Results

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Results

Newton-Raphson

After doing the Newton-Raphson modified with step and direction, the estimation of coefficients are:

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intercept	0.4870168
radius_mean	-7.2218505
texture_mean	1.6547562
perimeter_mean	-1.7376303
area_mean	14.0048456
smoothness_mean	1.0749533
compactness_mean	-0.0772346
concavity_mean	0.6751231
concave points_mean	2.5928743
symmetry_mean	0.4462563
fractal_dimension_mean	-0.4824842

Table 1. Estimated coefficients under Newton-Raphson method

Coordinate-Wise

From the New-Raphson results, the maximum coefficent is 14.So the range of λ we tried is (0.01,14) with length 100. The initial guess of all β including the intercept is 0.02. The Pearson-Chi square statistics(g.statistics) was introduced to compare the models. So in the 5-Fold Cross Validation. In each fold, the range of λ would be tried and selected one optimal λ with minimum G-statistics. Below is the results:

	Enter	Fold1	Fold2	Fold3	Fold4	Fold5
k	0	1	2	3	4	5
best_lambda	0	0.001	0.001	0.001	0.001	0.001
beta_vec1	0.02	-0.613524105797822	-0.633047391406877	-0.715895251324096	-0.666993384642204	-0.547212117903
beta_vec2	0.02	1.95513722283707	1.90784713089334	2.03371505606251	1.95781495846916	1.9765398969240
beta_vec3	0.02	0.745328663808087	0.82201274626507	0.796234927778929	0.722863788193366	0.7924235472107
beta_vec4	0.02	0.266421690390259	0.234351788371469	0.0772468377681766	0.279318553794357	0.1092735360011
beta_vec5	0.02	-0.00164236794008945	-0.00793463027955548	-0.0192878296915476	0	-0.005919472970
beta_vec6	0.02	0.718764850061118	0.697156614323523	0.661263007811562	0.649888500465765	0.8948914407125
beta_vec7	0.02	0.124132524412123	0.199180843134297	0.125338538728445	0.241673088647192	0.1232395531452
beta_vec8	0.02	0.271338994220987	0.264504538886279	0.321864177513411	0.330267723322934	0.2096763629245
beta_vec9	0.02	0.831838087422037	0.761352241281214	0.869795471850937	0.727460113326783	1.0099479901132
beta_vec10	0.02	0.104084906458982	0.123471469956635	0.09001860864094	0.125138668101311	0.1206826652207
beta_vec11	0.02	-0.151648965375399	-0.169153799341516	-0.158513513979993	-0.134176554805148	-0.125438067285?
g.stat_tr	Inf	136.612191549903	135.833647176775	117.551649109452	132.096976582581	115.55608420510
g.stat_te	Inf	23.1060167719698	23.5291444561847	45.0345806575656	34.1470100103225	46.073344066733

Table 2. Cross validatin results

In all 5 folds, the optimal λ is 0.001, with similar β_s in each fold. If we use the train function in the caret package, meaning the RMSE is the model selection criteria, the train function still produce the same optimal λ result as following Fig 2.
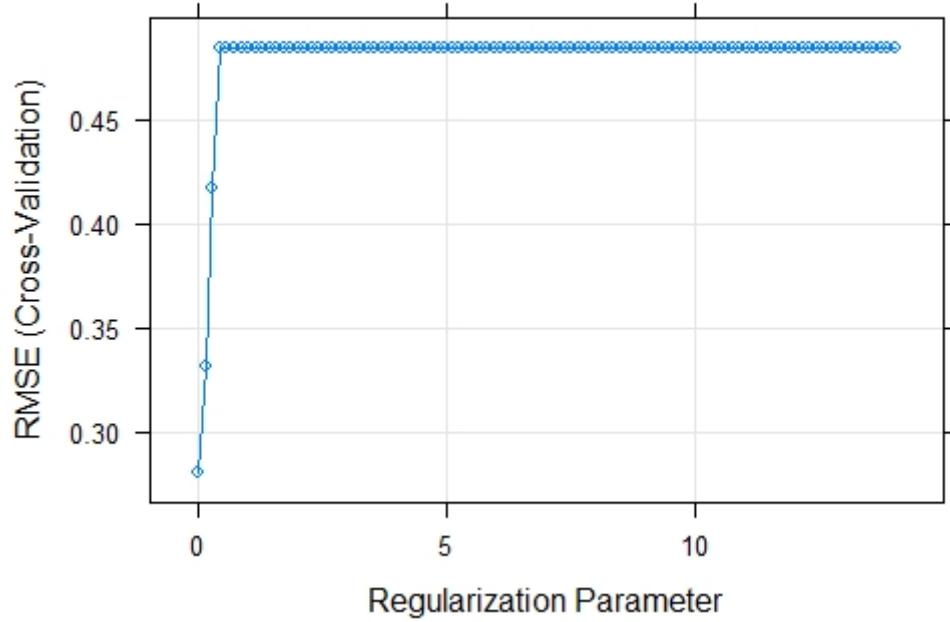

Fig 2. MSE vs λ

From Fig.2, we can tell that the MSE has an upward trend with the increase of λ. So when λ=0.001, it has smallest RMSE=0.2807 and MSE=0.0784. When the optimal λ=0.01 is applied on original predictors and response. the coefficients are as follow:

	.
(Intercept)	-1.5315370
texture_mean	0.0216265
perimeter_mean	0.0156391
area_mean	-0.0007061
smoothness_mean	2.3356763
compactness_mean	-1.2677496
concavity_mean	0.2262630
concave points_mean	6.1420082
symmetry_mean	1.0106152
fractal_dimension_mean	-1.3592103

Table 3. The coefficients of final model when λ is optimal

Surprisingly, none of coefficients are shrank into 0.But compared the coefficients in Newton-Raphson, the shrinkages on the predictor "radius_mean", "area_mean are large". But, unexpectedly, the coefficient of "concave point mean" inflated to 6.14