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CS6923 Homework Assignment 4*

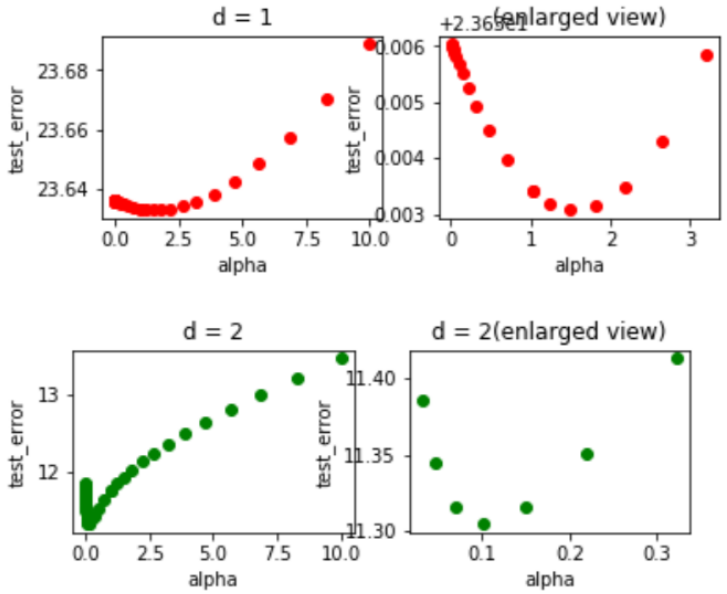
(1) The following examples were estimated MSE for d=1 and d=2:

	alpha	MSE_test	MSE_train	degree
0	0.000000	23.636069	21.806184	1
1	1.023293	23.633413	21.807512	1
2	1.237371	23.633196	21.808105	1
3	1.496236	23.633077	21.808958	1
4	1.809256	23.633137	21.810179	1
5	2.187762	23.633492	21.811920	1
6	2.645453	23.634312	21.814392	1
7	3.198895	23.635837	21.817882	1
8	3.868121	23.638400	21.822778	1
9	4.677351	23.642454	21.829599	1
10	5.655878	23.648603	21.839024	1
11	6.839116	23.657632	21.851931	1
12	8.269895	23.670544	21.869429	1
13	10.000000	23.688583	21.892901	1
14	0.000100	23.636068	21.806184	1
15	0.000147	23.636068	21.806184	1
16	0.000216	23.636068	21.806184	1
17	0.000317	23.636067	21.806184	1
18	0.000466	23.636067	21.806184	1
19	0.000685	23.636066	21.806184	1
20	0.001006	23.636065	21.806184	1
21	0.001478	23.636063	21.806184	1
22	0.002171	23.636060	21.806184	1
23	0.003190	23.636056	21.806184	1
24	0.004686	23.636050	21.806184	1
25	0.006885	23.636041	21.806184	1
26	0.010116	23.636028	21.806184	1
27	0.014862	23.636010	21.806184	1
28	0.021836	23.635982	21.806184	1
29	0.032081	23.635942	21.806185	1
30	0.047134	23.635884	21.806187	1
31	0.069250	23.635799	21.806190	1
32	0.101742	23.635678	21.806197	1
33	0.149480	23.635504	21.806213	1
34	0.219617	23.635261	21.806247	1
35	0.322664	23.634929	21.806320	1
36	0.474060	23.634493	21.806477	1
37	0.696493	23.633963	21.806809	1
38	1.023293	23.633413	21.807512	1

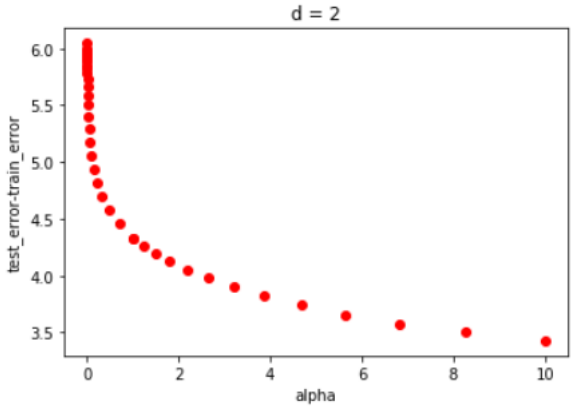
	alpha	MSE_test	MSE_train	degree
0	0.000000	11.854968	5.808821	2
1	1.023293	11.757217	7.429053	2
2	1.237371	11.837287	7.574286	2
3	1.496236	11.924501	7.728998	2
4	1.809256	12.019239	7.893864	2
5	2.187762	12.122080	8.069629	2
6	2.645453	12.233937	8.257179	2
7	3.198895	12.356226	8.457641	2
8	3.868121	12.491022	8.672500	2
9	4.677351	12.641170	8.903711	2
10	5.655878	12.810296	9.153772	2
11	6.839116	13.002701	9.425708	2
12	8.269895	13.223089	9.722948	2
13	10.000000	13.476138	10.049056	2
14	0.000100	11.807933	5.810779	2
15	0.000147	11.798512	5.811494	2
16	0.000216	11.788001	5.812315	2
17	0.000317	11.776059	5.813278	2
18	0.000466	11.762324	5.814475	2
19	0.000685	11.746473	5.816060	2
20	0.001006	11.728165	5.818225	2
21	0.001478	11.706887	5.821194	2
22	0.002171	11.681866	5.825274	2
23	0.003190	11.652206	5.830975	2
24	0.004686	11.617241	5.839182	2
25	0.006885	11.576881	5.851280	2
26	0.010116	11.531745	5.869158	2
27	0.014862	11.483163	5.895107	2
28	0.021836	11.433316	5.931718	2
29	0.032081	11.385574	5.981843	2
30	0.047134	11.344586	6.048568	2
31	0.069250	11.315782	6.134987	2
32	0.101742	11.304489	6.243750	2
33	0.149480	11.315153	6.376584	2
34	0.219617	11.350807	6.534194	2
35	0.322664	11.412827	6.716811	2
36	0.474060	11.501262	6.925172	2
37	0.696493	11.615883	7.161365	2
38	1.023293	11.757217	7.429053	2

(2) I would like to choose the ridge regression model, because the MSE is lower. And we choose λ=1.02. Using this model, the predicted price of the house is 25.6275060577533

(3) As the value of α increases, the value of test error decreases first and then increases. It is shown in the figure below:



From the picture below, we can find that the smaller the value of alpha, the greater the difference between MSE of test set and MSE of training set.



So in order to find the appropriate value of hyperparameter λ and avoid overfitting, we should make the difference between MSE of test set and MSE of training set the smallest at the same time when the values of MSE of test set and MSE of training set are both small.