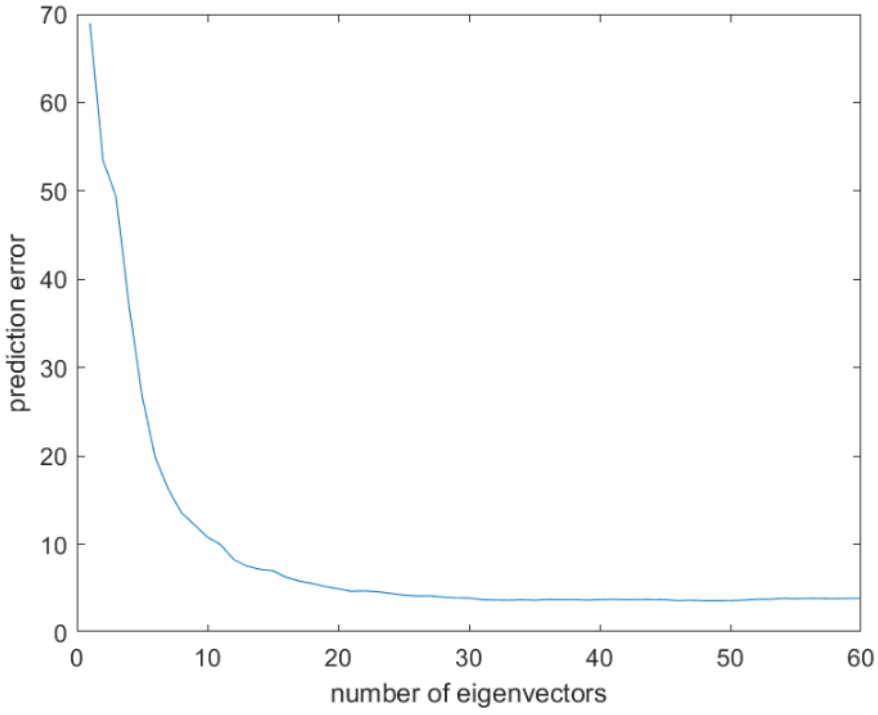
optimal parameter: d=48

classification error: 3.62%

confusion matrix:

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 when varying d from one to sixty:

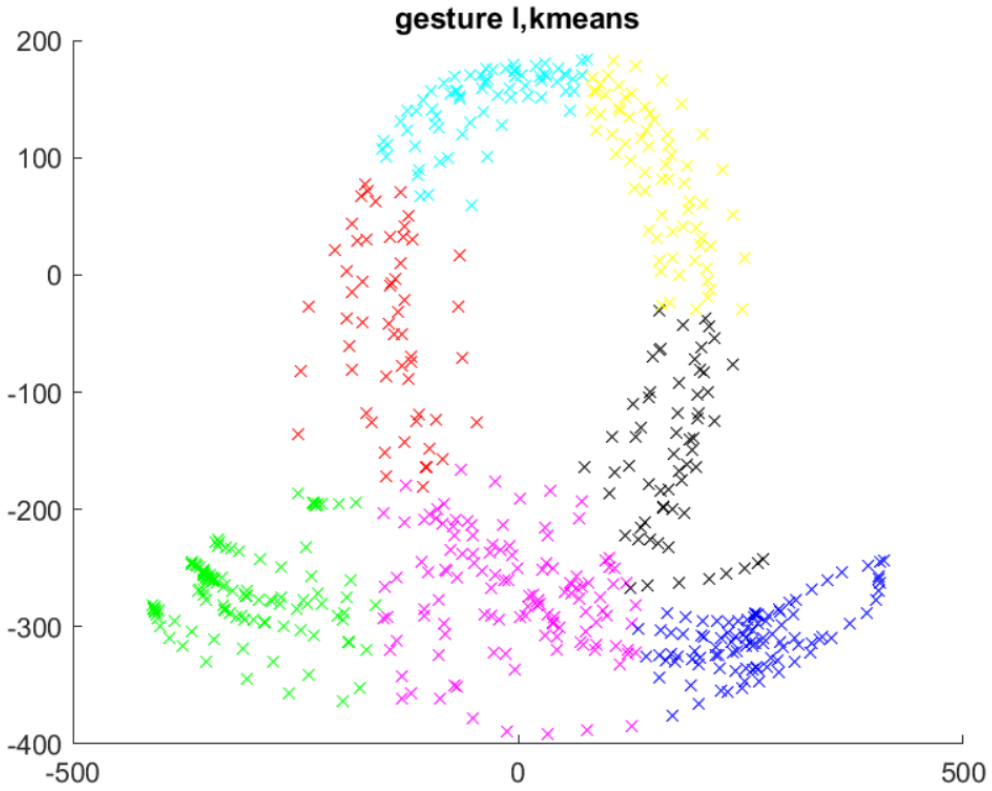


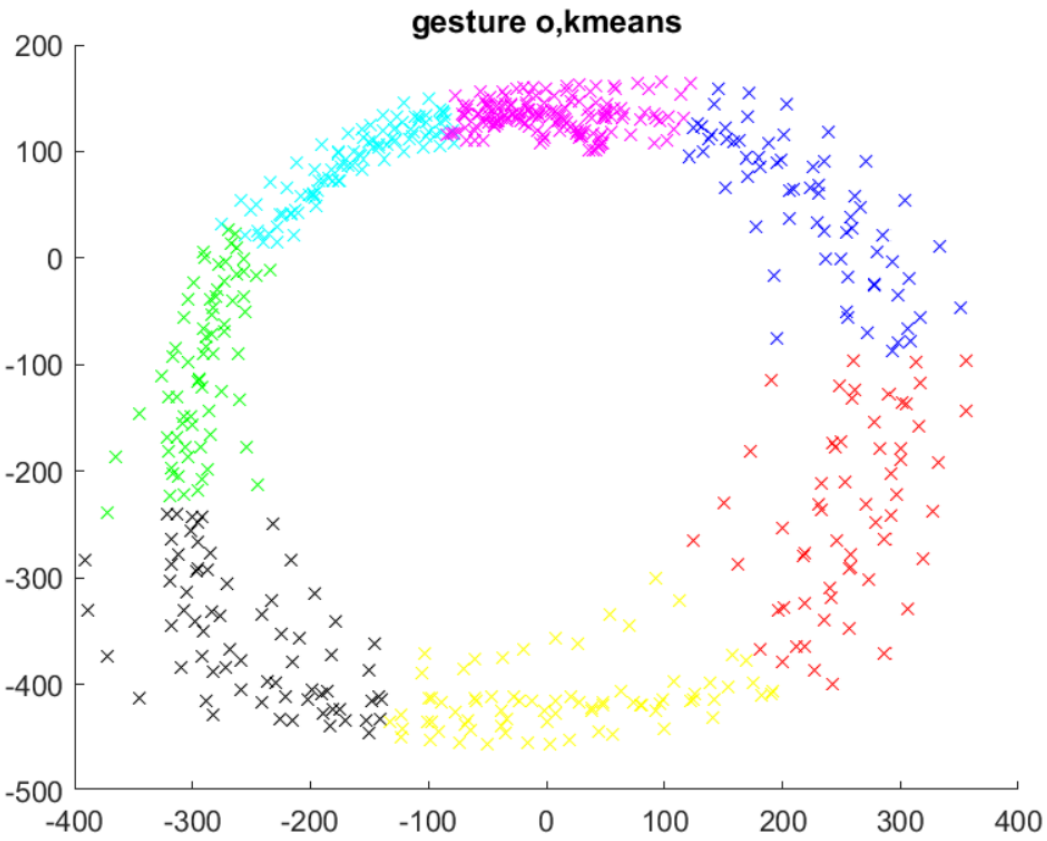
Exercise 3

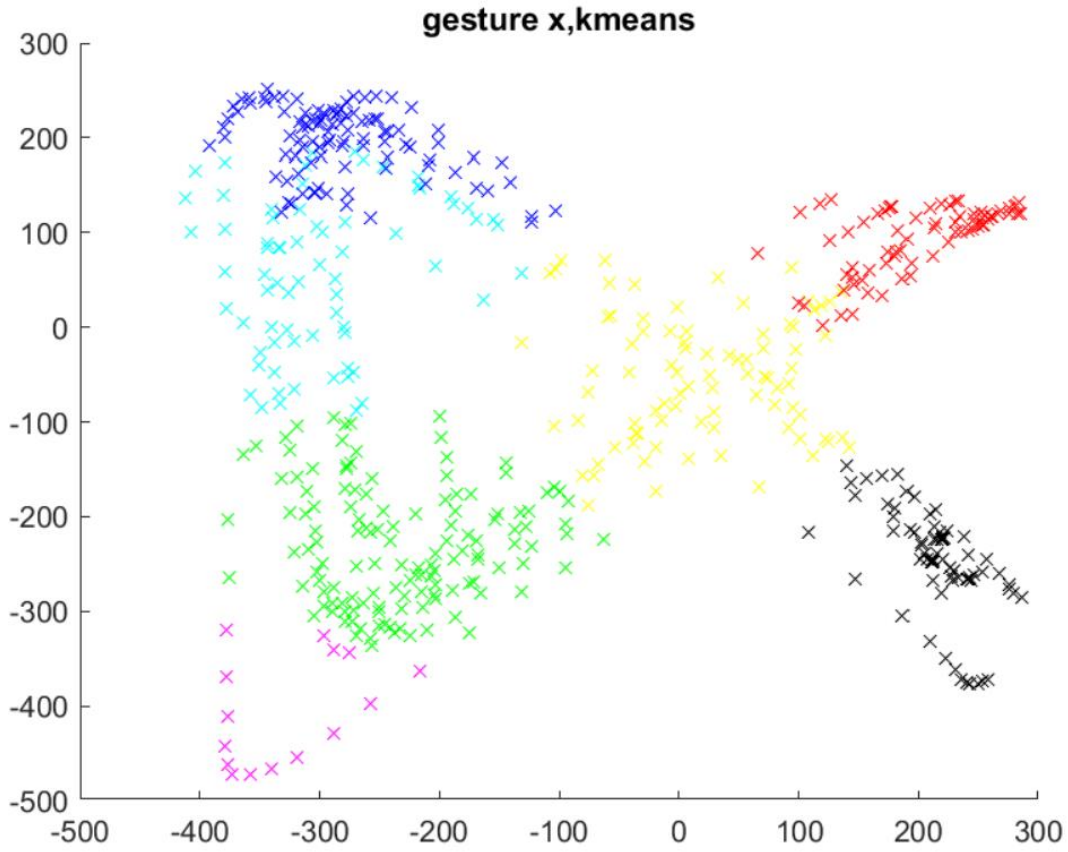
KMeans Split:

call the function:

```
Exercise3_kmeans(gesture_l,gesture_o,gesture_x,init_cluster_l,init_cluster_o,init_cluster_x,7)
```



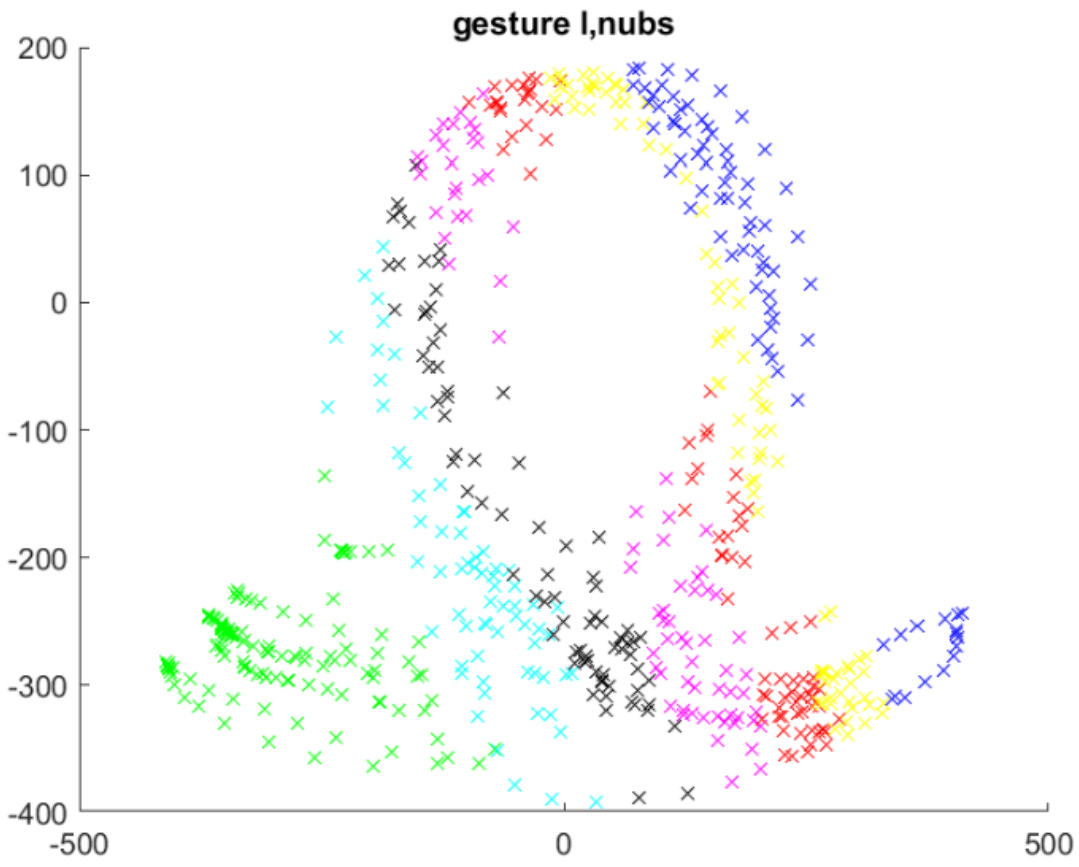

gesture o,kmeans
200
100
0
-100
-200
-300
-400
-500
-400
-300
-200
-100
0
100
200
300
400

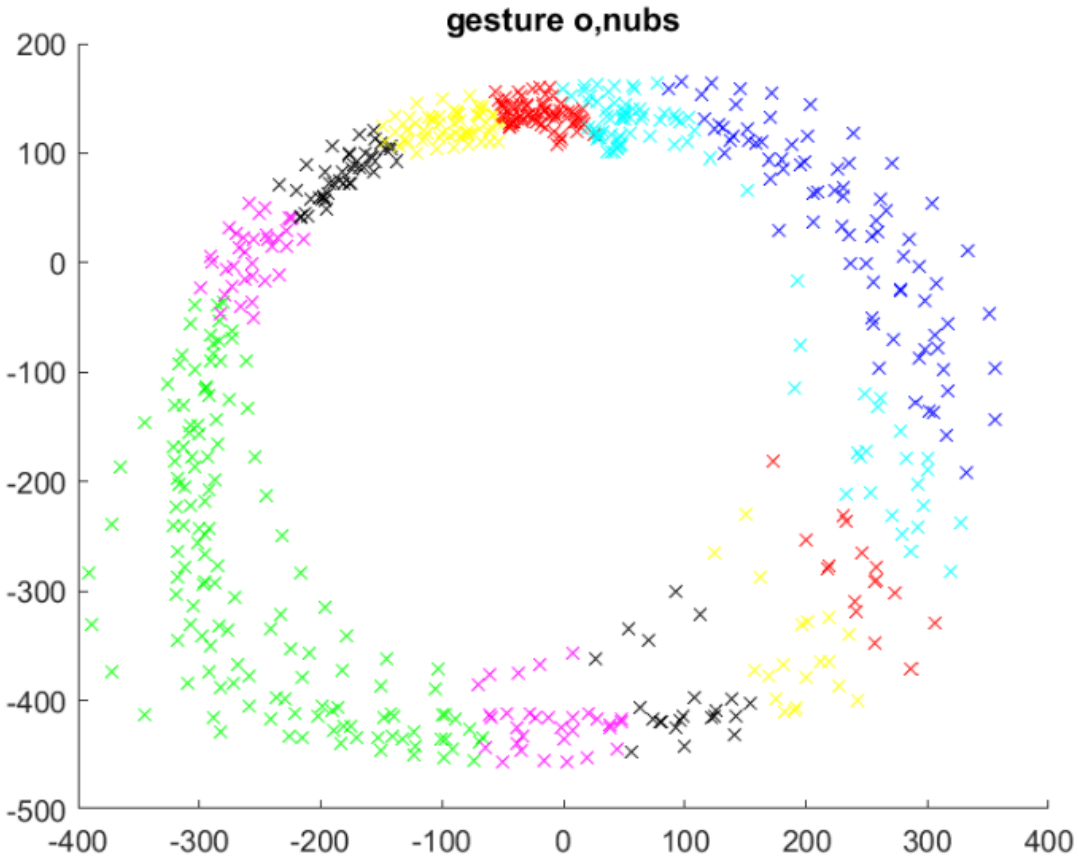

gesture x,kmeans
300
200
100
0
-100
-200
-300
-400
-500
-500
-400
-300
-200
-100
0
100
200
300

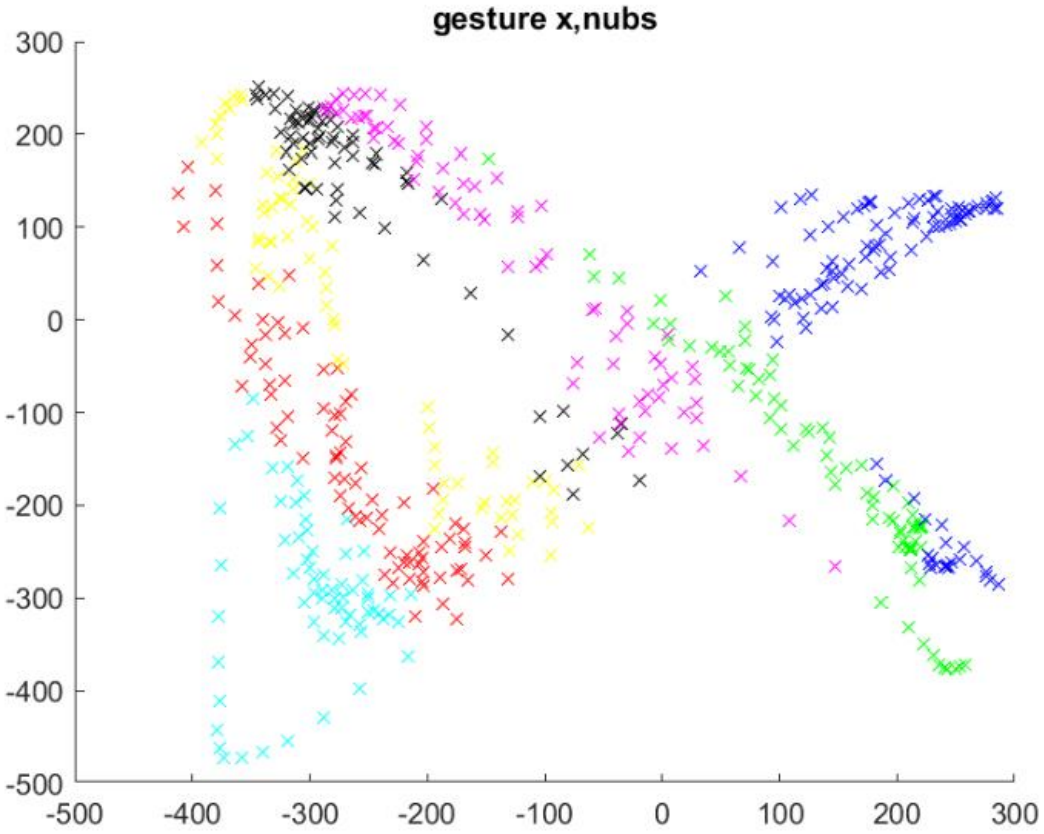
Non-Uniform Split:

call the function:

```
Exercise3_nubs(gesture_l,gesture_o,gesture_x,7)
```

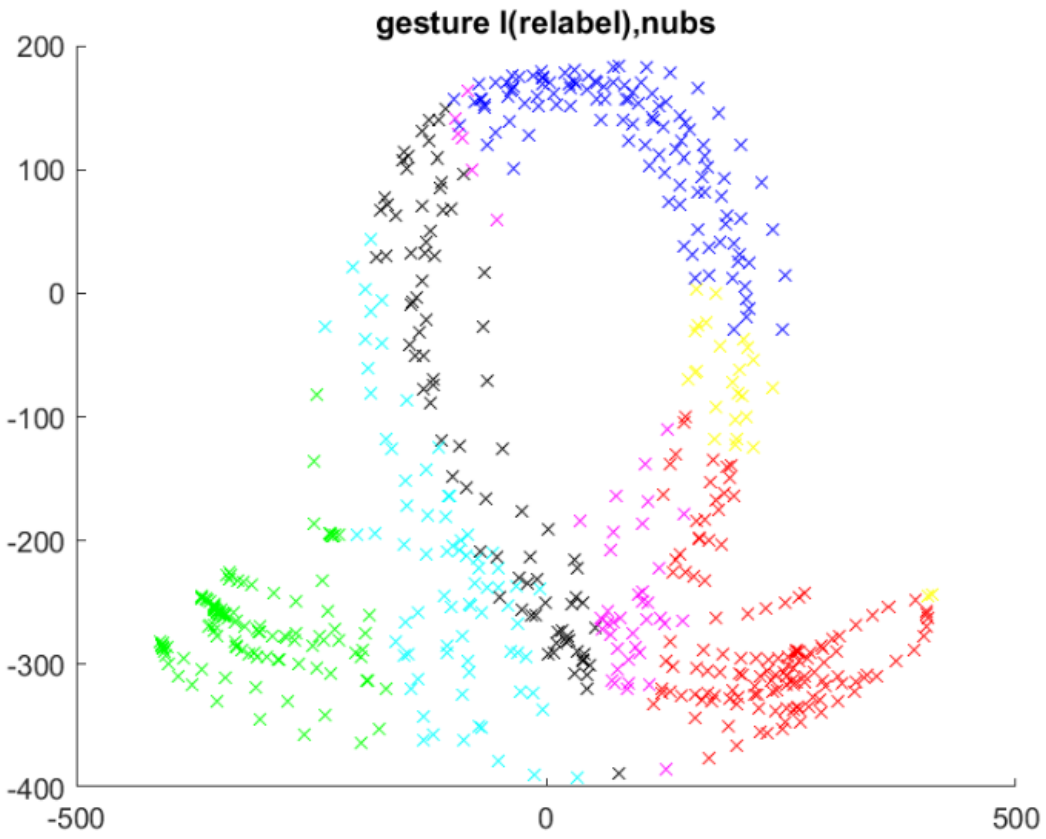


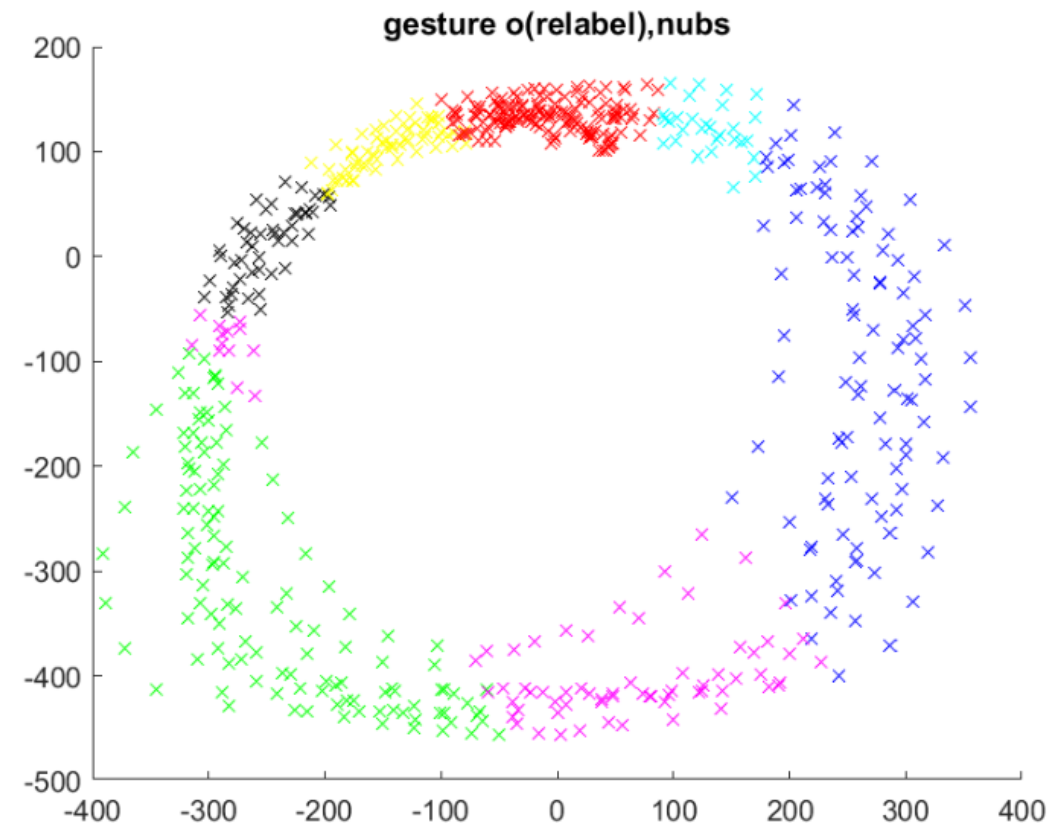

gesture o,nubs
200
100
0
-100
-200
-300
-400
-500
-400
-300
-200
-100
0
100
200
300
400

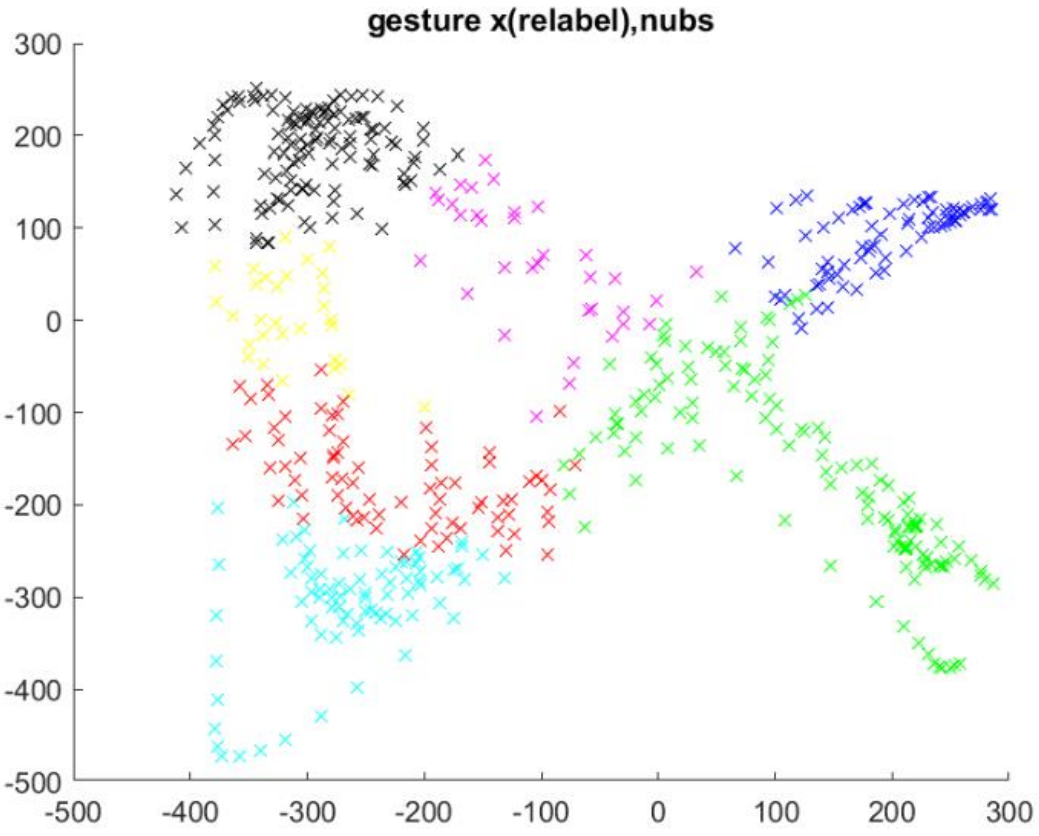

gesture x,nubs
300
200
100
0
-100
-200
-300
-400
-500
-500
-400
-300
-200
-100
0
100
200
300

if we relabel the cluster based on the updated cluster center,

the plots are shown as followings:




gesture o(relabel),nubs
200
100
0
-100
-200
-300
-400
-500
-400
-300
-200
-100
0
100
200
300
400


gesture x(relabel),nubs
300
200
100
0
-100
-200
-300
-400
-500
-500
-400
-300
-200
-100
0
100
200
300