

Lasso

Thomas FitzGerald and Mei Maddox

2022-10-13

```
## Warning: Unknown levels in `f`: 2.5Fin
## Warning: Unknown levels in `f`: ImStucc, Stone
## Warning in xtfrm.data.frame(x): cannot xtfrm data frames
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## Warning in xtfrm.data.frame(x): cannot xtfrm data frames
## Warning in xtfrm.data.frame(x): cannot xtfrm data frames
fit.all <- train %>% select(-Id) %>%
  lm(log(SalePrice) ~ ., data=.)
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 MSZoningR0 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	

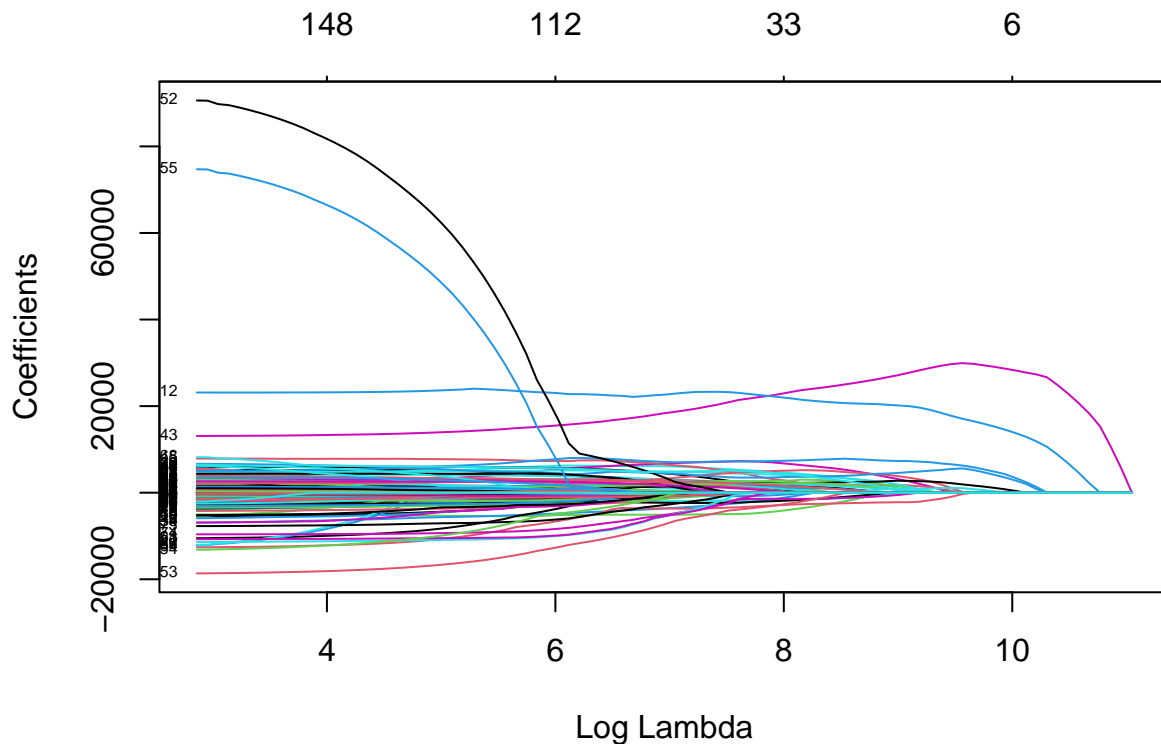
## 1	0.5094397	-0.4934012	-0.1882464	-0.2087408		
## 2	0.5094397	-0.4934012	-0.1882464	-0.2087408		
## 3	0.5094397	-0.4934012	-0.1882464	-0.2087408		
## 4	0.5094397	-0.4934012	-0.1882464	-0.2087408		
## 5	0.5094397	-0.4934012	-0.1882464	-0.2087408		
## 6	0.5094397	-0.4934012	-0.1882464	-0.2087408		
##	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	

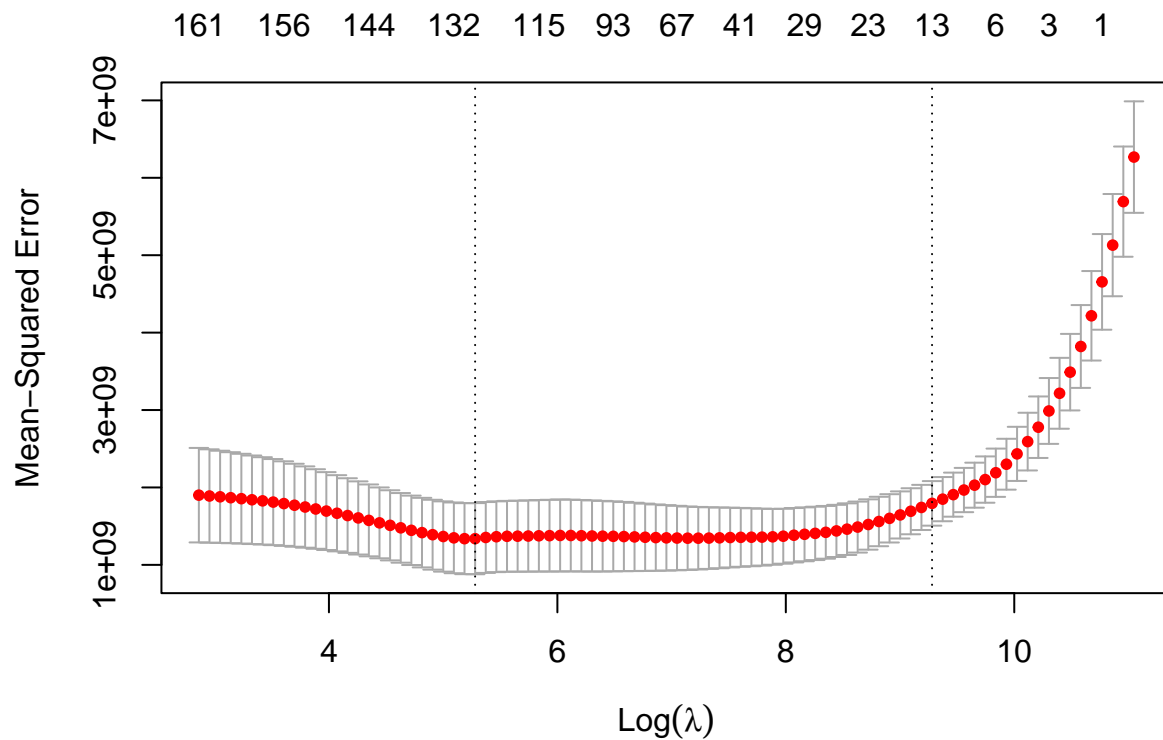
## 4	0.2966616	0.2710702	0.6002892	-0.1520184	1.6852770
## 5	1.5271330	0.2710702	0.6002892	-0.1520184	-0.5929678
## 6	-0.9338098	0.2710702	-0.9509007	-0.1520184	-0.5929678
##	FireplaceQunone	FireplaceQuPo	FireplaceQuTA	GarageTypeBuiltIn	
## 1	1.0560197	-0.1178108	-0.5222058	-0.2531719	
## 2	-0.9463034	-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
```

```
fit.lasso <- glmnet(x=X.sd, y=train$SalePrice, alpha=1)
plot(fit.lasso, xvar="lambda", label=TRUE)
```



```
cross.val <- cv.glmnet(x=X.sd, y=train$SalePrice, alpha=1)
plot(cross.val)
```



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

```
## 175 x 1 sparse Matrix of class "dgCMatrix"
##                                     s0
## (Intercept)                       -1.239160e+06
## MSSubClass1S SF other              -2.586675e+03
## MSSubClassmulti-level SF non PUD  -2.294972e+03
## MSSubClassother                   -1.451306e+04
## MSZoningRL                        .
## MSZoningR0                        -7.319622e+03
## MSZoningother                     -2.497329e+04
## LotArea                           4.912030e-01
## StreetPave                        2.522190e+04
## AlleyPave                         .
## Alleynone                         8.868484e+02
## LotShapeReg                       -4.242580e+02
## LandContourLvl                    4.019050e+03
## LotConfigInside                   -9.941754e+02
## LandSlopeMod                      7.293095e+03
## LandSlopeSev                     -1.544414e+04
## NeighborhoodBrkSide               5.614150e+02
## NeighborhoodCollgCr              -6.271326e+03
## NeighborhoodCrawfor               1.503774e+04
```

## NeighborhoodEdwards	-1.595523e+04
## NeighborhoodGilbert	-8.485790e+03
## NeighborhoodMitchel	-1.176207e+04
## NeighborhoodNAMES	-1.116128e+04
## NeighborhoodNoRidge	3.248206e+04
## NeighborhoodNridgHt	1.628204e+04
## NeighborhoodNWAmes	-1.132688e+04
## NeighborhoodOldTown	-4.162577e+03
## NeighborhoodSawyer	-5.960613e+03
## NeighborhoodSawyerW	-2.993265e+03
## NeighborhoodSomerst	3.572824e+03
## NeighborhoodTimber	-7.195687e+03
## Condition1Pos	.
## Condition1St	-4.695565e+02
## Condition1Norm	9.503227e+03
## Condition2Pos	-1.221074e+05
## Condition2St	.
## Condition2Norm	.
## BldgTypeMultiFam	.
## BldgTypeTwnhs	-9.851839e+03
## BldgTypeTwnhsE	-1.629377e+03
## HouseStyle1.5Unf	1.921210e+03
## HouseStyleEqMore2story	-4.118433e+03
## HouseStyle2.5Unf	.
## OverallQual	1.032784e+04
## OverallCond	5.333437e+03
## YearBuilt	2.555870e+02
## YearRemodAdd	7.373508e+01
## RoofStyleGable	.
## RoofStyleHip	4.016863e+02
## Exterior1stBrkFace	1.727904e+04
## Exterior1stCemntBd	3.628005e+03
## Exterior1stHdBoard	.
## Exterior1stMetalSd	1.864798e+03
## Exterior1stPlywood	.
## Exterior1stVinylSd	2.405263e+03
## Exterior1stWd Sdng	-9.438337e+01
## Exterior2ndTRUE	-3.214777e+02
## MasVnrTypeBrkFace	.
## MasVnrTypeNone	5.240739e+03
## MasVnrTypeStone	3.146648e+03
## MasVnrTypemissing	.
## MasVnrArea	2.222380e+01
## ExterQualFa	-7.027325e+03
## ExterQualGd	-1.628841e+04
## ExterQualTA	-2.094063e+04
## ExterCondFa	.
## ExterCondGd	-2.645567e+03
## ExterCondTA	.
## FoundationCBBlock	.
## FoundationPConc	3.943192e+02
## FoundationSlab	-1.876229e+03
## FoundationStone	3.440421e+03
## FoundationWood	-1.854257e+04

## BsmtQualFa	-9.696021e+03
## BsmtQualGd	-1.845673e+04
## BsmtQualTA	-1.381765e+04
## BsmtQualnone	.
## BsmtCondGd	.
## BsmtCondPo	9.976294e+03
## BsmtCondTA	2.961677e+03
## BsmtCondnone	.
## BsmtExposureGd	1.708976e+04
## BsmtExposureMn	.
## BsmtExposureNo	-5.359721e+03
## BsmtExposurenone	-6.436874e+03
## BsmtFinType1BLQ	1.517731e+03
## BsmtFinType1GLQ	3.264159e+03
## BsmtFinType1LwQ	-2.331664e+03
## BsmtFinType1Rec	.
## BsmtFinType1Unf	-2.756283e+03
## BsmtFinType1none	.
## BsmtFinSF1	6.834670e+00
## BsmtFinType2BLQ	-2.533861e+03
## BsmtFinType2GLQ	4.721596e+03
## BsmtFinType2LwQ	-2.797719e+03
## BsmtFinType2Rec	-1.018765e+03
## BsmtFinType2Unf	.
## BsmtFinType2none	.
## BsmtFinSF2	2.659810e-01
## BsmtUnfSF	.
## TotalBsmtSF	1.186891e+01
## HeatingGasW	.
## HeatingOther	-3.678434e+03
## HeatingQCFa	-2.036119e+02
## HeatingQCGd	-2.011839e+03
## HeatingQCPo	-1.282979e+04
## HeatingQCTA	-1.263910e+03
## CentralAirY	.
## ElectricalOther	-1.685479e+03
## `1stFlrSF`	.
## `2ndFlrSF`	4.187125e-01
## LowQualFinSF	-3.901252e+01
## GrLivArea	4.553924e+01
## BsmtFullBath	6.016454e+03
## BsmtHalfBath	.
## FullBath	5.468142e+03
## HalfBath	2.529065e+03
## BedroomAbvGr	-4.343059e+03
## KitchenAbvGr	-1.293056e+04
## KitchenQualFa	-1.571401e+04
## KitchenQualGd	-2.176320e+04
## KitchenQualTA	-2.055049e+04
## TotRmsAbvGrd	2.647817e+03
## FunctionalTRUE	1.327783e+04
## Fireplaces	1.987542e+03
## FireplaceQuFa	-3.366395e+03
## FireplaceQuGd	-4.539583e+02

```

## FireplaceQunone .
## FireplaceQuPo 8.651771e+03
## FireplaceQuTA -1.421019e+02
## GarageTypeBuiltIn 3.175397e+03
## GarageTypeDetchd .
## GarageTypenone .
## GarageTypeOther -4.523106e+03
## GarageFinishnone .
## GarageFinishRFn -2.696889e+03
## GarageFinishUnf -5.747649e+01
## GarageCars 8.416292e+03
## GarageArea 7.774485e+00
## GarageQualTA -1.343401e+04
## GarageQualPo -1.767276e+04
## GarageQualnone .
## GarageCondPo .
## GarageCondnone .
## GarageCondTA 3.736979e+03
## PavedDriveP -1.773214e+03
## PavedDriveY 1.488784e+03
## WoodDeckSF 1.970107e+01
## OpenPorchSF 2.755275e+00
## EnclosedPorch -3.497164e+00
## `3SsnPorch` 2.635572e+01
## ScreenPorch 4.623850e+01
## PoolArea 1.381732e+03
## PoolQCGd -3.540961e+05
## PoolQCFa -2.440241e+05
## PoolQCOther 6.120165e+05
## FenceGdWo .
## FenceMnPrv 1.495158e+02
## FenceMnWw -3.249126e+03
## Fencenone .
## MiscFeatureOther .
## MiscFeatureShed .
## MiscFeatureTenC 1.175750e+05
## MiscFeatureNone .
## MiscVal .
## MoSold -5.868929e+01
## YrSold -2.056611e+01
## SaleTypeOther 7.668391e+03
## SaleTypeNew 2.144464e+04
## SaleTypeWD -2.341039e+02
## SaleConditionAdjLand 8.606718e+03
## SaleConditionAlloca 1.409983e+02
## SaleConditionFamily .
## SaleConditionNormal 6.922067e+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.lasso <- test %>%
  select(-Id) %>%

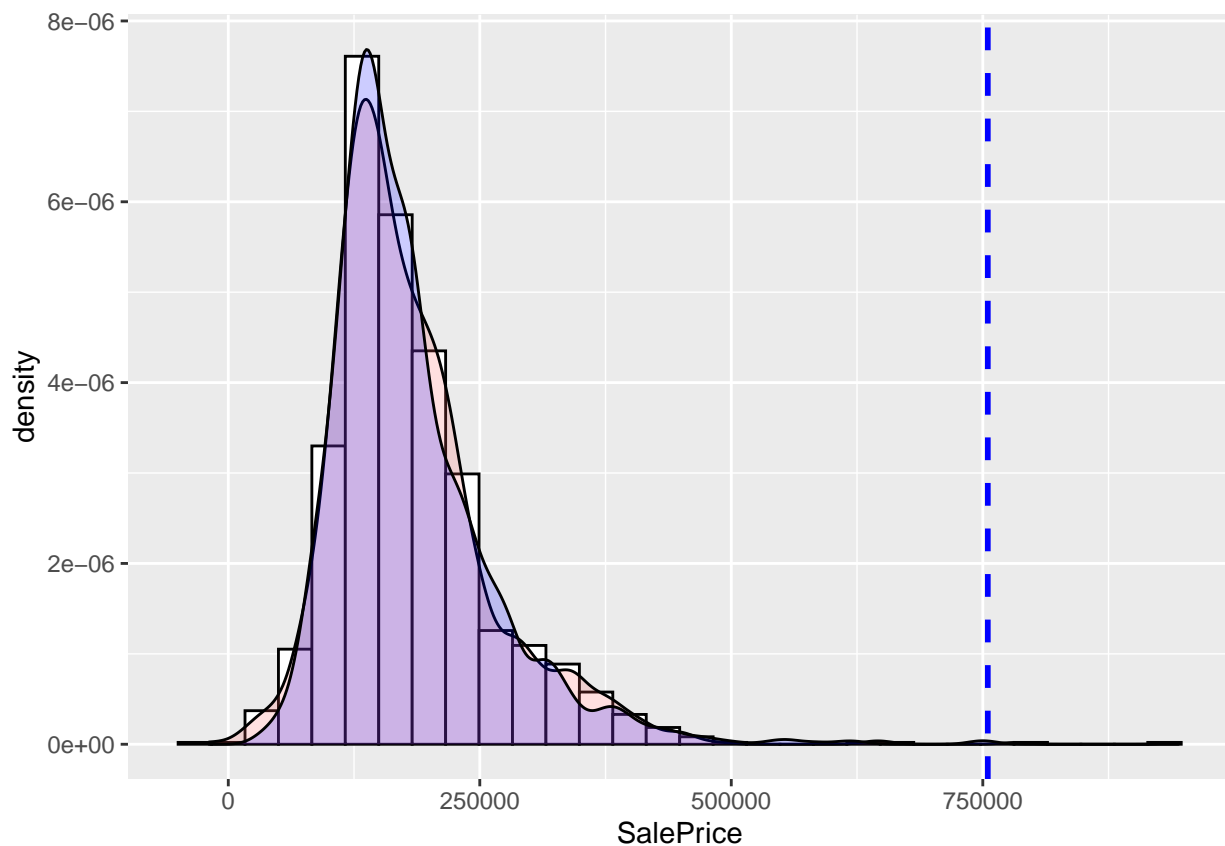
```

```

model.matrix(as.formula("~."), .) %>%
  tibble::as_tibble() %>%
  select(., -setdiff(colnames(.), colnames(X))) %>%
  as.matrix() %>%
  predict(fit.lasso.opt, newx=.)
SubmitDF <- data.frame(test$Id, predicted.lasso)
colnames(SubmitDF) <- c("Id", "SalePrice")
write.csv(file='../submissions/lasso1.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")

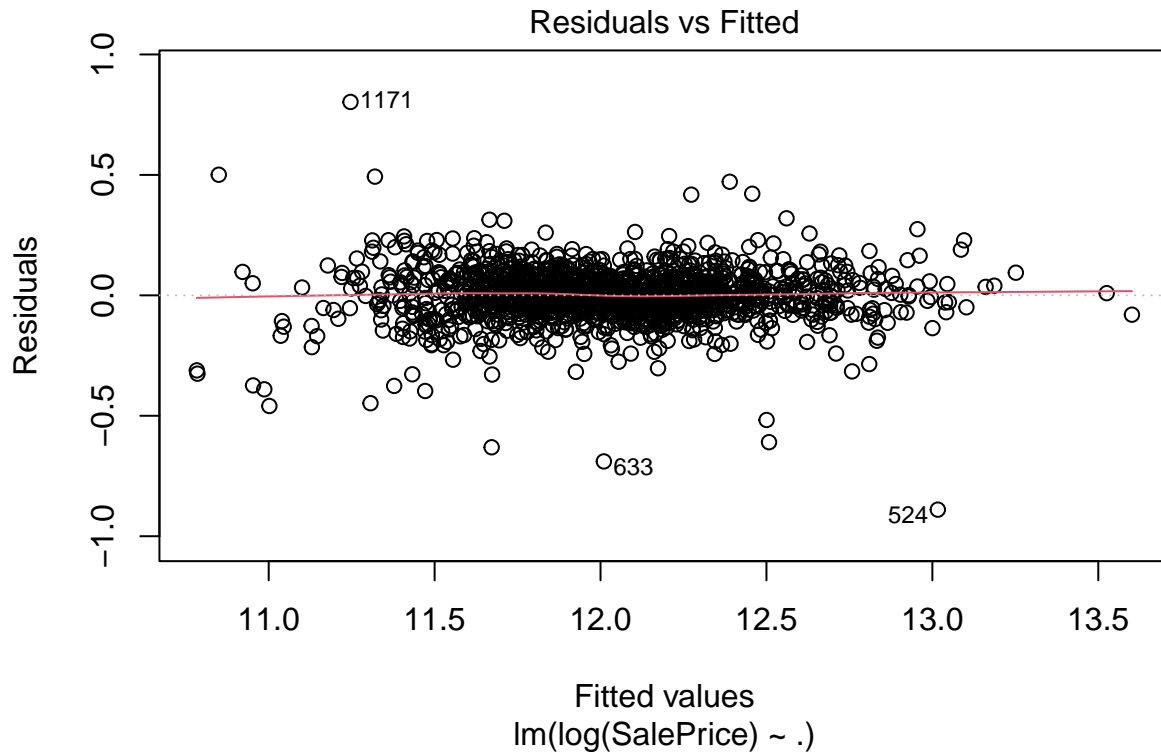
```



Influential Outliers

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

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



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

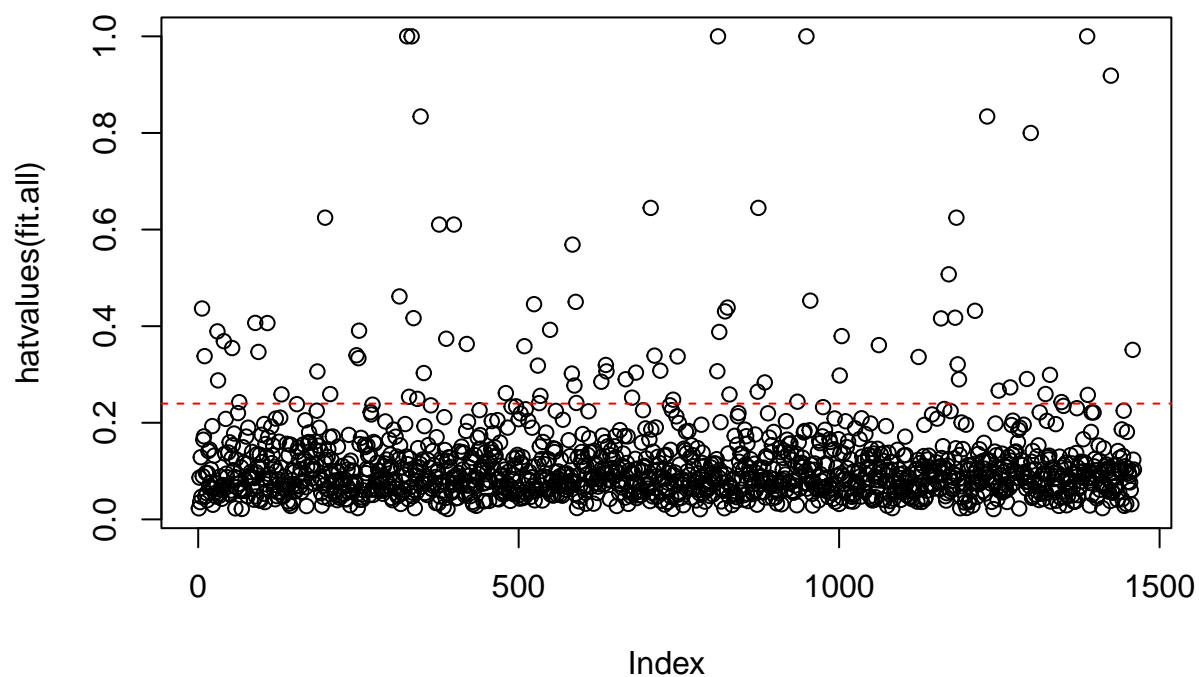
outliers <- which(abs(stand.resid) > 3)
indexes <- 1:length(stand.resid)

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 influential 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")
```

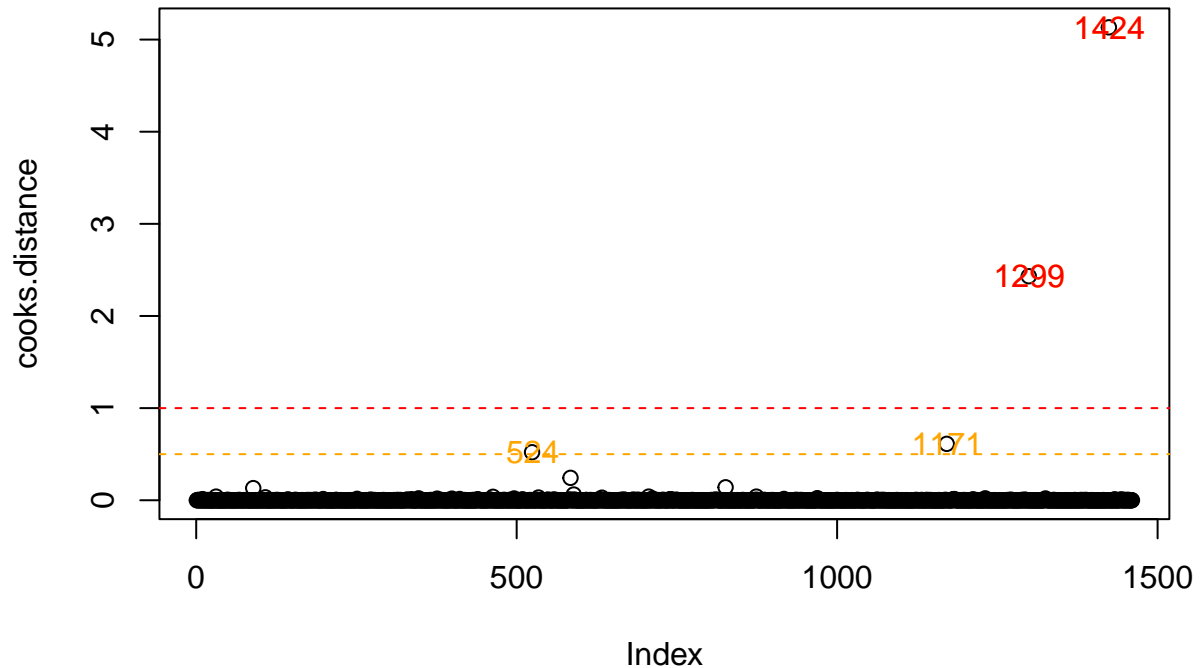
```
abline(h = 0.5, lty = 2, col = "orange") # add cutoff line
```

```
text(x=1:length(cooks.distance)+1, y=cooks.distance, labels=ifelse(cooks.distance>0.5, names(cooks.distance), ""))
```

```
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.distance), ""))
```

Cooks Distance for Influential Obs



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

```
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	

```

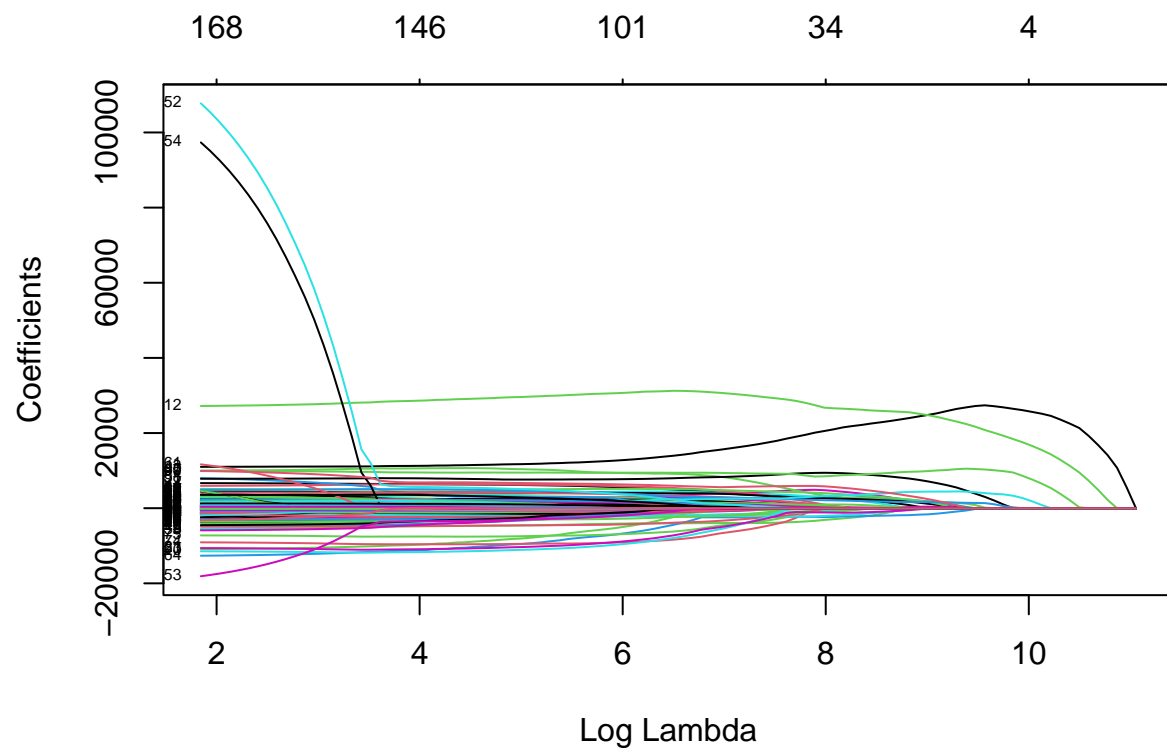
## 4 -0.08721943  0.4867037      -0.03707521      -0.1865528      -0.02620712
## 5 -0.08721943  0.4867037      -0.03707521      -0.1865528      -0.02620712
## 6 -0.08721943 -2.0532269      -0.03707521      5.3567308      -0.02620712
##   MiscFeatureNone   MiscVal   MoSold   YrSold SaleTypeOther SaleTypeNew
## 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

```

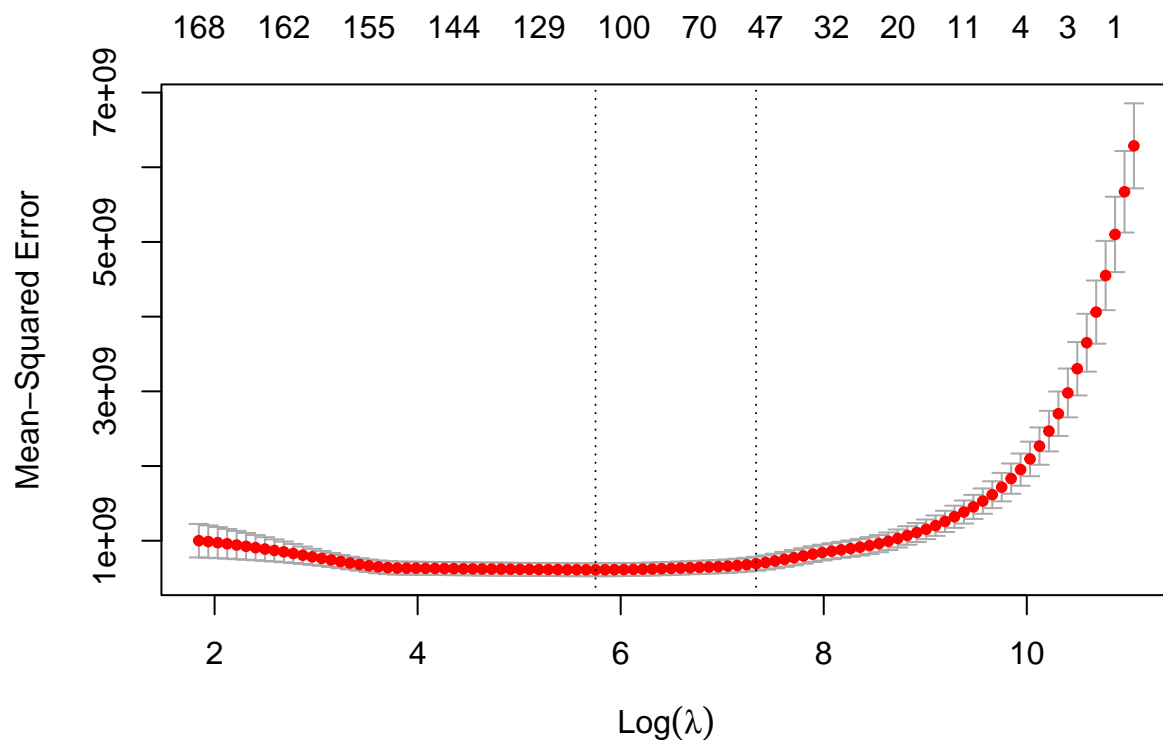
```

fit.lasso <- glmnet(x=X.sd, y=new.train$SalePrice, alpha=1)
plot(fit.lasso, xvar="lambda", label=TRUE)

```



```
cross.val <- cv.glmnet(x=X.sd, y=new.train$SalePrice, alpha=1)
plot(cross.val)
```



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

```
## 174 x 1 sparse Matrix of class "dgCMatrix"
##                                     s0
## (Intercept)                       -8.279388e+05
## MSSubClass1S SF other              .
## MSSubClassmulti-level SF non PUD  .
## MSSubClassother                    -1.126299e+04
## MSZoningRL                        .
## MSZoningRO                         -6.086214e+03
## MSZoningother                     -1.858972e+04
## LotArea                           5.860366e-01
## StreetPave                        2.295711e+04
## AlleyPave                         .
## Alleynone                         3.123454e+02
## LotShapeReg                       -8.613161e+02
## LandContourLvl                    .
## LotConfigInside                   -6.078850e+02
## LandSlopeMod                      1.801697e+03
## LandSlopeSev                     -2.386156e+04
## NeighborhoodBrkSide               5.173687e+03
## NeighborhoodCollgCr              -2.148339e+03
## NeighborhoodCrawfor               1.590304e+04
```

## NeighborhoodEdwards	-4.883796e+03
## NeighborhoodGilbert	-3.573081e+03
## NeighborhoodMitchel	-1.185192e+04
## NeighborhoodNAmes	-5.322854e+03
## NeighborhoodNoRidge	2.602309e+04
## NeighborhoodNridgHt	1.042479e+04
## NeighborhoodNWAmes	-7.643771e+03
## NeighborhoodOldTown	-1.075903e+03
## NeighborhoodSawyer	.
## NeighborhoodSawyerW	-1.709979e+02
## NeighborhoodSomerst	3.824847e+03
## NeighborhoodTimber	-6.587946e+03
## Condition1Pos	.
## Condition1St	.
## Condition1Norm	8.655385e+03
## Condition2Pos	.
## Condition2St	.
## Condition2Norm	.
## BldgTypeMultiFam	.
## BldgTypeTwnhs	-5.097868e+03
## BldgTypeTwnhsE	.
## HouseStyle1.5Unf	2.529663e+03
## HouseStyleEqMore2story	.
## HouseStyle2.5Unf	-4.659007e+03
## OverallQual	9.017987e+03
## OverallCond	5.376367e+03
## YearBuilt	3.142845e+02
## YearRemodAdd	9.081797e+01
## RoofStyleGable	.
## RoofStyleHip	.
## Exterior1stBrkFace	1.265144e+04
## Exterior1stCemntBd	2.321346e+03
## Exterior1stHdBoard	-1.403191e+02
## Exterior1stMetalSd	.
## Exterior1stPlywood	-4.471685e+03
## Exterior1stVinylSd	.
## Exterior1stWd Sdng	-1.243189e+03
## Exterior2ndTRUE	.
## MasVnrTypeBrkFace	.
## MasVnrTypeNone	5.899661e+03
## MasVnrTypeStone	6.622953e+03
## MasVnrTypemissing	.
## MasVnrArea	2.300804e+01
## ExterQualFa	.
## ExterQualGd	-1.278219e+04
## ExterQualTA	-1.580593e+04
## ExterCondFa	.
## ExterCondGd	-1.782322e+03
## ExterCondTA	.
## FoundationCBlock	.
## FoundationPConc	1.170706e+03
## FoundationSlab	.
## FoundationStone	.
## FoundationWood	-1.762820e+04

## BsmtQualFa	-8.335003e+03
## BsmtQualGd	-1.866114e+04
## BsmtQualTA	-1.428865e+04
## BsmtQualnone	8.478984e+02
## BsmtCondGd	.
## BsmtCondPo	3.251771e+03
## BsmtCondTA	1.852966e+03
## BsmtCondnone	.
## BsmtExposureGd	1.785075e+04
## BsmtExposureMn	.
## BsmtExposureNo	-4.337638e+03
## BsmtExposurenone	.
## BsmtFinType1BLQ	.
## BsmtFinType1GLQ	2.427085e+03
## BsmtFinType1LwQ	-3.144126e+03
## BsmtFinType1Rec	-1.614442e+03
## BsmtFinType1Unf	.
## BsmtFinType1none	6.091559e+02
## BsmtFinSF1	1.773892e+01
## BsmtFinType2BLQ	-4.453789e+01
## BsmtFinType2GLQ	7.012916e+03
## BsmtFinType2LwQ	-1.502759e+03
## BsmtFinType2Rec	.
## BsmtFinType2Unf	.
## BsmtFinType2none	.
## BsmtFinSF2	2.183787e+00
## BsmtUnfSF	.
## TotalBsmtSF	2.262699e+01
## HeatingGasW	-2.204449e+03
## HeatingOther	.
## HeatingQCFa	.
## HeatingQCGd	-1.741553e+03
## HeatingQCPO	.
## HeatingQCTA	-1.796693e+03
## CentralAirY	.
## ElectricalOther	-2.909804e+02
## `1stFlrSF`	.
## `2ndFlrSF`	.
## LowQualFinSF	-3.897169e+01
## GrLivArea	5.984837e+01
## BsmtFullBath	8.633400e+02
## BsmtHalfBath	-1.034769e+03
## FullBath	1.036759e+03
## HalfBath	5.649880e+02
## BedroomAbvGr	-5.400726e+03
## KitchenAbvGr	-1.312397e+04
## KitchenQualFa	-1.265866e+04
## KitchenQualGd	-2.069140e+04
## KitchenQualTA	-1.886475e+04
## TotRmsAbvGrd	7.791112e+02
## FunctionalTRUE	1.510049e+04
## Fireplaces	6.776874e+02
## FireplaceQuFa	-2.547554e+03
## FireplaceQuGd	.

```

## FireplaceQunone .
## FireplaceQuPo .
## FireplaceQuTA .
## GarageTypeBuiltIn 6.847571e+03
## GarageTypeDetchd .
## GarageTypenone .
## GarageTypeOther -5.687792e+03
## GarageFinishnone .
## GarageFinishRFn -2.165384e+03
## GarageFinishUnf .
## GarageCars 5.564101e+03
## GarageArea 9.034995e+00
## GarageQualTA -4.777185e+03
## GarageQualPo -7.610401e+03
## GarageQualnone .
## GarageCondPo -2.093787e+03
## GarageCondnone .
## GarageCondTA .
## PavedDriveP -2.428309e+03
## PavedDriveY .
## WoodDeckSF 1.253535e+01
## OpenPorchSF 1.125846e+01
## EnclosedPorch -9.012177e-01
## `3SsnPorch` 1.308149e+01
## ScreenPorch 3.320691e+01
## PoolArea 1.407061e+02
## PoolQCFA -6.366486e+04
## PoolQCOther .
## FenceGdWo .
## FenceMnPrv 1.017801e+03
## FenceMnWw -7.521023e+02
## Fencenone .
## MiscFeatureOther .
## MiscFeatureShed .
## MiscFeatureTenC -8.843606e+03
## MiscFeatureNone .
## MiscVal .
## MoSold -6.506512e+01
## YrSold .
## SaleTypeOther 4.662004e+03
## SaleTypeNew 2.346642e+04
## SaleTypeWD .
## SaleConditionAdjLand 3.451582e+03
## SaleConditionAlloca .
## SaleConditionFamily .
## SaleConditionNormal 5.722136e+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.lasso <- test %>%
  select(-Id) %>%
  model.matrix(as.formula("~."), .) %>%

```



```
tibble::as_tibble() %>%  
select(., -setdiff(colnames(.), colnames(X))) %>%  
as.matrix() %>%  
predict(fit.lasso.opt, newx=.)  
SubmitDF <- data.frame(test$Id, predicted.lasso)  
colnames(SubmitDF) <- c("Id", "SalePrice")  
write.csv(file='../submissions/lasso2.csv', SubmitDF, row.names = FALSE)
```