Ridge

Thomas FitzGerald and Mei Maddox

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```
## Warning: Unknown levels in `f`: 2.5Fin

## Warning: Unknown levels in `f`: ImStucc, Stone

## Warning in xtfrm.data.frame(x): cannot xtfrm data frames

## Warning in xtfrm.data.frame(x): cannot xtfrm data frames

## Warning in xtfrm.data.frame(x): cannot xtfrm data frames

## Warning in xtfrm.data.frame(x): cannot xtfrm data frames

## Warning in xtfrm.data.frame(x): cannot xtfrm data frames
```

```r
fit.all <- train %>% select(-Id) %>%
  lm(log(SalePrice) ~ ., data=.)
```

```r
X <- model.matrix(fit.all)[,-1]
X.sd = scale(X)
head(X.sd)
```

```
##   MSSubClass1S SF other MSSubClassmulti-level SF non PUD MSSubClassother
## 1          -0.4311615                        1.4904481      -0.4455898
## 2          -0.4311615                       -0.6704796      -0.4455898
## 3          -0.4311615                        1.4904481      -0.4455898
## 4          -0.4311615                        1.4904481      -0.4455898
## 5          -0.4311615                        1.4904481      -0.4455898
## 6           2.3177282                       -0.6704796      -0.4455898
##   MSZoningRL MSZoningRO MSZoningother    LotArea StreetPave  AlleyPave
## 1  0.5179559 -0.4367309   -0.08301703 -0.20707076 0.06421621 -0.1699229
## 2  0.5179559 -0.4367309   -0.08301703 -0.09185490 0.06421621 -0.1699229
## 3  0.5179559 -0.4367309   -0.08301703  0.07345481 0.06421621 -0.1699229
## 4  0.5179559 -0.4367309   -0.08301703 -0.09686428 0.06421621 -0.1699229
## 5  0.5179559 -0.4367309   -0.08301703  0.37501979 0.06421621 -0.1699229
## 6  0.5179559 -0.4367309   -0.08301703  0.36049258 0.06421621 -0.1699229
##   Alleynone LotShapeReg LandContourLvl LotConfigInside LandSlopeMod
## 1 0.2577331   0.7602514      0.3370102       0.6225488   -0.2157848
## 2 0.2577331   0.7602514      0.3370102      -1.6051995   -0.2157848
## 3 0.2577331  -1.3144534      0.3370102       0.6225488   -0.2157848
## 4 0.2577331  -1.3144534      0.3370102      -1.6051995   -0.2157848
## 5 0.2577331  -1.3144534      0.3370102      -1.6051995   -0.2157848
## 6 0.2577331  -1.3144534      0.3370102       0.6225488   -0.2157848
##   LandSlopeSev NeighborhoodBrkSide NeighborhoodCollgCr NeighborhoodCrawfor
## 1  -0.09475205         -0.2033252           2.9542091            -0.190187
## 2  -0.09475205         -0.2033252          -0.3382682            -0.190187
```

```
## 3  -0.09475205         -0.2033252        2.9542091         -0.190187
## 4  -0.09475205         -0.2033252       -0.3382682          5.254382
## 5  -0.09475205         -0.2033252       -0.3382682         -0.190187
## 6  -0.09475205         -0.2033252       -0.3382682         -0.190187
##   NeighborhoodEdwards NeighborhoodGilbert NeighborhoodMitchel NeighborhoodNAmes
## 1          -0.2710702          -0.2390936          -0.1862884        -0.4266866
## 2          -0.2710702          -0.2390936          -0.1862884        -0.4266866
## 3          -0.2710702          -0.2390936          -0.1862884        -0.4266866
## 4          -0.2710702          -0.2390936          -0.1862884        -0.4266866
## 5          -0.2710702          -0.2390936          -0.1862884        -0.4266866
## 6          -0.2710702          -0.2390936           5.3643448        -0.4266866
##   NeighborhoodNoRidge NeighborhoodNridgHt NeighborhoodNWAmes
## 1          -0.1699229          -0.2358769         -0.2293372
## 2          -0.1699229          -0.2358769         -0.2293372
## 3          -0.1699229          -0.2358769         -0.2293372
## 4          -0.1699229          -0.2358769         -0.2293372
## 5           5.8809906          -0.2358769         -0.2293372
## 6          -0.1699229          -0.2358769         -0.2293372
##   NeighborhoodOldTown NeighborhoodSawyer NeighborhoodSawyerW
## 1          -0.2895387         -0.2309859          -0.2051437
## 2          -0.2895387         -0.2309859          -0.2051437
## 3          -0.2895387         -0.2309859          -0.2051437
## 4          -0.2895387         -0.2309859          -0.2051437
## 5          -0.2895387         -0.2309859          -0.2051437
## 6          -0.2895387         -0.2309859          -0.2051437
##   NeighborhoodSomerst NeighborhoodTimber Condition1Pos Condition1St
## 1          -0.2500962         -0.1634155    -0.1372177   -0.3112125
## 2          -0.2500962         -0.1634155    -0.1372177    3.2110376
## 3          -0.2500962         -0.1634155    -0.1372177   -0.3112125
## 4          -0.2500962         -0.1634155    -0.1372177   -0.3112125
## 5          -0.2500962         -0.1634155    -0.1372177   -0.3112125
## 6          -0.2500962         -0.1634155    -0.1372177   -0.3112125
##   Condition1Norm Condition2Pos Condition2St Condition2Norm BldgTypeMultiFam
## 1      0.3982731   -0.04536094  -0.07420154      0.1018504       -0.2454275
## 2     -2.5091204   -0.04536094  -0.07420154      0.1018504       -0.2454275
## 3      0.3982731   -0.04536094  -0.07420154      0.1018504       -0.2454275
## 4      0.3982731   -0.04536094  -0.07420154      0.1018504       -0.2454275
## 5      0.3982731   -0.04536094  -0.07420154      0.1018504       -0.2454275
## 6      0.3982731   -0.04536094  -0.07420154      0.1018504       -0.2454275
##   BldgTypeTwnhs BldgTypeTwnhsE HouseStyle1.5Unf HouseStyleEqMore2story
## 1    -0.1741408      -0.290925      -0.09836285              1.4904481
## 2    -0.1741408      -0.290925      -0.09836285             -0.6704796
## 3    -0.1741408      -0.290925      -0.09836285              1.4904481
## 4    -0.1741408      -0.290925      -0.09836285              1.4904481
## 5    -0.1741408      -0.290925      -0.09836285              1.4904481
## 6    -0.1741408      -0.290925      -0.09836285             -0.6704796
##   HouseStyle2.5Unf OverallQual OverallCond   YearBuilt YearRemodAdd
## 1      -0.08709904  0.65125610  -0.5170227   1.0506338    0.8783671
## 2      -0.08709904 -0.07181151   2.1788812   0.1566800   -0.4294298
## 3      -0.08709904  0.65125610  -0.5170227   0.9844150    0.8299302
## 4      -0.08709904  0.65125610  -0.5170227  -1.8629933   -0.7200514
## 5      -0.08709904  1.37432370  -0.5170227   0.9513056    0.7330564
## 6      -0.08709904 -0.79487911  -0.5170227   0.7195398    0.4908717
##   RoofStyleGable RoofStyleHip Exterior1stBrkFace Exterior1stCemntBd
```

```
## 1      0.5094397    -0.4934012           -0.1882464            -0.2087408
## 2      0.5094397    -0.4934012           -0.1882464            -0.2087408
## 3      0.5094397    -0.4934012           -0.1882464            -0.2087408
## 4      0.5094397    -0.4934012           -0.1882464            -0.2087408
## 5      0.5094397    -0.4934012           -0.1882464            -0.2087408
## 6      0.5094397    -0.4934012           -0.1882464            -0.2087408
##   Exterior1stHdBoard Exterior1stMetalSd Exterior1stPlywood Exterior1stVinylSd
## 1         -0.4233186         -0.4210675         -0.2825366          1.3541398
## 2         -0.4233186          2.3732895         -0.2825366         -0.7379704
## 3         -0.4233186         -0.4210675         -0.2825366          1.3541398
## 4         -0.4233186         -0.4210675         -0.2825366         -0.7379704
## 5         -0.4233186         -0.4210675         -0.2825366          1.3541398
## 6         -0.4233186         -0.4210675         -0.2825366          1.3541398
##   Exterior1stWd Sdng Exterior2ndTRUE MasVnrTypeBrkFace MasVnrTypeNone
## 1         -0.4051689      -0.3216856         1.5097472     -1.2036077
## 2         -0.4051689      -0.3216856        -0.6619089      0.8302664
## 3         -0.4051689      -0.3216856         1.5097472     -1.2036077
## 4          2.4664163       3.1064964        -0.6619089      0.8302664
## 5         -0.4051689      -0.3216856         1.5097472     -1.2036077
## 6         -0.4051689      -0.3216856        -0.6619089      0.8302664
##   MasVnrTypeStone MasVnrTypemissing MasVnrArea ExterQualFa ExterQualGd
## 1      -0.3098875       -0.07420154  0.5139278 -0.09836285   1.4108292
## 2      -0.3098875       -0.07420154 -0.5705546 -0.09836285  -0.7083175
## 3      -0.3098875       -0.07420154  0.3258033 -0.09836285   1.4108292
## 4      -0.3098875       -0.07420154 -0.5705546 -0.09836285  -0.7083175
## 5      -0.3098875       -0.07420154  1.3660211 -0.09836285   1.4108292
## 6      -0.3098875       -0.07420154 -0.5705546 -0.09836285  -0.7083175
##   ExterQualTA ExterCondFa ExterCondGd ExterCondTA FoundationCBlock
## 1  -1.2783814  -0.1397844  -0.3332192   0.3724922       -0.8758018
## 2   0.7817034  -0.1397844  -0.3332192   0.3724922        1.1410288
## 3  -1.2783814  -0.1397844  -0.3332192   0.3724922       -0.8758018
## 4   0.7817034  -0.1397844  -0.3332192   0.3724922       -0.8758018
## 5  -1.2783814  -0.1397844  -0.3332192   0.3724922       -0.8758018
## 6   0.7817034  -0.1397844  -0.3332192   0.3724922       -0.8758018
##   FoundationPConc FoundationSlab FoundationStone FoundationWood BsmtQualFa
## 1       1.1205838     -0.1292348     -0.06421621    -0.04536094 -0.1566671
## 2      -0.8917807     -0.1292348     -0.06421621    -0.04536094 -0.1566671
## 3       1.1205838     -0.1292348     -0.06421621    -0.04536094 -0.1566671
## 4      -0.8917807     -0.1292348     -0.06421621    -0.04536094 -0.1566671
## 5       1.1205838     -0.1292348     -0.06421621    -0.04536094 -0.1566671
## 6      -0.8917807     -0.1292348     -0.06421621    22.03029773 -0.1566671
##   BsmtQualGd BsmtQualTA BsmtQualnone BsmtCondGd  BsmtCondPo BsmtCondTA
## 1  1.1668446 -0.8942586   -0.1611943 -0.2157848 -0.03702435  0.3370102
## 2  1.1668446 -0.8942586   -0.1611943 -0.2157848 -0.03702435  0.3370102
## 3  1.1668446 -0.8942586   -0.1611943 -0.2157848 -0.03702435  0.3370102
## 4 -0.8564251  1.1174788   -0.1611943  4.6310732 -0.03702435 -2.9652371
## 5  1.1668446 -0.8942586   -0.1611943 -0.2157848 -0.03702435  0.3370102
## 6  1.1668446 -0.8942586   -0.1611943 -0.2157848 -0.03702435  0.3370102
##   BsmtCondnone BsmtExposureGd BsmtExposureMn BsmtExposureNo BsmtExposurenone
## 1   -0.1611943     -0.3177839      -0.290925      0.7291363       -0.1634155
## 2   -0.1611943      3.1446374      -0.290925     -1.3705462       -0.1634155
## 3   -0.1611943     -0.3177839       3.434957     -1.3705462       -0.1634155
## 4   -0.1611943     -0.3177839      -0.290925      0.7291363       -0.1634155
## 5   -0.1611943     -0.3177839      -0.290925     -1.3705462       -0.1634155
```

```
## 6   -0.1611943   -0.3177839   -0.290925   0.7291363   -0.1634155
##    BsmtFinType1BLQ BsmtFinType1GLQ BsmtFinType1LwQ BsmtFinType1Rec
## 1      -0.3357493       1.5783268      -0.2309859      -0.3164766
## 2      -0.3357493      -0.6331484      -0.2309859      -0.3164766
## 3      -0.3357493       1.5783268      -0.2309859      -0.3164766
## 4      -0.3357493      -0.6331484      -0.2309859      -0.3164766
## 5      -0.3357493       1.5783268      -0.2309859      -0.3164766
## 6      -0.3357493       1.5783268      -0.2309859      -0.3164766
##    BsmtFinType1Unf BsmtFinType1none   BsmtFinSF1 BsmtFinType2BLQ BsmtFinType2GLQ
## 1      -0.6459023      -0.1611943  0.57522774      -0.1520184     -0.09836285
## 2      -0.6459023      -0.1611943  1.17159068      -0.1520184     -0.09836285
## 3      -0.6459023      -0.1611943  0.09287536      -0.1520184     -0.09836285
## 4      -0.6459023      -0.1611943 -0.49910256      -0.1520184     -0.09836285
## 5      -0.6459023      -0.1611943  0.46340969      -0.1520184     -0.09836285
## 6      -0.6459023      -0.1611943  0.63223302      -0.1520184     -0.09836285
##    BsmtFinType2LwQ BsmtFinType2Rec BsmtFinType2Unf BsmtFinType2none BsmtFinSF2
## 1      -0.180304      -0.1959095       0.4028761      -0.1634155 -0.288554
## 2      -0.180304      -0.1959095       0.4028761      -0.1634155 -0.288554
## 3      -0.180304      -0.1959095       0.4028761      -0.1634155 -0.288554
## 4      -0.180304      -0.1959095       0.4028761      -0.1634155 -0.288554
## 5      -0.180304      -0.1959095       0.4028761      -0.1634155 -0.288554
## 6      -0.180304      -0.1959095       0.4028761      -0.1634155 -0.288554
##     BsmtUnfSF TotalBsmtSF HeatingGasW HeatingOther HeatingQCFa HeatingQCGd
## 1 -0.94426706  -0.4591452  -0.1116876  -0.09836285  -0.1862884  -0.4444858
## 2 -0.64100836   0.4663051  -0.1116876  -0.09836285  -0.1862884  -0.4444858
## 3 -0.30153966  -0.3132614  -0.1116876  -0.09836285  -0.1862884  -0.4444858
## 4 -0.06164845  -0.6870887  -0.1116876  -0.09836285  -0.1862884   2.2482497
## 5 -0.17480468   0.1996113  -0.1116876  -0.09836285  -0.1862884  -0.4444858
## 6 -1.13889578  -0.5959113  -0.1116876  -0.09836285  -0.1862884  -0.4444858
##    HeatingQCPo HeatingQCTA CentralAirY ElectricalOther  `1stFlrSF`  `2ndFlrSF`
## 1  -0.0261712  -0.6437737   0.2637222       0.3045502 -0.79316202   1.1614536
## 2  -0.0261712  -0.6437737   0.2637222       0.3045502  0.25705235  -0.7948909
## 3  -0.0261712  -0.6437737   0.2637222       0.3045502 -0.62761099   1.1889432
## 4  -0.0261712  -0.6437737   0.2637222       0.3045502 -0.52155486   0.9369551
## 5  -0.0261712  -0.6437737   0.2637222       0.3045502 -0.04559563   1.6173231
## 6  -0.0261712  -0.6437737   0.2637222       0.3045502 -0.94836612   0.5017028
##    LowQualFinSF   GrLivArea BsmtFullBath BsmtHalfBath   FullBath    HalfBath
## 1  -0.1202005   0.3702066    1.1074307   -0.2409785   0.789470   1.2271649
## 2  -0.1202005  -0.4823466   -0.8196835    3.9474568   0.789470  -0.7613598
## 3  -0.1202005   0.5148362    1.1074307   -0.2409785   0.789470   1.2271649
## 4  -0.1202005   0.3835277    1.1074307   -0.2409785  -1.025689  -0.7613598
## 5  -0.1202005   1.2988806    1.1074307   -0.2409785   0.789470   1.2271649
## 6  -0.1202005  -0.2920446    1.1074307   -0.2409785  -1.025689   1.2271649
##    BedroomAbvGr KitchenAbvGr KitchenQualFa KitchenQualGd KitchenQualTA
## 1     0.163723   -0.2113812      -0.16561     1.2208382    -1.0065281
## 2     0.163723   -0.2113812      -0.16561    -0.8185483     0.9928338
## 3     0.163723   -0.2113812      -0.16561     1.2208382    -1.0065281
## 4     0.163723   -0.2113812      -0.16561     1.2208382    -1.0065281
## 5     1.389547   -0.2113812      -0.16561     1.2208382    -1.0065281
## 6    -2.287924   -0.2113812      -0.16561    -0.8185483     0.9928338
##    TotRmsAbvGrd FunctionalTRUE Fireplaces FireplaceQuFa FireplaceQuGd
## 1    0.9118973      0.2710702 -0.9509007    -0.1520184    -0.5929678
## 2   -0.3185741      0.2710702  0.6002892    -0.1520184    -0.5929678
## 3   -0.3185741      0.2710702  0.6002892    -0.1520184    -0.5929678
```

```
## 4    0.2966616      0.2710702  0.6002892    -0.1520184        1.6852770
## 5    1.5271330      0.2710702  0.6002892    -0.1520184       -0.5929678
## 6   -0.9338098      0.2710702 -0.9509007    -0.1520184       -0.5929678
##    FireplaceQunone FireplaceQuPo FireplaceQuTA GarageTypeBuiltIn
## 1        1.0560197    -0.1178108    -0.5222058        -0.2531719
## 2       -0.9463034    -0.1178108     1.9136423        -0.2531719
## 3       -0.9463034    -0.1178108     1.9136423        -0.2531719
## 4       -0.9463034    -0.1178108    -0.5222058        -0.2531719
## 5       -0.9463034    -0.1178108     1.9136423        -0.2531719
## 6        1.0560197    -0.1178108    -0.5222058        -0.2531719
##    GarageTypeDetchd GarageTypenone GarageTypeOther GarageFinishnone
## 1       -0.6003532     -0.2422767      -0.1543586       -0.2422767
## 2       -0.6003532     -0.2422767      -0.1543586       -0.2422767
## 3       -0.6003532     -0.2422767      -0.1543586       -0.2422767
## 4        1.6645452     -0.2422767      -0.1543586       -0.2422767
## 5       -0.6003532     -0.2422767      -0.1543586       -0.2422767
## 6       -0.6003532     -0.2422767      -0.1543586       -0.2422767
##    GarageFinishRFn GarageFinishUnf GarageCars   GarageArea GarageQualTA
## 1        1.5678109      -0.8409029  0.3116179  0.35088009    0.3370102
## 2        1.5678109      -0.8409029  0.3116179 -0.06071021    0.3370102
## 3        1.5678109      -0.8409029  0.3116179  0.63150985    0.3370102
## 4       -0.6373952       1.1883834  1.6497417  0.79053338    0.3370102
## 5        1.5678109      -0.8409029  1.6497417  1.69790291    0.3370102
## 6       -0.6373952       1.1883834  0.3116179  0.03283304    0.3370102
##    GarageQualPo GarageQualnone GarageCondPo GarageCondnone GarageCondTA
## 1    -0.190187     -0.2422767   -0.1720433     -0.2422767    0.3177839
## 2    -0.190187     -0.2422767   -0.1720433     -0.2422767    0.3177839
## 3    -0.190187     -0.2422767   -0.1720433     -0.2422767    0.3177839
## 4    -0.190187     -0.2422767   -0.1720433     -0.2422767    0.3177839
## 5    -0.190187     -0.2422767   -0.1720433     -0.2422767    0.3177839
## 6    -0.190187     -0.2422767   -0.1720433     -0.2422767    0.3177839
##    PavedDriveP PavedDriveY WoodDeckSF OpenPorchSF EnclosedPorch `3SsnPorch`
## 1  -0.1447918   0.2991503 -0.7519182  0.21642900    -0.3592018  -0.1162994
## 2  -0.1447918   0.2991503  1.6256378 -0.70424195    -0.3592018  -0.1162994
## 3  -0.1447918   0.2991503 -0.7519182 -0.07033736    -0.3592018  -0.1162994
## 4  -0.1447918   0.2991503 -0.7519182 -0.17598812     4.0911220  -0.1162994
## 5  -0.1447918   0.2991503  0.7799299  0.56356723    -0.3592018  -0.1162994
## 6  -0.1447918   0.2991503 -0.4327832 -0.25145296    -0.3592018  10.7987462
##    ScreenPorch     PoolArea      PoolQCGd     PoolQCFa PoolQCOther   FenceGdWo
## 1  -0.2701158 -0.06866822 -0.04536094 -0.03702435  0.06938529 -0.1959095
## 2  -0.2701158 -0.06866822 -0.04536094 -0.03702435  0.06938529 -0.1959095
## 3  -0.2701158 -0.06866822 -0.04536094 -0.03702435  0.06938529 -0.1959095
## 4  -0.2701158 -0.06866822 -0.04536094 -0.03702435  0.06938529 -0.1959095
## 5  -0.2701158 -0.06866822 -0.04536094 -0.03702435  0.06938529 -0.1959095
## 6  -0.2701158 -0.06866822 -0.04536094 -0.03702435  0.06938529 -0.1959095
##    FenceMnPrv    FenceMnWw   Fencenone MiscFeatureOther MiscFeatureShed
## 1 -0.3469995 -0.08709904   0.4880311      -0.03702435      -0.1862884
## 2 -0.3469995 -0.08709904   0.4880311      -0.03702435      -0.1862884
## 3 -0.3469995 -0.08709904   0.4880311      -0.03702435      -0.1862884
## 4 -0.3469995 -0.08709904   0.4880311      -0.03702435      -0.1862884
## 5 -0.3469995 -0.08709904   0.4880311      -0.03702435      -0.1862884
## 6  2.8798747 -0.08709904  -2.0476464      -0.03702435       5.3643448
##    MiscFeatureTenC MiscFeatureNone    MiscVal     MoSold      YrSold
## 1       -0.0261712       0.1959095 -0.08765778 -1.5985634   0.1387300
```

```
## 2        -0.0261712          0.1959095 -0.08765778 -0.4889425 -0.6142282
## 3        -0.0261712          0.1959095 -0.08765778  0.9905519  0.1387300
## 4        -0.0261712          0.1959095 -0.08765778 -1.5985634 -1.3671863
## 5        -0.0261712          0.1959095 -0.08765778  2.1001728  0.1387300
## 6        -0.0261712         -5.1009022  1.32328259  1.3604256  0.8916881
##   SaleTypeOther SaleTypeNew SaleTypeWD SaleConditionAdjLand SaleConditionAlloca
## 1    -0.1397844  -0.3018583  0.3901589          -0.05239629         -0.09100339
## 2    -0.1397844  -0.3018583  0.3901589          -0.05239629         -0.09100339
## 3    -0.1397844  -0.3018583  0.3901589          -0.05239629         -0.09100339
## 4    -0.1397844  -0.3018583  0.3901589          -0.05239629         -0.09100339
## 5    -0.1397844  -0.3018583  0.3901589          -0.05239629         -0.09100339
## 6    -0.1397844  -0.3018583  0.3901589          -0.05239629         -0.09100339
##   SaleConditionFamily SaleConditionNormal SaleConditionPartial
## 1          -0.1178108           0.4674912           -0.3058902
## 2          -0.1178108           0.4674912           -0.3058902
## 3          -0.1178108           0.4674912           -0.3058902
## 4          -0.1178108          -2.1376125           -0.3058902
## 5          -0.1178108           0.4674912           -0.3058902
## 6          -0.1178108           0.4674912           -0.3058902
```

```r
fit.ridge <- glmnet(x=X.sd, y=train$SalePrice, alpha=0)
plot(fit.ridge, xvar="lambda", label=TRUE)
```
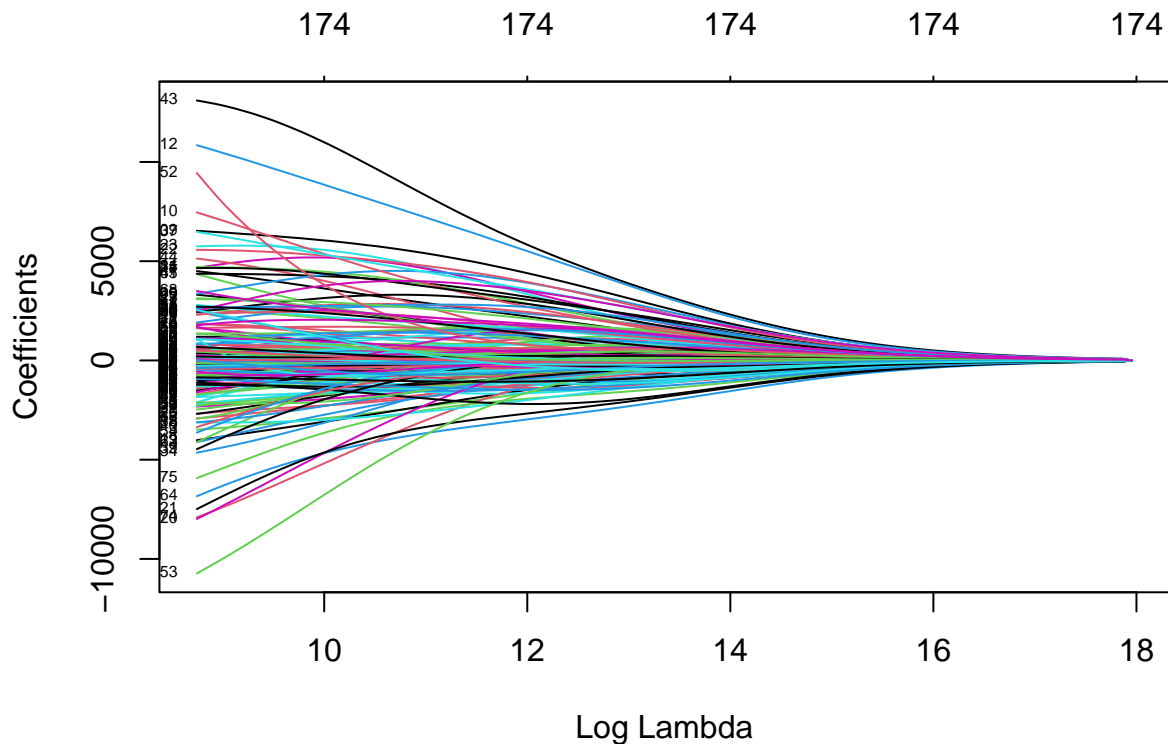


```r
cross.val <- cv.glmnet(x=X.sd, y=train$SalePrice, alpha=0)
plot(cross.val)
```
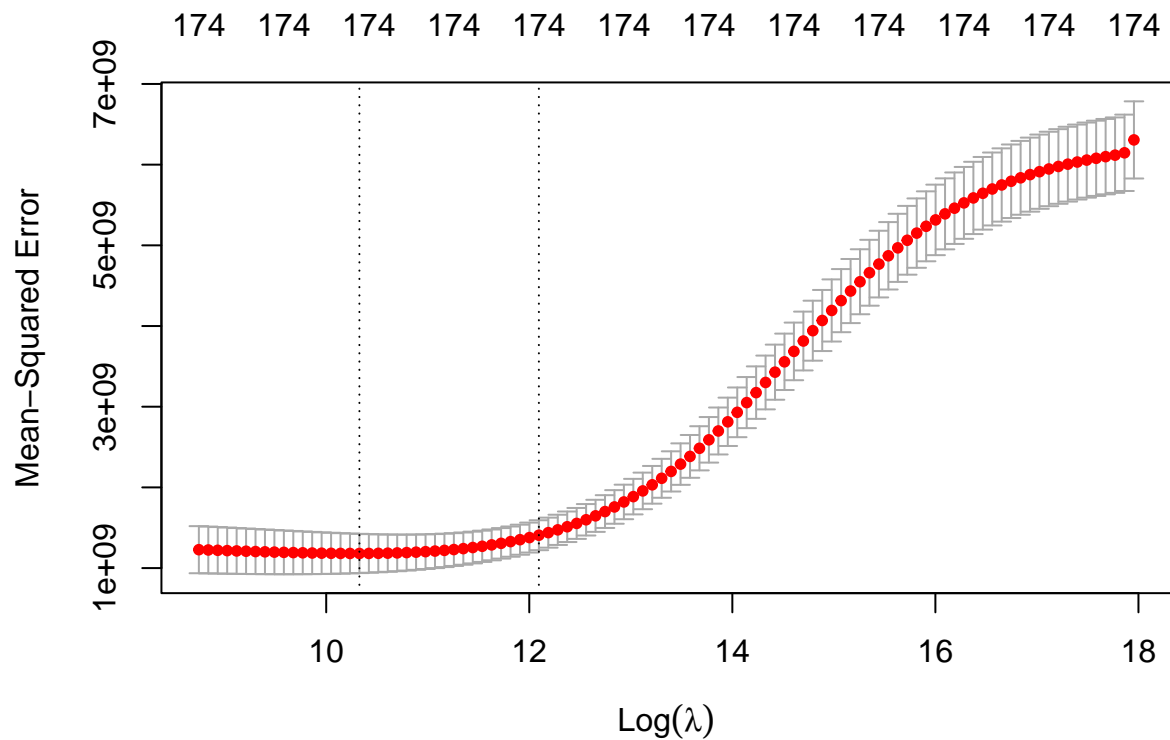
```
fit.ridge.opt <- glmnet(x=X, y=train$SalePrice,
                        lambda=cross.val$lambda.min,
                        alpha = 1, standardize = TRUE)
coef(fit.ridge.opt)

## 175 x 1 sparse Matrix of class "dgCMatrix"
##                                        s0
## (Intercept)                     35810.657
## MSSubClass1S SF other                   .
## MSSubClassmulti-level SF non PUD        .
## MSSubClassother                         .
## MSZoningRL                              .
## MSZoningRO                              .
## MSZoningother                           .
## LotArea                                 .
## StreetPave                              .
## AlleyPave                               .
## Alleynone                               .
## LotShapeReg                             .
## LandContourLvl                          .
## LotConfigInside                         .
## LandSlopeMod                            .
## LandSlopeSev                            .
## NeighborhoodBrkSide                     .
## NeighborhoodCollgCr                     .
## NeighborhoodCrawfor                     .
```

```
## NeighborhoodEdwards                 .
## NeighborhoodGilbert                 .
## NeighborhoodMitchel                 .
## NeighborhoodNAmes                   .
## NeighborhoodNoRidge                 .
## NeighborhoodNridgHt                 .
## NeighborhoodNWAmes                  .
## NeighborhoodOldTown                 .
## NeighborhoodSawyer                  .
## NeighborhoodSawyerW                 .
## NeighborhoodSomerst                 .
## NeighborhoodTimber                  .
## Condition1Pos                       .
## Condition1St                        .
## Condition1Norm                      .
## Condition2Pos                       .
## Condition2St                        .
## Condition2Norm                      .
## BldgTypeMultiFam                    .
## BldgTypeTwnhs                       .
## BldgTypeTwnhsE                      .
## HouseStyle1.5Unf                    .
## HouseStyleEqMore2story              .
## HouseStyle2.5Unf                    .
## OverallQual                 18981.506
## OverallCond                         .
## YearBuilt                           .
## YearRemodAdd                        .
## RoofStyleGable                      .
## RoofStyleHip                        .
## Exterior1stBrkFace                  .
## Exterior1stCemntBd                  .
## Exterior1stHdBoard                  .
## Exterior1stMetalSd                  .
## Exterior1stPlywood                  .
## Exterior1stVinylSd                  .
## Exterior1stWd Sdng                  .
## Exterior2ndTRUE                     .
## MasVnrTypeBrkFace                   .
## MasVnrTypeNone                      .
## MasVnrTypeStone                     .
## MasVnrTypemissing                   .
## MasVnrArea                          .
## ExterQualFa                         .
## ExterQualGd                         .
## ExterQualTA                         .
## ExterCondFa                         .
## ExterCondGd                         .
## ExterCondTA                         .
## FoundationCBlock                    .
## FoundationPConc                     .
## FoundationSlab                      .
## FoundationStone                     .
## FoundationWood                      .
```

```
## BsmtQualFa                          .
## BsmtQualGd                          .
## BsmtQualTA                          .
## BsmtQualnone                        .
## BsmtCondGd                          .
## BsmtCondPo                          .
## BsmtCondTA                          .
## BsmtCondnone                        .
## BsmtExposureGd                      .
## BsmtExposureMn                      .
## BsmtExposureNo                      .
## BsmtExposurenone                    .
## BsmtFinType1BLQ                     .
## BsmtFinType1GLQ                     .
## BsmtFinType1LwQ                     .
## BsmtFinType1Rec                     .
## BsmtFinType1Unf                     .
## BsmtFinType1none                    .
## BsmtFinSF1                          .
## BsmtFinType2BLQ                     .
## BsmtFinType2GLQ                     .
## BsmtFinType2LwQ                     .
## BsmtFinType2Rec                     .
## BsmtFinType2Unf                     .
## BsmtFinType2none                    .
## BsmtFinSF2                          .
## BsmtUnfSF                           .
## TotalBsmtSF                         .
## HeatingGasW                         .
## HeatingOther                        .
## HeatingQCFa                         .
## HeatingQCGd                         .
## HeatingQCPo                         .
## HeatingQCTA                         .
## CentralAirY                         .
## ElectricalOther                     .
## `1stFlrSF`                          .
## `2ndFlrSF`                          .
## LowQualFinSF                        .
## GrLivArea                      19.358
## BsmtFullBath                        .
## BsmtHalfBath                        .
## FullBath                            .
## HalfBath                            .
## BedroomAbvGr                        .
## KitchenAbvGr                        .
## KitchenQualFa                       .
## KitchenQualGd                       .
## KitchenQualTA                       .
## TotRmsAbvGrd                        .
## FunctionalTRUE                      .
## Fireplaces                          .
## FireplaceQuFa                       .
## FireplaceQuGd                       .
```

```
## FireplaceQunone                      .
## FireplaceQuPo                        .
## FireplaceQuTA                        .
## GarageTypeBuiltIn                     .
## GarageTypeDetchd                      .
## GarageTypenone                        .
## GarageTypeOther                       .
## GarageFinishnone                      .
## GarageFinishRFn                       .
## GarageFinishUnf                       .
## GarageCars                            .
## GarageArea                            .
## GarageQualTA                          .
## GarageQualPo                          .
## GarageQualnone                        .
## GarageCondPo                          .
## GarageCondnone                        .
## GarageCondTA                          .
## PavedDriveP                           .
## PavedDriveY                           .
## WoodDeckSF                            .
## OpenPorchSF                           .
## EnclosedPorch                         .
## `3SsnPorch`                           .
## ScreenPorch                           .
## PoolArea                              .
## PoolQCGd                              .
## PoolQCFa                              .
## PoolQCOther                           .
## FenceGdWo                             .
## FenceMnPrv                            .
## FenceMnWw                             .
## Fencenone                             .
## MiscFeatureOther                      .
## MiscFeatureShed                       .
## MiscFeatureTenC                       .
## MiscFeatureNone                       .
## MiscVal                               .
## MoSold                                .
## YrSold                                .
## SaleTypeOther                         .
## SaleTypeNew                           .
## SaleTypeWD                            .
## SaleConditionAdjLand                  .
## SaleConditionAlloca                   .
## SaleConditionFamily                   .
## SaleConditionNormal                   .
## SaleConditionPartial                  .
```

`predict(fit.ridge.opt, newx=test)` raises an error regarding the number of variables. This is because the fit function creates dummy variables. We must model the test set to have the same structure as the modeled training set (175 variables).

```
predicted.ridge = test %>%
  select(-Id) %>%
```

```
  model.matrix(as.formula("~."), .) %>%
  tibble::as_tibble() %>%
  select(., -setdiff(colnames(.), colnames(X))) %>%
  as.matrix() %>%
  predict(fit.ridge.opt, newx=.) %>% exp()
SubmitDF <- data.frame(test$Id, predicted.ridge)
colnames(SubmitDF) <- c("Id", "SalePrice")
write.csv(file='../submissions/ridge1.csv', SubmitDF, row.names = FALSE)
```

```
ggplot(SubmitDF, aes(x=SalePrice)) +
  geom_histogram(aes(y=..density..),
                 colour="black", fill="white") +
  geom_density(alpha=.2, fill="#FF6666") +
  geom_density(mapping=aes(x=train$SalePrice[-1]), alpha=.2, fill="blue") +
  geom_vline(xintercept=max(train$SalePrice), color="blue", size=1, linetype="dashed")
```

```
## Warning: Removed 1459 rows containing non-finite values (stat_bin).
```

```
## Warning: Removed 1459 rows containing non-finite values (stat_density).
```
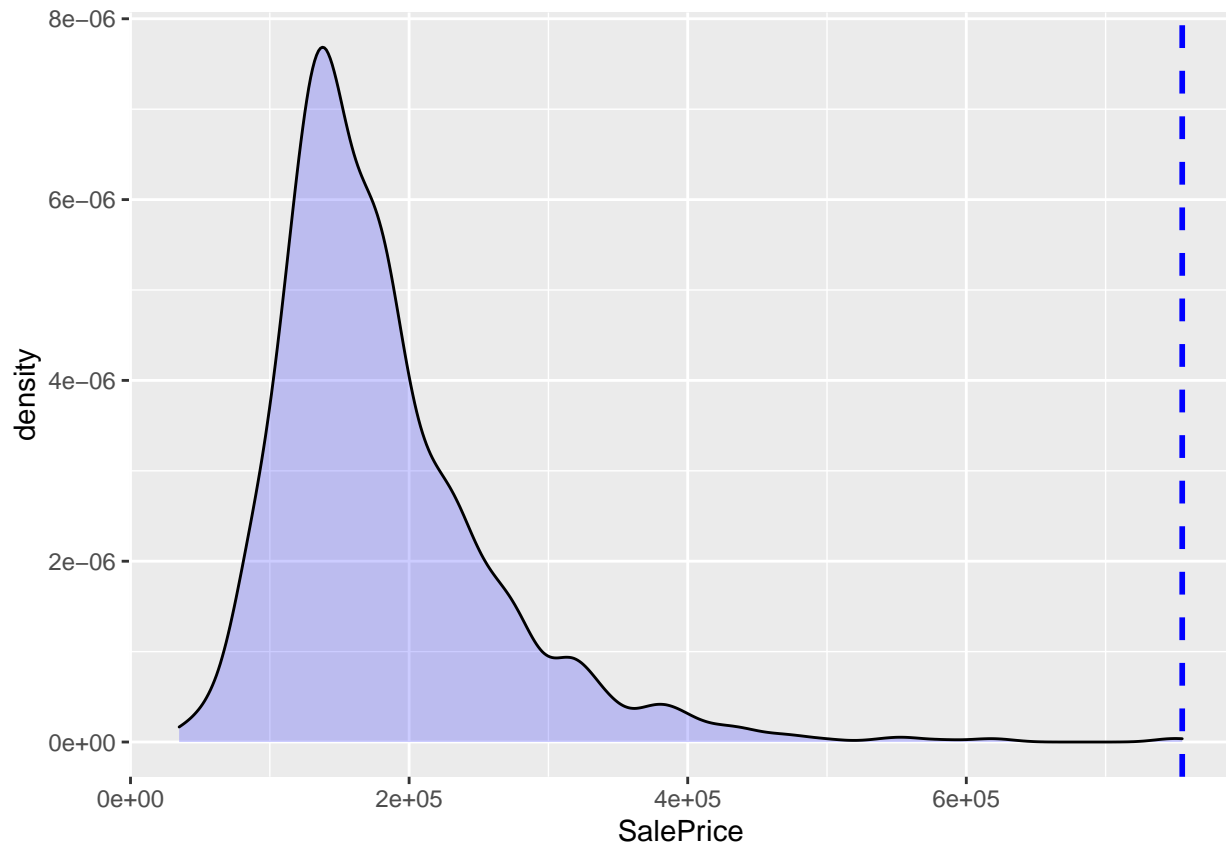

Influential Outliers

standardized residuals help determine regression outliers: 1171, 633, 524

```
plot(fit.all, which=1)
```

Residuals vs Fitted

Fitted values
lm(log(SalePrice) ~ .)
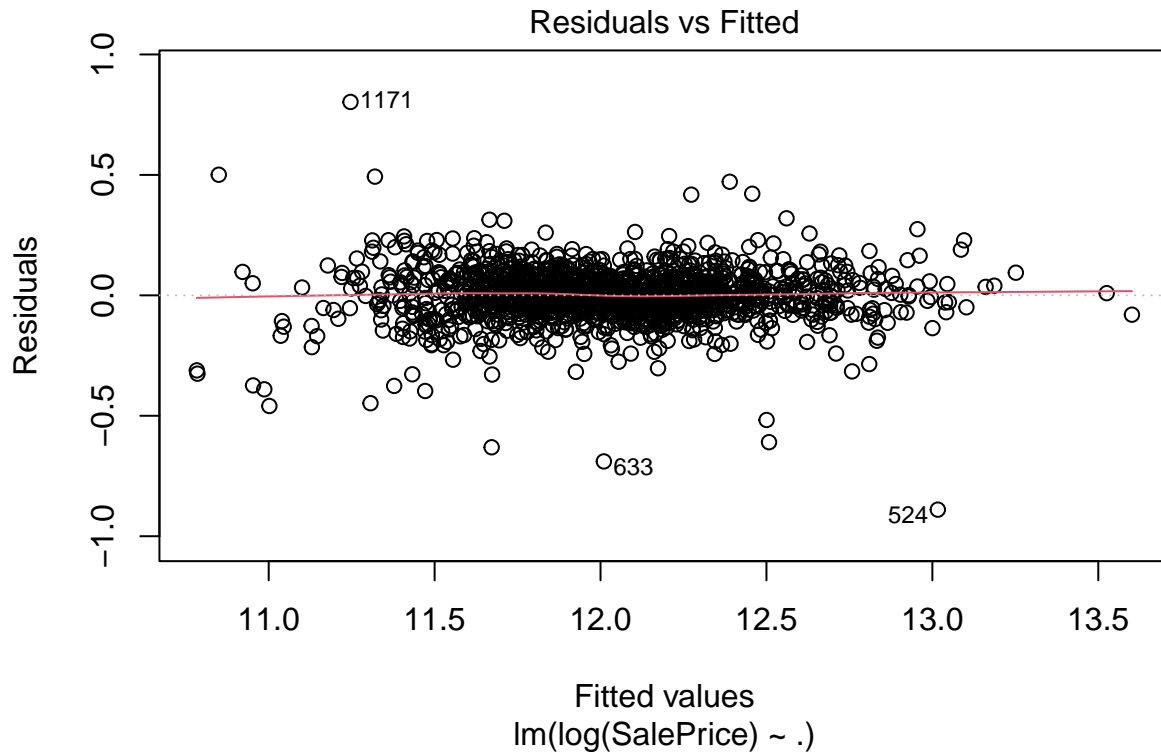
```
fitted.values <- predict(fit.lasso.opt, newx=X)
residuals <- train$SalePrice - fitted.values
stand.resid <- scale(residuals)

outliers <- which(abs(stand.resid) > 3)
indexes <- 1:length(stand.resid)

ggplot(mapping=aes(x=fitted.values, y=stand.resid)) +
  geom_point(shape=1) +
  geom_hline(yintercept=0, color="red", size=1, linetype="dashed") +

  ggrepel::geom_text_repel(aes(label = ifelse(indexes %in% outliers, indexes, "")))
```

Hat-Values to identify influencial observations

```
threshold <- 2*length(coefficients(fit.all))/nrow(fit.all$model)
plot(hatvalues(fit.all))
abline(h = threshold, lty = 2, col = "red") # add cutoff line
```
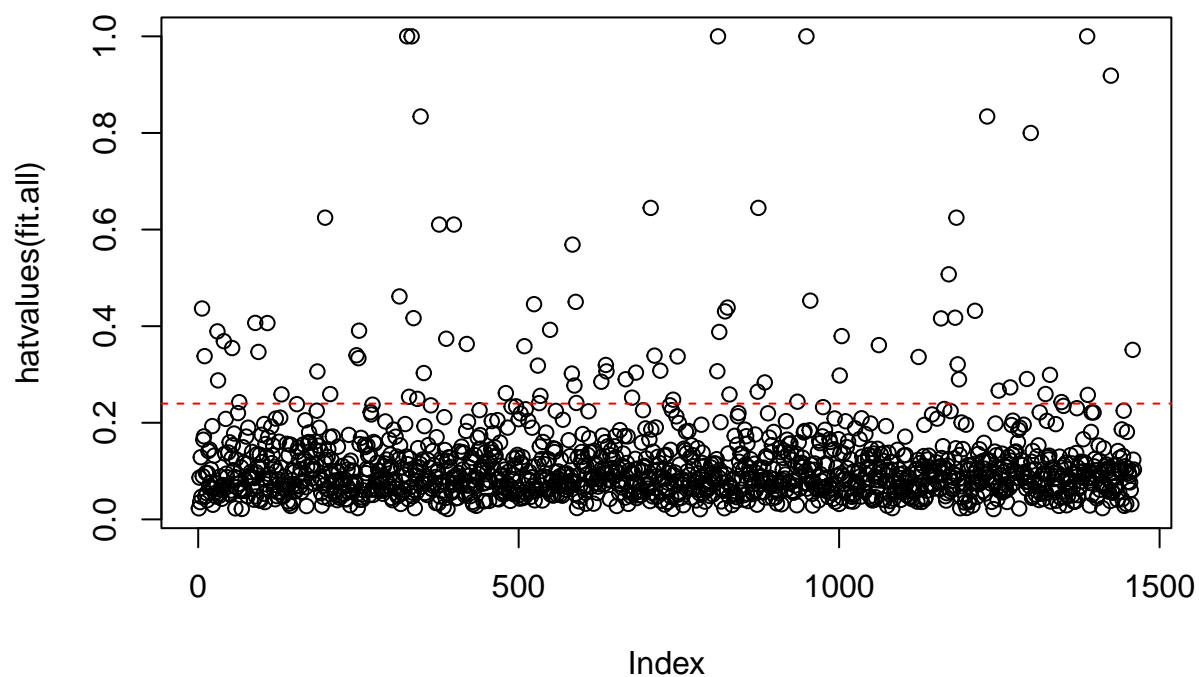
0.5: 524, 1171 1: 1299, 1424

```
cooks.distance <- cooks.distance(fit.all)

plot(cooks.distance, main = "Cooks Distance for Influential Obs")
abline(h = 0.5, lty = 2, col = "orange") # add cutoff line
text(x=1:length(cooks.distance)+1, y=cooks.distance, labels=ifelse(cooks.distance>0.5, names(cooks.dist
abline(h = 1, lty = 2, col = "red") # add cutoff line
text(x=1:length(cooks.distance)+1, y=cooks.distance, labels=ifelse(cooks.distance>1, names(cooks.distan
```

Cooks Distance for Influential Obs
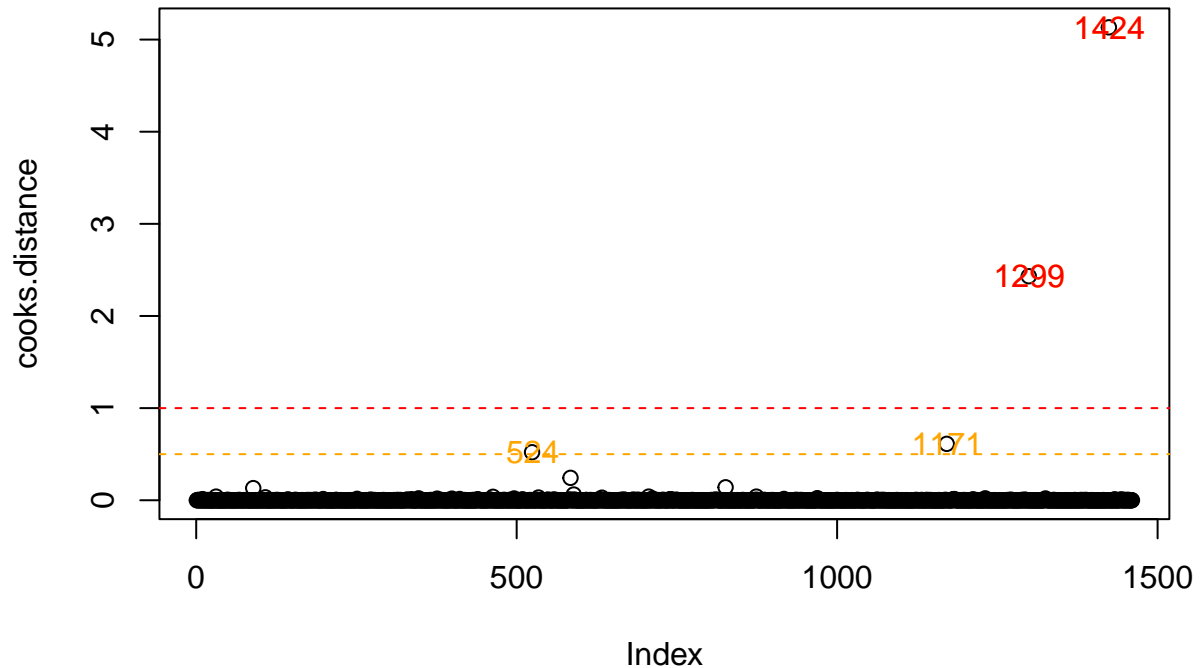

```r
new.train <- train %>% filter(!(row_number() %in% c(524, 1171, 1299, 1424)))
fit.all <- new.train %>% select(-Id) %>%
  lm(log(SalePrice) ~ ., data=.)
```

```r
X <- model.matrix(fit.all)[,-1]
X.sd = scale(X)
head(X.sd)
```

```
##   MSSubClass1S SF other MSSubClassmulti-level SF non PUD MSSubClassother
## 1            -0.4318633                        1.4970709      -0.4463229
## 2            -0.4318633                       -0.6675123      -0.4463229
## 3            -0.4318633                        1.4970709      -0.4463229
## 4            -0.4318633                        1.4970709      -0.4463229
## 5            -0.4318633                        1.4970709      -0.4463229
## 6             2.3139573                       -0.6675123      -0.4463229
##   MSZoningRL MSZoningRO MSZoningother     LotArea StreetPave   AlleyPave
## 1  0.5188578 -0.4374447    -0.0831317 -0.20318339 0.06430466 -0.1701628
## 2  0.5188578 -0.4374447    -0.0831317 -0.08658590 0.06430466 -0.1701628
## 3  0.5188578 -0.4374447    -0.0831317  0.08070616 0.06430466 -0.1701628
## 4  0.5188578 -0.4374447    -0.0831317 -0.09165535 0.06430466 -0.1701628
## 5  0.5188578 -0.4374447    -0.0831317  0.38588743 0.06430466 -0.1701628
## 6  0.5188578 -0.4374447    -0.0831317  0.37118601 0.06430466 -0.1701628
##   Alleynone LotShapeReg LandContourLvl LotConfigInside LandSlopeMod
## 1 0.2581102   0.7585263       0.334996       0.6216117   -0.2160946
## 2 0.2581102   0.7585263       0.334996      -1.6076165   -0.2160946
## 3 0.2581102  -1.3174404       0.334996       0.6216117   -0.2160946
## 4 0.2581102  -1.3174404       0.334996      -1.6076165   -0.2160946
```

```
## 5 0.2581102  -1.3174404         0.334996      -1.6076165   -0.2160946
## 6 0.2581102  -1.3174404         0.334996       0.6216117   -0.2160946
##   LandSlopeSev NeighborhoodBrkSide NeighborhoodCollgCr NeighborhoodCrawfor
## 1   -0.0948832          -0.2036157           2.9496927          -0.1904573
## 2   -0.0948832          -0.2036157          -0.3387855          -0.1904573
## 3   -0.0948832          -0.2036157           2.9496927          -0.1904573
## 4   -0.0948832          -0.2036157          -0.3387855           5.2469132
## 5   -0.0948832          -0.2036157          -0.3387855          -0.1904573
## 6   -0.0948832          -0.2036157          -0.3387855          -0.1904573
##   NeighborhoodEdwards NeighborhoodGilbert NeighborhoodMitchel NeighborhoodNAmes
## 1          -0.2670711          -0.2394404          -0.1845738        -0.4273789
## 2          -0.2670711          -0.2394404          -0.1845738        -0.4273789
## 3          -0.2670711          -0.2394404          -0.1845738        -0.4273789
## 4          -0.2670711          -0.2394404          -0.1845738        -0.4273789
## 5          -0.2670711          -0.2394404          -0.1845738        -0.4273789
## 6          -0.2670711          -0.2394404           5.4141654        -0.4273789
##   NeighborhoodNoRidge NeighborhoodNridgHt NeighborhoodNWAmes
## 1          -0.1701628          -0.2362186         -0.2296683
## 2          -0.1701628          -0.2362186         -0.2296683
## 3          -0.1701628          -0.2362186         -0.2296683
## 4          -0.1701628          -0.2362186         -0.2296683
## 5           5.8726903          -0.2362186         -0.2296683
## 6          -0.1701628          -0.2362186         -0.2296683
##   NeighborhoodOldTown NeighborhoodSawyer NeighborhoodSawyerW
## 1          -0.2899693          -0.2313197          -0.205437
## 2          -0.2899693          -0.2313197          -0.205437
## 3          -0.2899693          -0.2313197          -0.205437
## 4          -0.2899693          -0.2313197          -0.205437
## 5          -0.2899693          -0.2313197          -0.205437
## 6          -0.2899693          -0.2313197          -0.205437
##   NeighborhoodSomerst NeighborhoodTimber Condition1Pos Condition1St
## 1          -0.2504608          -0.1636457    -0.1347937   -0.3103536
## 2          -0.2504608          -0.1636457    -0.1347937    3.2199184
## 3          -0.2504608          -0.1636457    -0.1347937   -0.3103536
## 4          -0.2504608          -0.1636457    -0.1347937   -0.3103536
## 5          -0.2504608          -0.1636457    -0.1347937   -0.3103536
## 6          -0.2504608          -0.1636457    -0.1347937   -0.3103536
##   Condition1Norm Condition2Pos Condition2St Condition2Norm BldgTypeMultiFam
## 1      0.3965912   -0.03707521  -0.07430389     0.09849909       -0.2457846
## 2     -2.5197563   -0.03707521  -0.07430389     0.09849909       -0.2457846
## 3      0.3965912   -0.03707521  -0.07430389     0.09849909       -0.2457846
## 4      0.3965912   -0.03707521  -0.07430389     0.09849909       -0.2457846
## 5      0.3965912   -0.03707521  -0.07430389     0.09849909       -0.2457846
## 6      0.3965912   -0.03707521  -0.07430389     0.09849909       -0.2457846
##   BldgTypeTwnhs BldgTypeTwnhsE HouseStyle1.5Unf HouseStyleEqMore2story
## 1    -0.1743869      -0.291358      -0.09849909              1.4922637
## 2    -0.1743869      -0.291358      -0.09849909             -0.6696626
## 3    -0.1743869      -0.291358      -0.09849909              1.4922637
## 4    -0.1743869      -0.291358      -0.09849909              1.4922637
## 5    -0.1743869      -0.291358      -0.09849909              1.4922637
## 6    -0.1743869      -0.291358      -0.09849909             -0.6696626
##   HouseStyle2.5Unf OverallQual OverallCond  YearBuilt YearRemodAdd
## 1      -0.08721943  0.65773626  -0.5162934  1.0519124    0.8788637
## 2      -0.08721943 -0.06831681   2.1780550  0.1582813   -0.4287051
```

```
## 3     -0.08721943  0.65773626 -0.5162934  0.9857175     0.8304352
## 4     -0.08721943  0.65773626 -0.5162934 -1.8606631    -0.7192759
## 5     -0.08721943  1.38378933 -0.5162934  0.9526201     0.7335783
## 6     -0.08721943 -0.79436987 -0.5162934  0.7209379     0.4914359
##   RoofStyleGable RoofStyleHip Exterior1stBrkFace Exterior1stCemntBd
## 1      0.5071129   -0.4920919         -0.1885138         -0.2072448
## 2      0.5071129   -0.4920919         -0.1885138         -0.2072448
## 3      0.5071129   -0.4920919         -0.1885138         -0.2072448
## 4      0.5071129   -0.4920919         -0.1885138         -0.2072448
## 5      0.5071129   -0.4920919         -0.1885138         -0.2072448
## 6      0.5071129   -0.4920919         -0.1885138         -0.2072448
##   Exterior1stHdBoard Exterior1stMetalSd Exterior1stPlywood Exterior1stVinylSd
## 1         -0.4240038         -0.4217479         -0.2801153          1.3512696
## 2         -0.4240038          2.3694563         -0.2801153         -0.7395365
## 3         -0.4240038         -0.4217479         -0.2801153          1.3512696
## 4         -0.4240038         -0.4217479         -0.2801153         -0.7395365
## 5         -0.4240038         -0.4217479         -0.2801153          1.3512696
## 6         -0.4240038         -0.4217479         -0.2801153          1.3512696
##   Exterior1stWd Sdng Exterior2ndTRUE MasVnrTypeBrkFace MasVnrTypeNone
## 1        -0.4058162      -0.3221727        1.5067680     -1.2042349
## 2        -0.4058162      -0.3221727       -0.6632164      0.8298324
## 3        -0.4058162      -0.3221727        1.5067680     -1.2042349
## 4         2.4624771       3.1017938       -0.6632164      0.8298324
## 5        -0.4058162      -0.3221727        1.5067680     -1.2042349
## 6        -0.4058162      -0.3221727       -0.6632164      0.8298324
##   MasVnrTypeStone MasVnrTypemissing MasVnrArea ExterQualFa ExterQualGd
## 1      -0.3076878       -0.07430389  0.5227310 -0.09849909   1.4100945
## 2      -0.3076878       -0.07430389 -0.5710628 -0.09849909  -0.7086853
## 3      -0.3076878       -0.07430389  0.3329913 -0.09849909   1.4100945
## 4      -0.3076878       -0.07430389 -0.5710628 -0.09849909  -0.7086853
## 5      -0.3076878       -0.07430389  1.3821405 -0.09849909   1.4100945
## 6      -0.3076878       -0.07430389 -0.5710628 -0.09849909  -0.7086853
##   ExterQualTA ExterCondFa ExterCondGd ExterCondTA FoundationCBlock
## 1  -1.2811480  -0.1399799  -0.3324555   0.3718794        -0.875479
## 2   0.7800139  -0.1399799  -0.3324555   0.3718794         1.141447
## 3  -1.2811480  -0.1399799  -0.3324555   0.3718794        -0.875479
## 4   0.7800139  -0.1399799  -0.3324555   0.3718794        -0.875479
## 5  -1.2811480  -0.1399799  -0.3324555   0.3718794        -0.875479
## 6   0.7800139  -0.1399799  -0.3324555   0.3718794        -0.875479
##   FoundationPConc FoundationSlab FoundationStone FoundationWood BsmtQualFa
## 1       1.1209374     -0.1294151     -0.06430466    -0.04542329 -0.1568873
## 2      -0.8914977     -0.1294151     -0.06430466    -0.04542329 -0.1568873
## 3       1.1209374     -0.1294151     -0.06430466    -0.04542329 -0.1568873
## 4      -0.8914977     -0.1294151     -0.06430466    -0.04542329 -0.1568873
## 5       1.1209374     -0.1294151     -0.06430466    -0.04542329 -0.1568873
## 6      -0.8914977     -0.1294151     -0.06430466    22.00001561 -0.1568873
##   BsmtQualGd BsmtQualTA BsmtQualnone BsmtCondGd  BsmtCondPo BsmtCondTA
## 1  1.1657065 -0.8952259   -0.1614212 -0.2160946 -0.03707521  0.3375252
## 2  1.1657065 -0.8952259   -0.1614212 -0.2160946 -0.03707521  0.3375252
## 3  1.1657065 -0.8952259   -0.1614212 -0.2160946 -0.03707521  0.3375252
## 4 -0.8572597  1.1162693   -0.1614212  4.6244245 -0.03707521 -2.9607073
## 5  1.1657065 -0.8952259   -0.1614212 -0.2160946 -0.03707521  0.3375252
## 6  1.1657065 -0.8952259   -0.1614212 -0.2160946 -0.03707521  0.3375252
##   BsmtCondnone BsmtExposureGd BsmtExposureMn BsmtExposureNo BsmtExposurenone
```

```
## 1   -0.1614212   -0.3156413   -0.291358    0.7262537   -0.1636457
## 2   -0.1614212    3.1659776   -0.291358   -1.3759836   -0.1636457
## 3   -0.1614212   -0.3156413    3.429846   -1.3759836   -0.1636457
## 4   -0.1614212   -0.3156413   -0.291358    0.7262537   -0.1636457
## 5   -0.1614212   -0.3156413   -0.291358   -1.3759836   -0.1636457
## 6   -0.1614212   -0.3156413   -0.291358    0.7262537   -0.1636457
##    BsmtFinType1BLQ BsmtFinType1GLQ BsmtFinType1LwQ BsmtFinType1Rec
## 1       -0.336262        1.5805958      -0.2313197       -0.3169543
## 2       -0.336262       -0.6322383      -0.2313197       -0.3169543
## 3       -0.336262        1.5805958      -0.2313197       -0.3169543
## 4       -0.336262       -0.6322383      -0.2313197       -0.3169543
## 5       -0.336262        1.5805958      -0.2313197       -0.3169543
## 6       -0.336262        1.5805958      -0.2313197       -0.3169543
##    BsmtFinType1Unf BsmtFinType1none BsmtFinSF1 BsmtFinType2BLQ BsmtFinType2GLQ
## 1       -0.6460918       -0.1614212  0.6163091      -0.1522318     -0.09849909
## 2       -0.6460918       -0.1614212  1.2443277      -0.1522318     -0.09849909
## 3       -0.6460918       -0.1614212  0.1083530      -0.1522318     -0.09849909
## 4       -0.6460918       -0.1614212 -0.5150478      -0.1522318     -0.09849909
## 5       -0.6460918       -0.1614212  0.4985557      -0.1522318     -0.09849909
## 6       -0.6460918       -0.1614212  0.6763403      -0.1522318     -0.09849909
##    BsmtFinType2LwQ BsmtFinType2Rec BsmtFinType2Unf BsmtFinType2none BsmtFinSF2
## 1       -0.1805594      -0.1961886       0.4035188       -0.1636457 -0.2889829
## 2       -0.1805594      -0.1961886       0.4035188       -0.1636457 -0.2889829
## 3       -0.1805594      -0.1961886       0.4035188       -0.1636457 -0.2889829
## 4       -0.1805594      -0.1961886       0.4035188       -0.1636457 -0.2889829
## 5       -0.1805594      -0.1961886       0.4035188       -0.1636457 -0.2889829
## 6       -0.1805594      -0.1961886       0.4035188       -0.1636457 -0.2889829
##      BsmtUnfSF TotalBsmtSF HeatingGasW HeatingOther HeatingQCFa HeatingQCGd
## 1 -0.94263948  -0.4739156  -0.1118427  -0.09849909  -0.1865528  -0.4452164
## 2 -0.63973094   0.5040178  -0.1118427  -0.09849909  -0.1865528  -0.4452164
## 3 -0.30065423  -0.3197586  -0.1118427  -0.09849909  -0.1865528  -0.4452164
## 4 -0.06104002  -0.7147859  -0.1118427  -0.09849909  -0.1865528   2.2445559
## 5 -0.17406559   0.2221995  -0.1118427  -0.09849909  -0.1865528  -0.4452164
## 6 -1.13704346  -0.6184378  -0.1118427  -0.09849909  -0.1865528  -0.4452164
##    HeatingQCPo HeatingQCTA CentralAirY ElectricalOther `1stFlrSF` `2ndFlrSF`
## 1 -0.02620712  -0.6428905   0.2641092       0.3050068 -0.8131311  1.1667394
## 2 -0.02620712  -0.6428905   0.2641092       0.3050068  0.2778749 -0.7939241
## 3 -0.02620712  -0.6428905   0.2641092       0.3050068 -0.6411499  1.1942897
## 4 -0.02620712  -0.6428905   0.2641092       0.3050068 -0.5309744  0.9417453
## 5 -0.02620712  -0.6428905   0.2641092       0.3050068 -0.0365283  1.6236154
## 6 -0.02620712  -0.6428905   0.2641092       0.3050068 -0.9743635  0.5055321
##    LowQualFinSF  GrLivArea BsmtFullBath BsmtHalfBath   FullBath   HalfBath
## 1   -0.1203678  0.3933414    1.1136720   -0.2413283  0.7930271  1.2278772
## 2   -0.1203678 -0.4888946   -0.8189936    3.9416954  0.7930271 -0.7607649
## 3   -0.1203678  0.5430064    1.1136720   -0.2413283  0.7930271  1.2278772
## 4   -0.1203678  0.4071263    1.1136720   -0.2413283 -1.0253153 -0.7607649
## 5   -0.1203678  1.3543484    1.1136720   -0.2413283  0.7930271  1.2278772
## 6   -0.1203678 -0.2919669    1.1136720   -0.2413283 -1.0253153  1.2278772
##    BedroomAbvGr KitchenAbvGr KitchenQualFa KitchenQualGd KitchenQualTA
## 1     0.1649022   -0.2116841    -0.1658434     1.2197813    -1.0079297
## 2     0.1649022   -0.2116841    -0.1658434    -0.8192561     0.9914513
## 3     0.1649022   -0.2116841    -0.1658434     1.2197813    -1.0079297
## 4     0.1649022   -0.2116841    -0.1658434     1.2197813    -1.0079297
## 5     1.3898900   -0.2116841    -0.1658434     1.2197813    -1.0079297
```

```
## 6   -2.2850733   -0.2116841   -0.1658434   -0.8192561    0.9914513
##    TotRmsAbvGrd FunctionalTRUE Fireplaces FireplaceQuFa FireplaceQuGd
## 1    0.9215787      0.2714695 -0.9506594    -0.1522318    -0.5908956
## 2   -0.3156906      0.2714695  0.6063261    -0.1522318    -0.5908956
## 3   -0.3156906      0.2714695  0.6063261    -0.1522318    -0.5908956
## 4    0.3029440      0.2714695  0.6063261    -0.1522318     1.6911840
## 5    1.5402134      0.2714695  0.6063261    -0.1522318    -0.5908956
## 6   -0.9343253      0.2714695 -0.9506594    -0.1522318    -0.5908956
##    FireplaceQunone FireplaceQuPo FireplaceQuTA GarageTypeBuiltIn
## 1        1.0532723    -0.1149474    -0.5231182        -0.2520047
## 2       -0.9487701    -0.1149474     1.9103008        -0.2520047
## 3       -0.9487701    -0.1149474     1.9103008        -0.2520047
## 4       -0.9487701    -0.1149474    -0.5231182        -0.2520047
## 5       -0.9487701    -0.1149474     1.9103008        -0.2520047
## 6        1.0532723    -0.1149474    -0.5231182        -0.2520047
##    GarageTypeDetchd GarageTypenone GarageTypeOther GarageFinishnone
## 1       -0.6014748     -0.2426286      -0.1545754       -0.2426286
## 2       -0.6014748     -0.2426286      -0.1545754       -0.2426286
## 3       -0.6014748     -0.2426286      -0.1545754       -0.2426286
## 4        1.6614382     -0.2426286      -0.1545754       -0.2426286
## 5       -0.6014748     -0.2426286      -0.1545754       -0.2426286
## 6       -0.6014748     -0.2426286      -0.1545754       -0.2426286
##    GarageFinishRFn GarageFinishUnf GarageCars   GarageArea GarageQualTA
## 1        1.5647856      -0.8416848  0.3124708   0.35714633     0.336262
## 2        1.5647856      -0.8416848  0.3124708  -0.05724160     0.336262
## 3        1.5647856      -0.8416848  0.3124708   0.63968355     0.336262
## 4       -0.6386262       1.1872772  1.6505811   0.79978798     0.336262
## 5        1.5647856      -0.8416848  1.6505811   1.71332501     0.336262
## 6       -0.6386262       1.1872772  0.3124708   0.03693747     0.336262
##    GarageQualPo GarageQualnone GarageCondPo GarageCondnone GarageCondTA
## 1    -0.1904573     -0.2426286   -0.1722863     -0.2426286    0.3169543
## 2    -0.1904573     -0.2426286   -0.1722863     -0.2426286    0.3169543
## 3    -0.1904573     -0.2426286   -0.1722863     -0.2426286    0.3169543
## 4    -0.1904573     -0.2426286   -0.1722863     -0.2426286    0.3169543
## 5    -0.1904573     -0.2426286   -0.1722863     -0.2426286    0.3169543
## 6    -0.1904573     -0.2426286   -0.1722863     -0.2426286    0.3169543
##    PavedDriveP PavedDriveY WoodDeckSF OpenPorchSF EnclosedPorch `3SsnPorch`
## 1   -0.1449945   0.2995975 -0.7509470  0.22795792    -0.3597584  -0.1164611
## 2   -0.1449945   0.2995975  1.6380585 -0.70824437    -0.3597584  -0.1164611
## 3   -0.1449945   0.2995975 -0.7509470 -0.06364607    -0.3597584  -0.1164611
## 4   -0.1449945   0.2995975 -0.7509470 -0.17107912     4.0852491  -0.1164611
## 5   -0.1449945   0.2995975  0.7882780  0.58095223    -0.3597584  -0.1164611
## 6   -0.1449945   0.2995975 -0.4302752 -0.24781701    -0.3597584  10.7838145
##    ScreenPorch    PoolArea    PoolQCFa PoolQCOther  FenceGdWo FenceMnPrv
## 1   -0.2705135 -0.05222247 -0.03707521  0.05246836 -0.1961886  -0.347533
## 2   -0.2705135 -0.05222247 -0.03707521  0.05246836 -0.1961886  -0.347533
## 3   -0.2705135 -0.05222247 -0.03707521  0.05246836 -0.1961886  -0.347533
## 4   -0.2705135 -0.05222247 -0.03707521  0.05246836 -0.1961886  -0.347533
## 5   -0.2705135 -0.05222247 -0.03707521  0.05246836 -0.1961886  -0.347533
## 6   -0.2705135 -0.05222247 -0.03707521  0.05246836 -0.1961886   2.875448
##     FenceMnWw  Fencenone MiscFeatureOther MiscFeatureShed MiscFeatureTenC
## 1 -0.08721943  0.4867037      -0.03707521     -0.1865528     -0.02620712
## 2 -0.08721943  0.4867037      -0.03707521     -0.1865528     -0.02620712
## 3 -0.08721943  0.4867037      -0.03707521     -0.1865528     -0.02620712
```

```
## 4 -0.08721943  0.4867037      -0.03707521      -0.1865528      -0.02620712
## 5 -0.08721943  0.4867037      -0.03707521      -0.1865528      -0.02620712
## 6 -0.08721943 -2.0532269      -0.03707521       5.3567308      -0.02620712
##    MiscFeatureNone      MiscVal      MoSold      YrSold SaleTypeOther SaleTypeNew
## 1         0.1961886 -0.08777895 -1.5995777  0.1374787    -0.1399799  -0.2995975
## 2         0.1961886 -0.08777895 -0.4891271 -0.6150365    -0.1399799  -0.2995975
## 3         0.1961886 -0.08777895  0.9914738  0.1374787    -0.1399799  -0.2995975
## 4         0.1961886 -0.08777895 -1.5995777 -1.3675518    -0.1399799  -0.2995975
## 5         0.1961886 -0.08777895  2.1019244  0.1374787    -0.1399799  -0.2995975
## 6        -5.0936363  1.32124085  1.3616240  0.8899940    -0.1399799  -0.2995975
##    SaleTypeWD SaleConditionAdjLand SaleConditionAlloca SaleConditionFamily
## 1  0.3884385          -0.05246836         -0.08721943             -0.1179746
## 2  0.3884385          -0.05246836         -0.08721943             -0.1179746
## 3  0.3884385          -0.05246836         -0.08721943             -0.1179746
## 4  0.3884385          -0.05246836         -0.08721943             -0.1179746
## 5  0.3884385          -0.05246836         -0.08721943             -0.1179746
## 6  0.3884385          -0.05246836         -0.08721943             -0.1179746
##    SaleConditionNormal SaleConditionPartial
## 1            0.4650007           -0.3036605
## 2            0.4650007           -0.3036605
## 3            0.4650007           -0.3036605
## 4           -2.1490573           -0.3036605
## 5            0.4650007           -0.3036605
## 6            0.4650007           -0.3036605
```
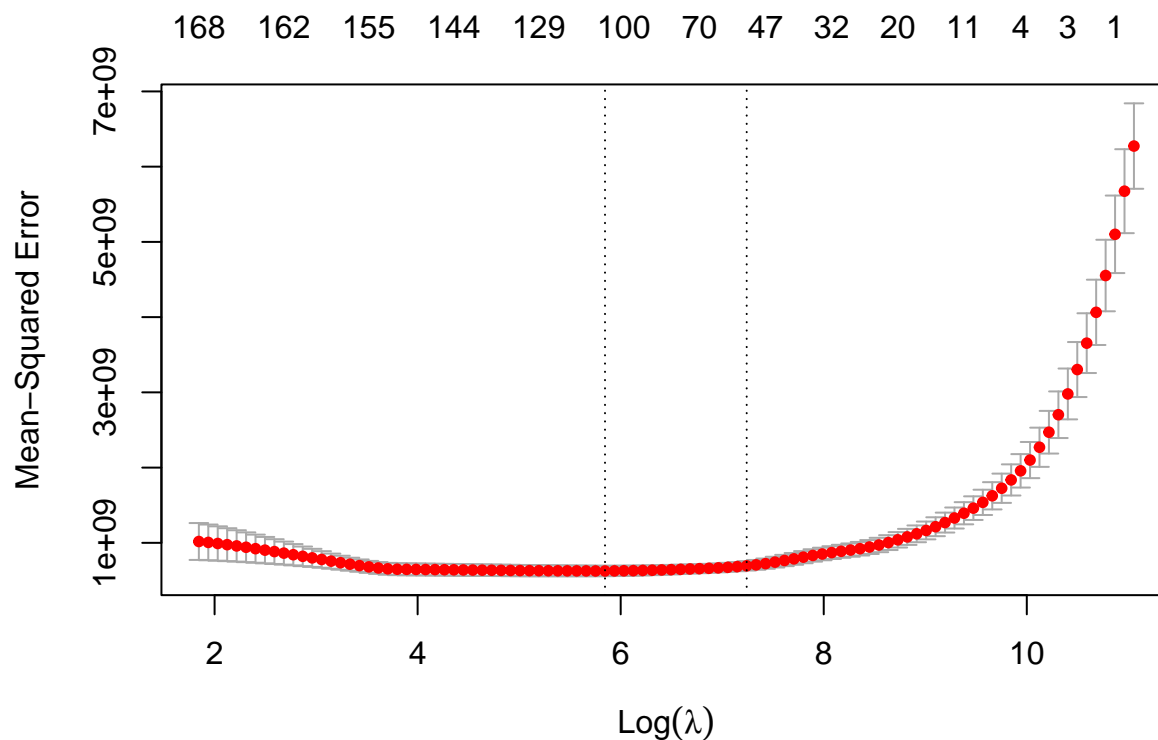
```r
fit.ridge <- glmnet(x=X.sd, y=new.train$SalePrice, alpha=1)
plot(fit.ridge, xvar="lambda", label=TRUE)
```
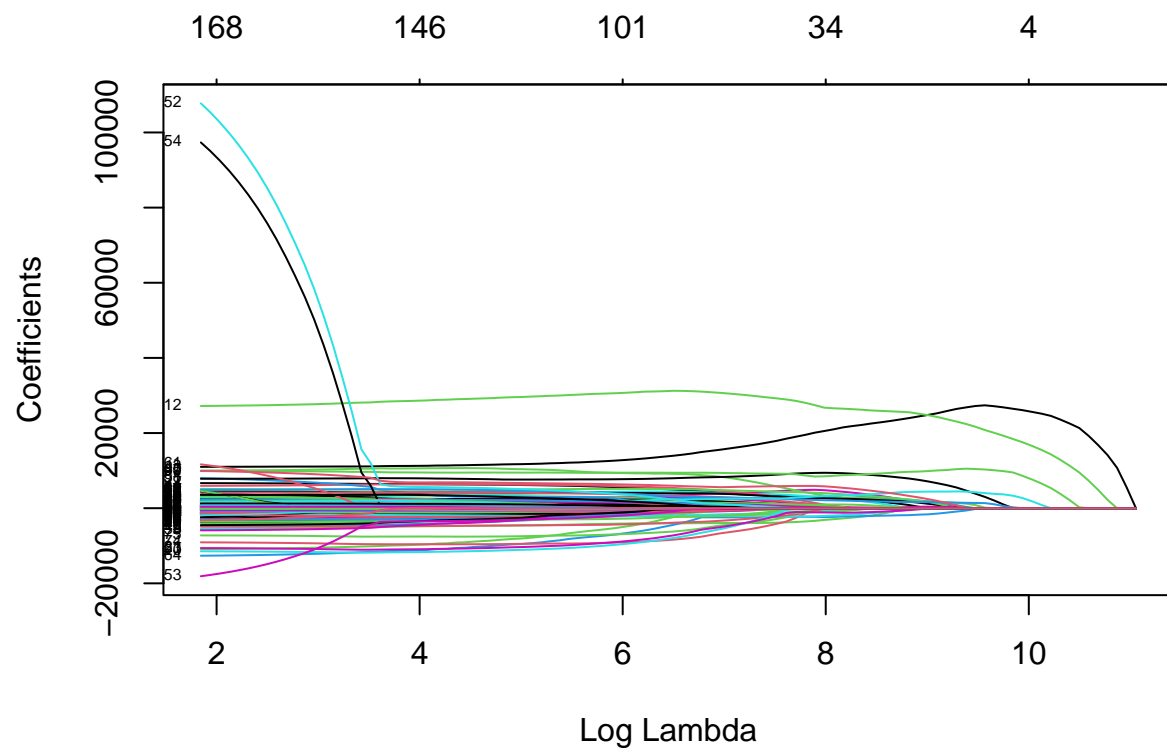
```
cross.val <- cv.glmnet(x=X.sd, y=new.train$SalePrice, alpha=1)
plot(cross.val)
```

```
fit.ridge.opt <- glmnet(x=X, y=new.train$SalePrice,
                        lambda=cross.val$lambda.min,
                        alpha = 1, standardize = TRUE)
coef(fit.ridge.opt)
```

```
## 174 x 1 sparse Matrix of class "dgCMatrix"
##                                      s0
## (Intercept)                 -8.259052e+05
## MSSubClass1S SF other             .
## MSSubClassmulti-level SF non PUD  .
## MSSubClassother             -1.117595e+04
## MSZoningRL                        .
## MSZoningRO                  -6.000384e+03
## MSZoningother               -1.815478e+04
## LotArea                      5.786323e-01
## StreetPave                   2.204828e+04
## AlleyPave                         .
## Alleynone                    2.911653e+02
## LotShapeReg                 -8.629965e+02
## LandContourLvl                    .
## LotConfigInside             -5.308730e+02
## LandSlopeMod                 1.670291e+03
## LandSlopeSev                -2.306695e+04
## NeighborhoodBrkSide          5.161351e+03
## NeighborhoodCollgCr         -1.662617e+03
## NeighborhoodCrawfor          1.587633e+04
```

```
## NeighborhoodEdwards            -4.413062e+03
## NeighborhoodGilbert            -2.977639e+03
## NeighborhoodMitchel            -1.132065e+04
## NeighborhoodNAmes              -5.015472e+03
## NeighborhoodNoRidge             2.626549e+04
## NeighborhoodNridgHt             1.103000e+04
## NeighborhoodNWAmes             -7.248741e+03
## NeighborhoodOldTown            -1.019383e+03
## NeighborhoodSawyer              .
## NeighborhoodSawyerW             .
## NeighborhoodSomerst             4.019113e+03
## NeighborhoodTimber            -6.033296e+03
## Condition1Pos                   .
## Condition1St                    .
## Condition1Norm                  8.475746e+03
## Condition2Pos                   .
## Condition2St                    .
## Condition2Norm                  .
## BldgTypeMultiFam                .
## BldgTypeTwnhs                 -4.987510e+03
## BldgTypeTwnhsE                  .
## HouseStyle1.5Unf                2.338762e+03
## HouseStyleEqMore2story          .
## HouseStyle2.5Unf              -4.312861e+03
## OverallQual                     9.115487e+03
## OverallCond                     5.309453e+03
## YearBuilt                       3.113292e+02
## YearRemodAdd                    9.254442e+01
## RoofStyleGable                  .
## RoofStyleHip                    .
## Exterior1stBrkFace              1.268560e+04
## Exterior1stCemntBd              2.623921e+03
## Exterior1stHdBoard              .
## Exterior1stMetalSd              .
## Exterior1stPlywood            -4.296864e+03
## Exterior1stVinylSd              .
## Exterior1stWd Sdng            -1.073920e+03
## Exterior2ndTRUE                 .
## MasVnrTypeBrkFace               .
## MasVnrTypeNone                  5.784317e+03
## MasVnrTypeStone                 6.543236e+03
## MasVnrTypemissing               .
## MasVnrArea                      2.290265e+01
## ExterQualFa                     .
## ExterQualGd                   -1.211680e+04
## ExterQualTA                   -1.524728e+04
## ExterCondFa                     .
## ExterCondGd                   -1.633488e+03
## ExterCondTA                     .
## FoundationCBlock                .
## FoundationPConc                 1.178527e+03
## FoundationSlab                  .
## FoundationStone                 .
## FoundationWood                -1.689674e+04
```

```
## BsmtQualFa                   -7.988463e+03
## BsmtQualGd                   -1.853833e+04
## BsmtQualTA                   -1.414379e+04
## BsmtQualnone                  9.551169e+02
## BsmtCondGd                    .
## BsmtCondPo                    1.363626e+03
## BsmtCondTA                    1.684847e+03
## BsmtCondnone                  .
## BsmtExposureGd                1.787487e+04
## BsmtExposureMn                .
## BsmtExposureNo               -4.312573e+03
## BsmtExposurenone              .
## BsmtFinType1BLQ               .
## BsmtFinType1GLQ               2.410109e+03
## BsmtFinType1LwQ              -2.988043e+03
## BsmtFinType1Rec              -1.548431e+03
## BsmtFinType1Unf               .
## BsmtFinType1none              4.425613e+02
## BsmtFinSF1                    1.776360e+01
## BsmtFinType2BLQ               .
## BsmtFinType2GLQ               6.899397e+03
## BsmtFinType2LwQ              -1.306446e+03
## BsmtFinType2Rec               .
## BsmtFinType2Unf               .
## BsmtFinType2none              .
## BsmtFinSF2                    1.825270e+00
## BsmtUnfSF                     .
## TotalBsmtSF                   2.267220e+01
## HeatingGasW                  -2.074639e+03
## HeatingOther                  .
## HeatingQCFa                   .
## HeatingQCGd                  -1.637200e+03
## HeatingQCPo                   .
## HeatingQCTA                  -1.757291e+03
## CentralAirY                   .
## ElectricalOther              -4.378066e+01
## `1stFlrSF`                    .
## `2ndFlrSF`                    .
## LowQualFinSF                 -3.769821e+01
## GrLivArea                     6.001875e+01
## BsmtFullBath                  8.233893e+02
## BsmtHalfBath                 -9.276196e+02
## FullBath                      8.663011e+02
## HalfBath                      4.836926e+02
## BedroomAbvGr                 -5.360134e+03
## KitchenAbvGr                 -1.292232e+04
## KitchenQualFa                -1.193007e+04
## KitchenQualGd                -2.031852e+04
## KitchenQualTA                -1.851410e+04
## TotRmsAbvGrd                  7.268839e+02
## FunctionalTRUE                1.489972e+04
## Fireplaces                    6.787334e+02
## FireplaceQuFa                -2.288607e+03
## FireplaceQuGd                 .
```

```
## FireplaceQunone                        .
## FireplaceQuPo                          .
## FireplaceQuTA                          .
## GarageTypeBuiltIn              6.833931e+03
## GarageTypeDetchd                        .
## GarageTypenone                          .
## GarageTypeOther               -5.711578e+03
## GarageFinishnone                        .
## GarageFinishRFn               -2.145903e+03
## GarageFinishUnf                         .
## GarageCars                     5.455745e+03
## GarageArea                     9.060960e+00
## GarageQualTA                  -4.366900e+03
## GarageQualPo                  -7.098551e+03
## GarageQualnone                          .
## GarageCondPo                  -1.981130e+03
## GarageCondnone                          .
## GarageCondTA                            .
## PavedDriveP                   -2.280439e+03
## PavedDriveY                             .
## WoodDeckSF                     1.239317e+01
## OpenPorchSF                    1.111969e+01
## EnclosedPorch                 -4.711221e-01
## `3SsnPorch`                    1.174859e+01
## ScreenPorch                    3.255403e+01
## PoolArea                       1.350333e+02
## PoolQCFa                      -6.002983e+04
## PoolQCOther                             .
## FenceGdWo                               .
## FenceMnPrv                     8.753407e+02
## FenceMnWw                     -4.527517e+02
## Fencenone                               .
## MiscFeatureOther                        .
## MiscFeatureShed                         .
## MiscFeatureTenC               -8.149977e+03
## MiscFeatureNone                         .
## MiscVal                                 .
## MoSold                        -5.839153e+01
## YrSold                                  .
## SaleTypeOther                  4.245176e+03
## SaleTypeNew                    2.329541e+04
## SaleTypeWD                              .
## SaleConditionAdjLand           2.497289e+03
## SaleConditionAlloca                     .
## SaleConditionFamily                     .
## SaleConditionNormal            5.425965e+03
## SaleConditionPartial                    .
```

`predict(fit.lasso.opt, newx=test)` raises an error regarding the number of variables. This is because the fit function creates dummy variables. We must model the test set to have the same structure as the modeled training set (175 variables).

```
predicted.ridge <- test %>%
  select(-Id) %>%
  model.matrix(as.formula("~."), .) %>%
```

```
    tibble::as_tibble() %>%
    select(., -setdiff(colnames(.), colnames(X))) %>%
    as.matrix() %>%
    predict(fit.ridge.opt, newx=.)
SubmitDF <- data.frame(test$Id, predicted.ridge)
colnames(SubmitDF) <- c("Id", "SalePrice")
write.csv(file='../submissions/ridge2.csv', SubmitDF, row.names = FALSE)
```