

Question - 4

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1) Lasso

Lasso optimizes the sum of the absolute value of the weight vector, which causes some weights to have value = 0. Value = 0 means that we do not include features corresponding to those weights. This effectively means that lasso tends to prefer some features over others (when features are correlated).

The accuracies I got for different values of alpha are:

alpha: 1e-09 accuracy: 0.730769230769
alpha: 1e-08 accuracy: 0.730769230769
alpha: 1e-07 accuracy: 0.730769230769
alpha: 1e-06 accuracy: 0.725961538462
alpha: 1e-05 accuracy: 0.716346153846
alpha: 0.0001 accuracy: 0.716346153846
alpha: 0.001 accuracy: 0.701923076923
alpha: 0.01 accuracy: 0.701923076923
alpha: 0.1 accuracy: 0.677884615385
alpha: 1.0 accuracy: 0.639423076923
alpha: 10.0 accuracy: 0.639423076923

The value of alpha I finally chose is:

1e-07

2) Ridge

Ridge Regularization, on the other hand gives preference to weight vectors with smaller norms, and does not force them to be set to 0.

All possible vectors of some L2-norm, say $1/2$, form a unit hypersphere. Putting an L2-norm of parameters in the objective function constraints the optimised theta to a specific limited length.

The accuracies I got for different values of alpha are:

alpha: 1e-09 accuracy: 0.730769230769
alpha: 1e-08 accuracy: 0.730769230769
alpha: 1e-07 accuracy: 0.730769230769
alpha: 1e-06 accuracy: 0.730769230769
alpha: 1e-05 accuracy: 0.725961538462
alpha: 0.0001 accuracy: 0.721153846154
alpha: 0.001 accuracy: 0.716346153846
alpha: 0.01 accuracy: 0.716346153846
alpha: 0.1 accuracy: 0.716346153846

alpha: 1.0 accuracy: 0.701923076923
alpha: 10.0 accuracy: 0.706730769231

The value of alpha I finally chose is:
1e-06

3) ElasticNet

ElasticNet linearly combines l1 norm(Lasso) and l2 norm(Ridge). In doing so, it tries to work upon the limitations of l1 and l2 as each offers something that the other method lacks.

The accuracies I got for different alphas and l1 to l2 ratio are:

alpha: 1e-09	l1_ratio: 0.1	accuracy: 0.730769230769
alpha: 1e-09	l1_ratio: 0.2	accuracy: 0.730769230769
alpha: 1e-09	l1_ratio: 0.3	accuracy: 0.730769230769
alpha: 1e-09	l1_ratio: 0.4	accuracy: 0.730769230769
alpha: 1e-09	l1_ratio: 0.5	accuracy: 0.730769230769
alpha: 1e-09	l1_ratio: 0.6	accuracy: 0.730769230769
alpha: 1e-09	l1_ratio: 0.7	accuracy: 0.730769230769
alpha: 1e-09	l1_ratio: 0.8	accuracy: 0.730769230769
alpha: 1e-09	l1_ratio: 0.9	accuracy: 0.730769230769
alpha: 1e-09	l1_ratio: 1.0	accuracy: 0.730769230769
alpha: 1e-08	l1_ratio: 0.1	accuracy: 0.725961538462
alpha: 1e-08	l1_ratio: 0.2	accuracy: 0.725961538462
alpha: 1e-08	l1_ratio: 0.3	accuracy: 0.725961538462
alpha: 1e-08	l1_ratio: 0.4	accuracy: 0.725961538462
alpha: 1e-08	l1_ratio: 0.5	accuracy: 0.730769230769
alpha: 1e-08	l1_ratio: 0.6	accuracy: 0.730769230769
alpha: 1e-08	l1_ratio: 0.7	accuracy: 0.730769230769
alpha: 1e-08	l1_ratio: 0.8	accuracy: 0.730769230769
alpha: 1e-08	l1_ratio: 0.9	accuracy: 0.730769230769
alpha: 1e-08	l1_ratio: 1.0	accuracy: 0.730769230769
alpha: 1e-07	l1_ratio: 0.1	accuracy: 0.725961538462
alpha: 1e-07	l1_ratio: 0.2	accuracy: 0.725961538462
alpha: 1e-07	l1_ratio: 0.3	accuracy: 0.725961538462
alpha: 1e-07	l1_ratio: 0.4	accuracy: 0.725961538462
alpha: 1e-07	l1_ratio: 0.5	accuracy: 0.725961538462
alpha: 1e-07	l1_ratio: 0.6	accuracy: 0.725961538462
alpha: 1e-07	l1_ratio: 0.7	accuracy: 0.725961538462
alpha: 1e-07	l1_ratio: 0.8	accuracy: 0.725961538462
alpha: 1e-07	l1_ratio: 0.9	accuracy: 0.725961538462
alpha: 1e-07	l1_ratio: 1.0	accuracy: 0.730769230769
alpha: 1e-06	l1_ratio: 0.1	accuracy: 0.711538461538

alpha: 1e-06 l1_ratio: 0.2 accuracy: 0.711538461538
alpha: 1e-06 l1_ratio: 0.3 accuracy: 0.711538461538
alpha: 1e-06 l1_ratio: 0.4 accuracy: 0.716346153846
alpha: 1e-06 l1_ratio: 0.5 accuracy: 0.716346153846
alpha: 1e-06 l1_ratio: 0.6 accuracy: 0.716346153846
alpha: 1e-06 l1_ratio: 0.7 accuracy: 0.716346153846
alpha: 1e-06 l1_ratio: 0.8 accuracy: 0.716346153846
alpha: 1e-06 l1_ratio: 0.9 accuracy: 0.725961538462
alpha: 1e-06 l1_ratio: 1.0 accuracy: 0.725961538462
alpha: 1e-05 l1_ratio: 0.1 accuracy: 0.716346153846
alpha: 1e-05 l1_ratio: 0.2 accuracy: 0.716346153846
alpha: 1e-05 l1_ratio: 0.3 accuracy: 0.716346153846
alpha: 1e-05 l1_ratio: 0.4 accuracy: 0.716346153846
alpha: 1e-05 l1_ratio: 0.5 accuracy: 0.716346153846
alpha: 1e-05 l1_ratio: 0.6 accuracy: 0.716346153846
alpha: 1e-05 l1_ratio: 0.7 accuracy: 0.716346153846
alpha: 1e-05 l1_ratio: 0.8 accuracy: 0.716346153846
alpha: 1e-05 l1_ratio: 0.9 accuracy: 0.716346153846
alpha: 1e-05 l1_ratio: 1.0 accuracy: 0.716346153846
alpha: 0.0001 l1_ratio: 0.1 accuracy: 0.716346153846
alpha: 0.0001 l1_ratio: 0.2 accuracy: 0.716346153846
alpha: 0.0001 l1_ratio: 0.3 accuracy: 0.716346153846
alpha: 0.0001 l1_ratio: 0.4 accuracy: 0.716346153846
alpha: 0.0001 l1_ratio: 0.5 accuracy: 0.716346153846
alpha: 0.0001 l1_ratio: 0.6 accuracy: 0.716346153846
alpha: 0.0001 l1_ratio: 0.7 accuracy: 0.716346153846
alpha: 0.0001 l1_ratio: 0.8 accuracy: 0.716346153846
alpha: 0.0001 l1_ratio: 0.9 accuracy: 0.716346153846
alpha: 0.0001 l1_ratio: 1.0 accuracy: 0.716346153846
alpha: 0.001 l1_ratio: 0.1 accuracy: 0.706730769231
alpha: 0.001 l1_ratio: 0.2 accuracy: 0.701923076923
alpha: 0.001 l1_ratio: 0.3 accuracy: 0.701923076923
alpha: 0.001 l1_ratio: 0.4 accuracy: 0.701923076923
alpha: 0.001 l1_ratio: 0.5 accuracy: 0.701923076923
alpha: 0.001 l1_ratio: 0.6 accuracy: 0.701923076923
alpha: 0.001 l1_ratio: 0.7 accuracy: 0.701923076923
alpha: 0.001 l1_ratio: 0.8 accuracy: 0.701923076923
alpha: 0.001 l1_ratio: 0.9 accuracy: 0.701923076923
alpha: 0.001 l1_ratio: 1.0 accuracy: 0.701923076923
alpha: 0.01 l1_ratio: 0.1 accuracy: 0.692307692308
alpha: 0.01 l1_ratio: 0.2 accuracy: 0.692307692308
alpha: 0.01 l1_ratio: 0.3 accuracy: 0.692307692308
alpha: 0.01 l1_ratio: 0.4 accuracy: 0.701923076923

alpha: 0.01 l1_ratio: 0.5 accuracy: 0.697115384615
alpha: 0.01 l1_ratio: 0.6 accuracy: 0.706730769231
alpha: 0.01 l1_ratio: 0.7 accuracy: 0.701923076923
alpha: 0.01 l1_ratio: 0.8 accuracy: 0.697115384615
alpha: 0.01 l1_ratio: 0.9 accuracy: 0.697115384615
alpha: 0.01 l1_ratio: 1.0 accuracy: 0.701923076923
alpha: 0.1 l1_ratio: 0.1 accuracy: 0.706730769231
alpha: 0.1 l1_ratio: 0.2 accuracy: 0.701923076923
alpha: 0.1 l1_ratio: 0.3 accuracy: 0.697115384615
alpha: 0.1 l1_ratio: 0.4 accuracy: 0.692307692308
alpha: 0.1 l1_ratio: 0.5 accuracy: 0.692307692308
alpha: 0.1 l1_ratio: 0.6 accuracy: 0.682692307692
alpha: 0.1 l1_ratio: 0.7 accuracy: 0.682692307692
alpha: 0.1 l1_ratio: 0.8 accuracy: 0.6875
alpha: 0.1 l1_ratio: 0.9 accuracy: 0.668269230769
alpha: 0.1 l1_ratio: 1.0 accuracy: 0.677884615385
alpha: 1.0 l1_ratio: 0.1 accuracy: 0.639423076923
alpha: 1.0 l1_ratio: 0.2 accuracy: 0.639423076923
alpha: 1.0 l1_ratio: 0.3 accuracy: 0.639423076923
alpha: 1.0 l1_ratio: 0.4 accuracy: 0.639423076923
alpha: 1.0 l1_ratio: 0.5 accuracy: 0.639423076923
alpha: 1.0 l1_ratio: 0.6 accuracy: 0.639423076923
alpha: 1.0 l1_ratio: 0.7 accuracy: 0.639423076923
alpha: 1.0 l1_ratio: 0.8 accuracy: 0.639423076923
alpha: 1.0 l1_ratio: 0.9 accuracy: 0.639423076923
alpha: 1.0 l1_ratio: 1.0 accuracy: 0.639423076923
alpha: 10.0 l1_ratio: 0.1 accuracy: 0.639423076923
alpha: 10.0 l1_ratio: 0.2 accuracy: 0.639423076923
alpha: 10.0 l1_ratio: 0.3 accuracy: 0.639423076923
alpha: 10.0 l1_ratio: 0.4 accuracy: 0.639423076923
alpha: 10.0 l1_ratio: 0.5 accuracy: 0.639423076923
alpha: 10.0 l1_ratio: 0.6 accuracy: 0.639423076923
alpha: 10.0 l1_ratio: 0.7 accuracy: 0.639423076923
alpha: 10.0 l1_ratio: 0.8 accuracy: 0.639423076923
alpha: 10.0 l1_ratio: 0.9 accuracy: 0.639423076923
alpha: 10.0 l1_ratio: 1.0 accuracy: 0.639423076923

The final value of alpha and l1:l2 ratio I'm using are:

Alpha : 1e-08, l1_ratio : 0.6

