ASM Practice

Ridge Regression

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Choosing the penalization parameter λ

1. Ridge regression lambda search

2. Ridge regression lambda search with CV

3. Prostate data application

```
## With validtion data of size 30 instances.

##            lambda        mspe             df
## 1   0.000000e+00   30.85271      8.0000000
## 2   6.155988e-01   31.74485      8.1556782
## 3   1.610159e+00   33.75810      8.4503648
## 4   3.216970e+00   39.94625      9.1041596
## 5   5.812932e+00   92.07644     11.5728805
## 6   1.000696e+01  218.45411      5.4722570
## 7   1.678284e+01 1488.16276     -3.9362259
## 8   2.772993e+01  137.46559      7.1886637
## 9   4.541604e+01 8575.48332    -22.3484395
## 10  7.398970e+01  873.40934     -2.8527972
## 11  1.201533e+02  522.26269      5.7160073
## 12  1.947351e+02 5355.56020      7.4949773
## 13  3.152293e+02  299.89089     -1.6781236
## 14  5.098997e+02  146.63789      0.5163548
## 15  8.244090e+02  109.61785      1.2410336
## 16  1.332530e+03   95.43963      1.5876187
## 17  2.153449e+03   89.34899      1.7837212
## 18  3.479725e+03   87.32017      1.9129395
## 19  5.622455e+03   88.17139      2.0187489
## 20  9.084248e+03   91.97952      2.1353897
## 21  1.467711e+04   99.88126      2.3101448
## 22  2.371294e+04  114.61781      2.6587492
## 23  3.831122e+04  142.33388      3.7289198
## 24  6.189618e+04  272.75885   -139.6254974
## 25  1.000000e+05  324.66293     -0.3345440

## With 5-fold and 10-fold Cross Validation respectively.

##            lambda        mspe             df
## 1   0.000000e+00    5.298880     8.00000000
## 2   6.155988e-01    6.164083     8.17613865
## 3   1.610159e+00    8.267170     8.51658683
## 4   3.216970e+00   14.153435     9.32736205
## 5   5.812932e+00  555.560214    16.31913915
## 6   1.000696e+01  120.188026     7.87336873
## 7   1.678284e+01  242.568508     1.75701125
## 8   2.772993e+01   98.660176     8.47247868
```

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## 9  4.541604e+01    757.075282    0.49781090
## 10 7.398970e+01    241.542287    0.33361634
## 11 1.201533e+02    695.697639    7.69630249
## 12 1.947351e+02 38697.876140  -65.51108705
## 13 3.152293e+02    103.912100   -0.95463315
## 14 5.098997e+02     42.226237    0.71393725
## 15 8.244090e+02     26.077057    1.32968829
## 16 1.332530e+03     20.369253    1.63542632
## 17 2.153449e+03     18.007488    1.81367165
## 18 3.479725e+03     18.258546    1.93544150
## 19 5.622455e+03     19.900879    2.04078190
## 20 9.084248e+03     24.215337    2.16493400
## 21 1.467711e+04     31.969540    2.36178625
## 22 2.371294e+04     46.343717    2.78509684
## 23 3.831122e+04     73.632125    4.34681744
## 24 6.189618e+04    133.173904   -8.45518432
## 25 1.000000e+05    235.077686    0.04135186

##          lambda          mspe            df
## 1   0.000000e+00 5.296222e+00    8.00000000
## 2   6.155988e-01 6.198700e+00    8.17624806
## 3   1.610159e+00 7.896163e+00    8.51668373
## 4   3.216970e+00 1.500603e+01    9.33838750
## 5   5.812932e+00 1.216737e+03   18.35473235
## 6   1.000696e+01 1.320235e+02    8.03159924
## 7   1.678284e+01 2.511457e+02    1.72838935
## 8   2.772993e+01 9.423128e+01    8.46137767
## 9   4.541604e+01 8.443025e+02    0.23591702
## 10  7.398970e+01 2.245961e+02    0.49526808
## 11  1.201533e+02 6.436315e+02    7.55025483
## 12  1.947351e+02 3.671914e+05  120.64142792
## 13  3.152293e+02 1.059488e+02   -0.96829255
## 14  5.098997e+02 4.237793e+01    0.71429475
## 15  8.244090e+02 2.614736e+01    1.32939828
## 16  1.332530e+03 2.019070e+01    1.63568090
## 17  2.153449e+03 1.795982e+01    1.81367069
## 18  3.479725e+03 1.811563e+01    1.93554463
## 19  5.622455e+03 1.986314e+01    2.04067560
## 20  9.084248e+03 2.460880e+01    2.16503459
## 21  1.467711e+04 3.188423e+01    2.36192811
## 22  2.371294e+04 4.607114e+01    2.78425735
## 23  3.831122e+04 7.275382e+01    4.35029882
## 24  6.189618e+04 1.314991e+02   -8.94479279
## 25  1.000000e+05 2.346412e+02    0.04039286

## With LOOCV (from n-CV and estimate)  and GCV estimate respectively.

##          lambda          mspe           df
## 1  0.000000e+00 5.294549e-01    8.0000000
## 2  6.155988e-01 1.421257e+00    8.1569472
## 3  1.610159e+00 3.260013e+00    8.4546067
## 4  3.216970e+00 8.199228e+00    9.1182168
## 5  5.812932e+00 4.397214e+01   11.6909446
```

```
## 6  1.000696e+01 1.069862e+02    5.6730334
## 7  1.678284e+01 6.967244e+02   -3.1897463
## 8  2.772993e+01 6.912591e+01    7.2257388
## 9  4.541604e+01 8.158006e+03  -26.6791779
## 10 7.398970e+01 4.243210e+02   -2.6741529
## 11 1.201533e+02 3.139371e+02    5.6926338
## 12 1.947351e+02 3.430454e+03    7.7855950
## 13 3.152293e+02 1.207943e+02   -1.6745387
## 14 5.098997e+02 3.629114e+01    0.5162096
## 15 8.244090e+02 1.733371e+01    1.2410016
## 16 1.332530e+03 1.066785e+01    1.5876870
## 17 2.153449e+03 8.295233e+00    1.7838731
## 18 3.479725e+03 8.229092e+00    1.9132044
## 19 5.622455e+03 1.007773e+01    2.0192062
## 20 9.084248e+03 1.423058e+01    2.1362150
## 21 1.467711e+04 2.185336e+01    2.3117774
## 22 2.371294e+04 3.538286e+01    2.6626849
## 23 3.831122e+04 5.999612e+01    3.7456216
## 24 6.189618e+04 2.668170e+05  192.8808766
## 25 1.000000e+05 2.084175e+02   -0.3195991

##          lambda      loocv        gcv          df
## 1  0.000000e+00  0.5294549  0.5274036    8.0000000
## 2  6.155988e-01  0.5315644  0.5296914    8.1550326
## 3  1.610159e+00  0.5383942  0.5366056    8.4483967
## 4  3.216970e+00  0.5691932  0.5654560    9.0986374
## 5  5.812932e+00  1.0587630  0.8997050   11.5413769
## 6  1.000696e+01  1.7097919  1.7351529    5.3974742
## 7  1.678284e+01  7.0112198  8.9226116   -4.2283387
## 8  2.772993e+01  1.3008377  1.2736298    7.1165292
## 9  4.541604e+01 46.8756988 72.3262759  -38.2976805
## 10 7.398970e+01  4.7192578  5.4968836   -3.1869233
## 11 1.201533e+02  3.8115277  3.3808122    5.5378463
## 12 1.947351e+02 39.1213393 49.7043247    4.9651564
## 13 3.152293e+02  2.6768722  2.8340192   -1.7697507
## 14 5.098997e+02  1.6832218  1.7240571    0.4922097
## 15 8.244090e+02  1.4057418  1.4238731    1.2305696
## 16 1.332530e+03  1.2890402  1.2991133    1.5821373
## 17 2.153449e+03  1.2308570  1.2372104    1.7804781
## 18 3.479725e+03  1.1996365  1.2039742    1.9107333
## 19 5.622455e+03  1.1829855  1.1860448    2.0168771
## 20 9.084248e+03  1.1759115  1.1779321    2.1332245
## 21 1.467711e+04  1.1780747  1.1788386    2.3066719
## 22 2.371294e+04  1.1961239  1.1943771    2.6509683
## 23 3.831122e+04  1.2642579  1.2522259    3.6971964
## 24 6.189618e+04 29.1384740  2.2227677 8094.6186582
## 25 1.000000e+05  1.5305456  1.5395003   -0.3663244
```

Ridge regression for the Boston Housing data