Assignment 1

Neeraj Sujan

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1 Exercise 1: Estimating velocity motion model of a mobile robot through linear regression

For k = 2, the optimal value of p1 was found to be 5 and the optimal value of p2 was found to be 2. For p1 = 5, the position error was found to be 0.1434 and for p2 = 2, the orientation error was found to be 0.0797. The following table shows the learned parameter values for k = 2.

-0.00341205072435176	-0.00133081997336782	-0.000844039053530441
0.921910609114964	-0.00202044659543627	-0.000152231840067979
-0.0112461385434997	0.0123658366752259	0.998247559336335
0.00866265210182128	0.470304303511855	0.000476390734696437
0.00143767001127300	7.96007338401155e-05	7.36409458436011e-05
0.000851396977402266	-0.00350121788513899	0.000465591975077999
-0.00182045601448650	0.000430739294202944	-0.000167377054282329
0.000116841739139900	0.000152990315132594	-9.91332649659856e-06
0.00686594075778088	-0.0154244912812969	0.00184266214410609
-0.000461567813010646	-0.000890497572300254	-2.12626507562885e-05
-1.21889869811914e-05	4.86331370040559e-07	-5.78375168434074e-07
-3.46454878880630e-05	0.000776942395076633	-0.000127559266531869
5.17648533745966e-06	-2.47077405238831e-06	6.83324176909940e-07
-2.05539397734701e-06	-1.43322678994901e-06	2.25952360862750e-07
-5.52145281914207e-05	0.00340027739012660	-5.90484615216999e-05
2.67851937563671e-06	1.85206496855959e-06	1.08598721262674e-07

For k = 5, i.e for the cross-validation value = 5, the optimal value for both p1 and p2 was found to be 3.For degree = 3, the position error was found to be 0.5977 and the orientation error was found to be 0.1328. The following table shows the learned parameter values for k = 5.

-2.6885e-05	-0.00251635712590028	-0.000497668519468949
0.9246	-0.000203922744497637	-0.000378546162795476
-0.0102	0.000459072138408382	0.998483272841569
-0.0038	0.461710084782774	-3.45726636996875e-05
0.000598031863450565	0.000198031110593278	1.43804070823976e-05
-0.00308330702699513	0.000253430529342283	-0.000424749989324638
-0.000895627424940756	0.000104046224663156	-5.17484684060965e-05
-7.85580232190116e-05	1.83720421108904e-05	8.15812876523229e-06
0.00570385680350250	0.000889715463665208	0.00151486618787380
0.000136739706572568	-0.000478724496669857	3.07386283781256e-06

Looking at the error rates for both k=2 and k=5, we can conclude that the optimal value for k = 2.

Figure 1: Robot Simulation for coordinates (0,0.05).

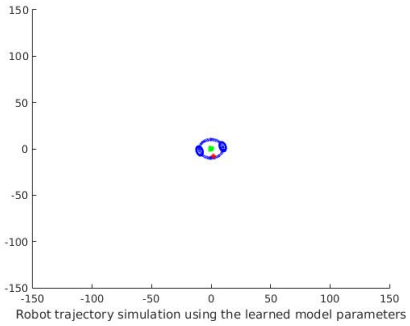


Figure 2: Robot Simulation for coordinates (1,0).

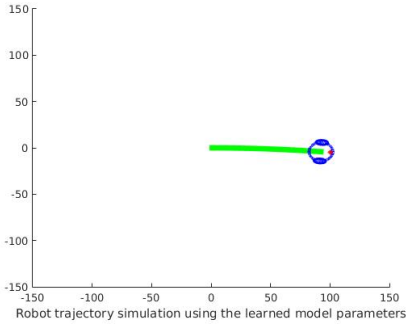


Figure 3: Robot Simulation for coordinates (1,0.05).

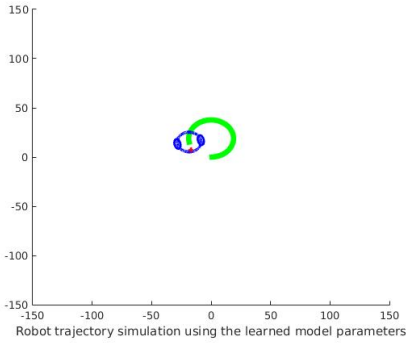
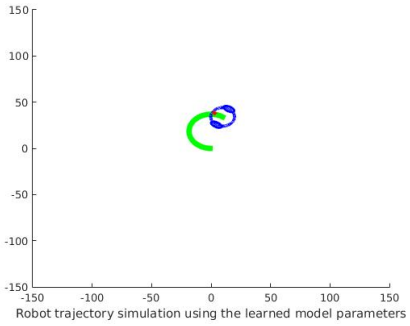


Figure 4: Robot Simulation for coordinates (-1,-0.05).



2 Exercise 2: Skin color detection using Baysian classifier.

The learned parameters are as follows

Sigma =

1.0e+03 * 1.7053	1.0e+03 * 1.4146	1.0e+03 * 1.4306
1.0e+03 * 1.4146	1.0e+03 * 1.4120	1.0e+03 * 1.4345
1.0e+03 * 1.4306	1.0e+03 * 1.4345	1.0e+03 * 1.5777

mu	mub
177.0057	103.3452
129.3040	98.9641
104.0630	87.1063

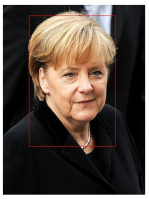
sigmab =

1.0e+03 * 5.5337	1.0e+03 * 4.7411	1.0e+03 * 4.2909
1.0e+03 * 4.7411	1.0e+03 * 4.7901	1.0e+03 * 4.5141
1.0e+03 * 4.2909	1.0e+03 * 4.5141	1.0e+03 * 5.0289

(a) $p(x \mid skinmodel)$

(b) p(x| background model)

(c) Binary Image

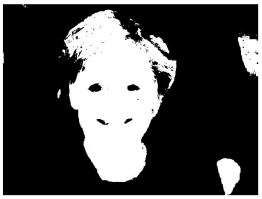


(d) Face Recognition

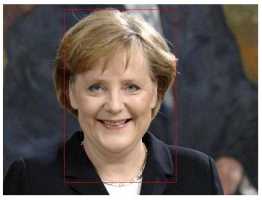
Figure 5: Sample Image 1

(a) $p(x \mid skinmodel)$

(b) p(x| background model)



(c) Binary Image

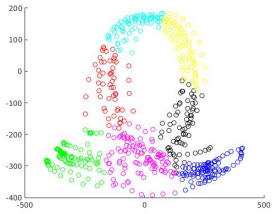


(d) Face Recognition

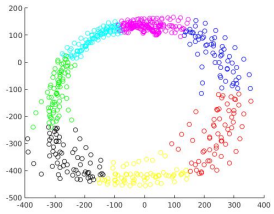
Figure 6: Sample Image 2

3 K means Algorithm.

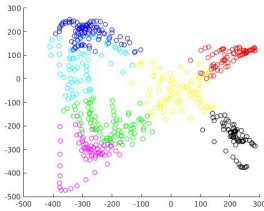
Analysis of K-Means and Non-Uniform Binary Split Algorithm: The K-means algorithm was observed to be slower than the Non-Uniform Binary Split Algorithm but the clustering works better in the case of K-Means algorithm.



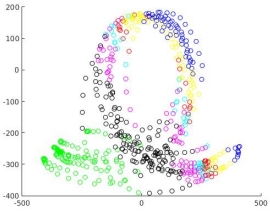
(a) letter l using k means



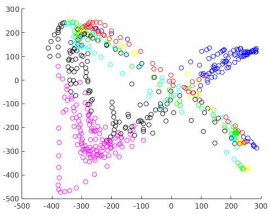
(b) letter o using k means



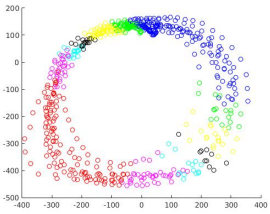
(c) letter x using k means



(d) letter l using nubs



(e) letter x using nubs



(f) letter o using nubs

Figure 7: K-means and NUBS