Ames, Iowa House Price Prediction

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25 September 2016

Key Word

Random forest, House price, Prediction

Abstract

Random forest can achieve high classification performance through a classifcation ensemble with a set of decision trees that grow using randomly selected subspaces of data. This prediction methodology is applied to predict the house prices in Ames based on many features of house.

Introduction

The *Ames Housing dataset* consists of 79 explanatory variables which describe various aspects of a house.

Random forest (RF) model randomly generates subsets of data and subsets of features (or attributes) to create a classification or regression tree. The ultimate prediction os cateogory or value that has the highest probability from the output aggregation of K trees.

No special treatment to input data is required although Random forest does not work on missing values.Nevertheless, I've judgementally decided to apply some adjustment to those variables that exhibit highly correlated missing values. As evidenced later, this addtional calibration resulted in better prediction accuracy.

Prediction

```
## randomForest 4.6-12
## Type rfNews() to see new features/changes/bug fixes.
## Loading required package: rJava
## Loading required package: xlsxjars
```

Two sets of data are loaded for training and prediction. As aforementioned, RF produces an error when a missing value is introduced. Missing values will need to be assigned either with a value or recognised as a proper object.

Alternatively, a new level must be explicitly added to the factor variables prior to assigning new of interpretation of missing values. (e.g. levels(x) = . . .)

```
dir = "C:/Users/Huran/Desktop/Data_Project/HousePrice_Competition_16"
setwd(dir)

train = read.csv("Data/train.csv",header=TRUE, sep = ",", na.strings = c("NA", " ", ""))
test = read.csv ("Data/test.csv", header=TRUE, sep=",", na.strings = c("NA", " ", ""))

data = list(train = train, test = test)

lapply(data, function(x) any(is.na(x)))

sapply(train, function(x) sum(is.na(x)))
```

As aforesaid, RF does not handle missing values well as there is no value to be split on.

Predictor variables with relatively high number of missing values as are follows:

LotFrontage: Linear feet of street connected to property Alley:Type of alley access BsmtExposure; BsmtFinType1; BsmtFinType2 : Features of Basement FireplaceQu: Fireplace quality (conditional on the existence of fireplace) GarageType; GarageYrBlt; GarageFinish; GarageQual;GarageCond: Features of Garage PoolQC:pool quality Fence: fence quality MiscFeature:Miscellaneous feature not covered in other categories

Notably, Basement and Garage features associated with a single feature of a house and will only be valid for those houses with such facilities.

A solution is to aggregate and create a dummy variable for the presence of facility itself. This assumes specific details of such facility will have immaterial impact on the ultimate house price.

Treat missing values first before building RF model The rule is: for all Basement related variables - if any one of values is NA - treat as 'no basement' for all Garage related variables - if any one of values is NA - treat as 'no garage'

```
for(i in seq(data)){

  for(j in 1:nrow(data[[i]])){
    bsmt = data[[i]][,grepl("Bsmt", names(data[[i]]))]

    if (any(is.na(bsmt[j,]))) {
      data[[i]]$BSMT[[j]] = 0
    }
    else {
      data[[i]]$BSMT[[j]] = 1
      }
  }
}

for(i in seq(data)){

  for(j in 1:nrow(data[[i]])){
    grg = data[[i]][,grepl("Garage", names(data[[i]]))]

    if (any(is.na(grg[j,]))) {
      data[[i]]$GRG[[j]] = 0
    }
    else {
      data[[i]]$GRG[[j]] = 1
      }
  }
}

for(i in seq(data)){

data[[i]] = data[[i]][,!names(data[[i]]) %in% names(bsmt)]
data[[i]] = data[[i]][,!names(data[[i]]) %in% names(grg)]
}

sapply(data, function(x) sum(is.na(x)))

for(i in 1:2){
```

```
 print(sapply(data[[i]],function(x) sum(is.na(x))))

}
```

The rest of missing values are treated via na.roughfix() function call. Alternatively, rfImpute() function call can be used which gives a better result in general [1]. However, rfImpute() function needs known target variables ,therefore not applicable to unsupervised cases and to this particular work too.

1. For numerical variables, NAs are replaced with column medians.
2. For factor variables, NAs are replaced with the most frequent levels (breaking ties at random). [2]

```
train = data[[1]]
test = data[[2]]

train = na.roughfix(train)
test = na.roughfix(test)
```

RF Algorithm

The dependent variable, house sale price, is continous therefore we are creating a RF for regression. This is done via randomForest() function call. No out-of-sample split is needed as validation is done internally during the RF run.

```
#rfm = randomForest(SalePrice~., data = train1, ntree=1000)
#partitioned data into train vs. test set for cross-validation and calculation of accuracy (MSE)
rfm = randomForest(SalePrice~., data = train, ntree=1000, do.trace=TRUE)
#pred = predict(rfm, train2)
#print(pred)

#calculates SMSE or MSE
# predict saleprice of the real prediction set
```

Result

Prediction is made on the test by applying the RF model.

```
for (i in names(test)){
  levels(train[, i]) = unique(c(levels(train[,i]), levels(test[,i])))
  levels(test[,i]) = levels(train[,i])
}


identical(colnames(subset(train, select=-SalePrice)), colnames(test))
```

```
[1] TRUE
```

[1] "http://www.listendata.com/2014/11/random-forest-with-r.html"
[2] "http://www.listendata.com/2014/11/random-forest-with-r.html"

```r
sale = predict(rfm, test)
print(sale)
```

```
        1         2         3         4         5         6         7
128731.04 156363.18 177204.01 184013.16 199372.48 187835.18 171768.79
        8         9        10        11        12        13        14
179141.07 174670.80 119803.63 179151.35  97762.05  98949.43 151306.15
       15        16        17        18        19        20        21
138600.81 408636.46 264707.18 312592.03 305841.48 436534.83 313186.94
       22        23        24        25        26        27        28
215202.86 180960.14 170784.56 174884.41 197383.07 318105.98 238752.84
       29        30        31        32        33        34        35
205788.95 199264.27 194837.65 109511.51 170916.98 303077.85 280125.36
       36        37        38        39        40        41        42
203453.21 184481.84 156837.34 154411.87 165540.38 174660.71 158311.28
       43        44        45        46        47        48        49
251910.42 229498.38 211188.37 186721.79 230921.76 190163.23 166563.74
       50        51        52        53        54        55        56
147404.23 138790.99 163726.88 150669.11 143755.90 193951.26 148871.35
       57        58        59        60        61        62        63
153605.20 132535.71 198268.31 137234.28 141456.75 165141.82 126753.05
       64        65        66        67        68        69        70
126390.42 127671.36 130407.79 116989.09 133221.14 139685.24 160539.02
       71        72        73        74        75        76        77
133188.63 105984.32 138448.37 120811.08 153903.82 119828.35  81977.41
       78        79        80        81        82        83        84
181689.36 236234.70 125048.66 136663.57 143321.10 188451.98  88452.11
       85        86        87        88        89        90        91
108063.14 128580.51 141949.43 135384.97 110692.40 142689.14 115071.54
       92        93        94        95        96        97        98
140013.21 153697.86 124510.72 179621.40 133244.99 118600.69 107475.78
       99       100       101       102       103       104       105
127551.31 142421.04 137948.14 128198.09 122401.70 148365.26 154288.45
      106       107       108       109       110       111       112
220089.84  92640.17 214331.04 139376.54 137218.49 135583.59 135981.31
      113       114       115       116       117       118       119
201714.30 124945.89 197155.72 200601.60 200610.12 158263.08 141236.45
      120       121       122       123       124       125       126
189512.66 148453.46 125158.03 292034.45 237900.09 141749.32  84310.09
      127       128       129       130       131       132       133
115144.00 138878.78 102925.36 133271.51 107978.51 135511.16 120791.65
      134       135       136       137       138       139       140
157699.13 143472.22 229611.63 192314.73 195694.81 178608.42 184265.45
      141       142       143       144       145       146       147
 80264.52 112885.84  95689.42 270979.49 217454.81 169753.65 172210.12
      148       149       150       151       152       153       154
200401.90 196943.15 173407.47 151893.57 170868.45 164836.40 113618.55
      155       156       157       158       159       160       161
 89230.33  86179.93  89245.61 130181.12 134676.39 174179.92 140864.08
      162       163       164       165       166       167       168
147462.30 240548.28 195463.13 128011.91 163276.98 180662.44 249539.59
      169       170       171       172       173       174       175
179262.38 338026.55 224057.66 270667.20 174029.35 184132.62 177259.49
```

176	177	178	179	180	181	182
169279.63	185529.25	207981.28	191385.24	242597.86	189935.62	232309.58
183	184	185	186	187	188	189
223205.23	223650.14	178635.95	159643.59	164232.34	135070.32	141094.34
190	191	192	193	194	195	196
119728.51	124288.62	95792.39	98592.79	151293.90	144157.55	147178.91
197	198	199	200	201	202	203
151644.68	153913.44	138973.29	146488.35	432649.67	363351.07	357863.64
204	205	206	207	208	209	210
419729.97	328429.05	293218.39	339256.67	330404.17	279205.00	340140.36
211	212	213	214	215	216	217
258741.35	416601.97	313221.82	257061.19	192153.65	192912.19	205407.11
218	219	220	221	222	223	224
447956.83	347205.18	342745.54	281090.90	294250.66	190156.87	176105.88
225	226	227	228	229	230	231
176771.75	172031.85	173636.94	188847.90	188986.53	181563.80	174931.77
232	233	234	235	236	237	238
233056.23	173115.67	180384.37	175941.09	243758.61	176326.39	321865.20
239	240	241	242	243	244	245
331875.88	254221.74	286251.36	262348.00	255376.98	257496.53	238806.72
246	247	248	249	250	251	252
355307.28	208098.36	210751.89	267662.36	226279.03	236142.45	265670.87
253	254	255	256	257	258	259
238193.49	215697.41	194045.46	183047.94	165470.34	154904.87	208536.12
260	261	262	263	264	265	266
236878.17	170745.33	146588.63	157828.73	200790.71	229347.86	194020.85
267	268	269	270	271	272	273
176101.15	185311.23	165901.78	167445.43	128014.64	124399.44	124240.11
274	275	276	277	278	279	280
131335.28	134342.53	123912.91	298677.90	221384.99	268408.90	222590.76
281	282	283	284	285	286	287
188043.63	173256.47	175078.88	291338.84	240361.61	263357.00	211175.44
288	289	290	291	292	293	294
228957.36	159610.16	149659.84	227412.13	118248.79	146363.32	195876.64
295	296	297	298	299	300	301
165947.27	119631.31	122147.52	142018.14	158511.85	155834.21	148141.77
302	303	304	305	306	307	308
170826.02	169680.79	125436.43	168014.37	165089.47	183824.23	142907.05
309	310	311	312	313	314	315
161222.71	148642.70	132131.60	144235.47	138972.72	142762.12	134054.13
316	317	318	319	320	321	322
131671.91	117764.69	137595.20	127794.78	162939.17	128549.84	102561.37
323	324	325	326	327	328	329
133233.30	108676.44	117862.25	153897.19	163727.89	82349.12	100168.78
330	331	332	333	334	335	336
90702.54	175200.89	160036.18	134778.21	139704.95	143974.90	148772.98
337	338	339	340	341	342	343
117425.87	130819.29	118266.72	137774.96	134089.12	141116.78	156213.30
344	345	346	347	348	349	350
138321.62	137453.19	127061.32	133892.87	128979.92	137244.93	139013.21
351	352	353	354	355	356	357
117122.07	118344.75	120582.23	99107.48	70715.12	113054.20	130323.85
358	359	360	361	362	363	364
152217.60	126999.93	92708.57	127192.12	144597.39	69279.28	152246.62

365	366	367	368	369	370	371
153082.40	115805.74	111056.62	146494.62	109373.28	136392.87	157356.13
372	373	374	375	376	377	378
122977.82	143892.79	136760.22	143915.53	135876.14	101587.55	135466.39
379	380	381	382	383	384	385
111030.62	158871.50	138659.84	103116.31	139396.32	141111.85	157486.85
386	387	388	389	390	391	392
150453.51	193683.84	82343.38	126779.64	124742.85	154945.92	122668.71
393	394	395	396	397	398	399
137823.42	164678.47	170186.98	210586.75	188823.21	149892.02	126595.00
400	401	402	403	404	405	406
151982.14	126825.78	246649.91	237175.36	237174.36	309994.60	302107.27
407	408	409	410	411	412	413
230782.54	272399.34	186752.00	213417.21	236749.98	175178.79	215006.94
414	415	416	417	418	419	420
138451.65	195578.35	194121.95	192850.86	209753.06	134111.07	126021.03
421	422	423	424	425	426	427
215869.30	255167.80	200607.77	213487.20	238202.80	260604.78	190329.22
428	429	430	431	432	433	434
242324.36	173777.17	128638.38	141216.96	105981.10	131449.11	134703.75
435	436	437	438	439	440	441
145644.67	121257.10	126596.24	130757.15	162428.07	159396.34	168785.83
442	443	444	445	446	447	448
154304.28	223337.88	147412.79	185933.65	168199.57	212440.06	132128.85
449	450	451	452	453	454	455
139548.99	136090.16	202424.46	289597.38	149623.45	76526.51	317206.54
456	457	458	459	460	461	462
77549.54	242136.11	142789.85	161984.68	163531.97	358805.30	313781.28
463	464	465	466	467	468	469
220126.57	206202.54	232593.74	350372.32	140754.68	156445.51	129475.37
470	471	472	473	474	475	476
144275.66	134735.08	141178.37	173832.75	179137.32	178399.56	182413.58
477	478	479	480	481	482	483
184846.54	177729.37	262834.52	196163.37	176026.46	189645.97	199001.94
484	485	486	487	488	489	490
318166.86	347120.31	176611.39	316215.02	172930.96	225416.78	173252.31
491	492	493	494	495	496	497
237344.77	221426.77	164592.41	201524.06	153048.88	254546.53	174563.51
498	499	500	501	502	503	504
265500.00	147178.33	119394.60	120748.29	95794.13	101714.12	112861.38
505	506	507	508	509	510	511
147179.90	145622.76	273629.05	373016.95	355369.34	381175.32	409935.34
512	513	514	515	516	517	518
338891.65	287115.33	297112.72	425570.71	258479.27	354942.98	340443.06
519	520	521	522	523	524	525
345374.69	199970.01	338423.65	229434.76	230702.56	172660.87	189150.04
526	527	528	529	530	531	532
194946.42	182257.96	182903.11	191751.85	217748.49	207681.96	205810.85
533	534	535	536	537	538	539
175430.17	229303.38	184173.40	299312.88	322112.65	312803.08	255202.95
540	541	542	543	544	545	546
298736.01	269439.91	219758.48	248612.50	245889.88	221989.98	220484.55
547	548	549	550	551	552	553
250380.22	210293.21	191727.11	194842.07	157053.26	179225.59	182794.68

554	555	556	557	558	559	560
189509.98	196846.86	189910.35	201345.43	131798.51	133698.91	117743.47
561	562	563	564	565	566	567
118707.43	182770.58	147957.16	270852.43	388618.86	184199.08	158726.95
568	569	570	571	572	573	574
161488.52	176321.10	278203.45	232148.64	248793.63	261525.65	168588.90
575	576	577	578	579	580	581
206295.78	193276.53	193421.38	321156.99	225776.71	340782.65	283361.27
582	583	584	585	586	587	588
208935.13	166860.00	178153.66	198784.40	151352.47	150184.43	132909.77
589	590	591	592	593	594	595
134771.30	175421.22	120388.27	132941.08	145767.01	97110.13	156769.00
596	597	598	599	600	601	602
150915.23	125542.98	209799.41	139616.03	155802.65	166435.03	134455.42
603	604	605	606	607	608	609
124382.50	138635.96	116731.08	172400.79	150926.59	143869.65	93415.61
610	611	612	613	614	615	616
114118.26	102418.17	134816.13	137809.98	165941.79	149231.75	120897.36
617	618	619	620	621	622	623
146239.66	129318.11	131287.55	129298.97	130851.03	135300.88	142409.74
624	625	626	627	628	629	630
119955.99	134426.27	137661.41	123217.57	114051.43	96039.28	135716.22
631	632	633	634	635	636	637
124919.71	130022.93	136689.12	133239.46	136076.48	100131.46	109155.52
638	639	640	641	642	643	644
136542.59	71190.10	131860.73	130388.82	138032.55	112793.45	128546.62
645	646	647	648	649	650	651
139531.01	80845.92	187917.57	116275.43	121662.22	132177.50	162063.52
652	653	654	655	656	657	658
148674.93	124317.28	127131.91	154868.51	115058.22	145394.84	128538.64
659	660	661	662	663	664	665
116307.83	120487.45	104486.12	106280.57	106737.02	164653.98	127716.59
666	667	668	669	670	671	672
162487.65	146898.27	136961.43	105559.38	140163.71	152634.36	120639.42
673	674	675	676	677	678	679
117337.85	126500.36	105277.85	102884.13	132674.13	137354.11	149308.75
680	681	682	683	684	685	686
136756.84	143754.04	141892.42	142552.50	123701.71	137805.86	149692.37
687	688	689	690	691	692	693
178894.55	131438.09	132801.88	203833.31	121899.09	161258.94	158406.52
694	695	696	697	698	699	700
108254.47	138792.08	247612.20	217430.81	237870.45	225044.93	176824.62
701	702	703	704	705	706	707
248743.84	329551.40	309022.07	233319.45	188995.79	138582.83	191941.22
708	709	710	711	712	713	714
203038.49	191280.19	212797.09	148085.40	140472.84	173198.07	233130.17
715	716	717	718	719	720	721
260354.84	262844.70	243101.07	222371.45	144511.45	191540.30	196944.64
722	723	724	725	726	727	728
219850.70	192866.18	128657.79	130357.98	136632.97	141497.32	144338.52
729	730	731	732	733	734	735
218523.33	100942.13	101950.12	93706.02	113041.90	117929.19	107433.94
736	737	738	739	740	741	742
121310.70	116749.59	153773.18	160934.70	153549.03	155979.86	201399.02

743	744	745	746	747	748	749
172200.43	192271.64	140722.60	145715.11	221717.13	236940.82	207834.72
750	751	752	753	754	755	756
132718.72	114762.21	120578.91	112608.55	151268.50	112556.42	141711.01
757	758	759	760	761	762	763
79137.39	105484.43	91196.72	92638.92	319317.77	233018.66	241940.65
764	765	766	767	768	769	770
196190.00	149826.94	175141.18	199158.12	245907.34	234329.77	172037.63
771	772	773	774	775	776	777
201303.07	190271.52	182471.22	236151.95	208353.94	264068.76	297563.42
778	779	780	781	782	783	784
183183.13	127683.88	158519.80	141989.63	119788.28	136505.22	92730.44
785	786	787	788	789	790	791
95358.12	148202.59	113824.26	128879.16	131806.17	130085.27	145925.66
792	793	794	795	796	797	798
168097.90	169745.59	182273.59	182195.53	181486.47	215310.75	172369.06
799	800	801	802	803	804	805
183132.68	159457.37	199419.80	210587.35	323774.28	410167.83	166512.82
806	807	808	809	810	811	812
292140.54	353199.28	385304.03	161076.37	181988.93	197551.88	198614.32
813	814	815	816	817	818	819
167871.20	173765.69	163041.99	175363.66	182436.14	149963.92	129208.88
820	821	822	823	824	825	826
123277.30	174774.73	172921.53	102329.58	118607.30	145482.54	126824.84
827	828	829	830	831	832	833
335089.61	294568.53	352398.92	405645.82	324728.65	383987.43	414251.97
834	835	836	837	838	839	840
383006.93	432044.37	307709.92	297765.41	344426.46	376974.52	305063.21
841	842	843	844	845	846	847
274745.47	218096.65	268569.30	248419.97	184812.96	183755.88	191614.13
848	849	850	851	852	853	854
222898.20	286070.64	237061.68	188110.11	178187.13	178572.26	183786.91
855	856	857	858	859	860	861
177061.71	197793.01	176656.35	179245.97	179894.23	179647.68	228752.40
862	863	864	865	866	867	868
174847.04	174267.97	170808.21	211105.88	172968.66	209506.25	219712.03
869	870	871	872	873	874	875
181156.57	182219.19	323210.66	363344.01	294898.24	265762.71	274058.89
876	877	878	879	880	881	882
302093.26	205824.34	240447.86	237115.78	337510.87	222584.41	230035.54
883	884	885	886	887	888	889
212819.40	236712.13	224427.97	215780.90	200883.86	226862.26	185641.70
890	891	892	893	894	895	896
255816.86	278988.92	253205.89	250967.86	144443.71	164338.06	151064.23
897	898	899	900	901	902	903
202563.51	199980.12	143603.17	127273.23	133277.14	259246.46	134329.84
904	905	906	907	908	909	910
145331.00	207763.56	201424.47	230371.54	195304.96	227453.94	175005.27
911	912	913	914	915	916	917
173436.23	199338.47	256473.12	269083.97	247545.06	260598.29	318132.48
918	919	920	921	922	923	924
155769.40	207161.04	150423.66	160610.74	198754.47	201551.24	230863.86
925	926	927	928	929	930	931
157528.31	146626.70	142903.68	111293.19	135651.76	146877.91	134581.68

932	933	934	935	936	937	938
124720.61	161172.29	140621.08	184008.17	157054.73	180307.17	131023.84
939	940	941	942	943	944	945
69524.98	72913.93	116026.26	138010.24	139811.30	152589.40	157896.16
946	947	948	949	950	951	952
137324.32	126379.93	138495.80	135255.01	162267.85	122748.61	156210.70
953	954	955	956	957	958	959
134128.43	145110.31	136299.92	124745.53	131585.71	134777.44	132685.17
960	961	962	963	964	965	966
124705.25	152389.59	113278.72	137981.25	154300.43	203150.64	113000.95
967	968	969	970	971	972	973
144981.68	174762.80	117555.51	133971.73	126460.51	137441.01	144270.16
974	975	976	977	978	979	980
138328.01	148397.84	119182.13	116650.90	125047.60	113881.30	118032.58
981	982	983	984	985	986	987
98627.17	108435.22	123180.12	128027.49	104438.91	132496.42	186716.37
988	989	990	991	992	993	994
144670.69	114715.86	134464.14	133077.14	198195.20	111349.06	136885.57
995	996	997	998	999	1000	1001
114553.09	135596.11	127809.23	126703.29	114305.00	137992.46	125505.56
1002	1003	1004	1005	1006	1007	1008
139464.79	120397.79	155335.56	133949.13	119326.45	133685.07	102330.84
1009	1010	1011	1012	1013	1014	1015
92762.80	179703.05	179655.80	155647.37	115831.99	112856.88	197779.48
1016	1017	1018	1019	1020	1021	1022
123519.80	133190.86	155868.90	113272.61	146855.47	130906.11	129298.89
1023	1024	1025	1026	1027	1028	1029
123317.60	128877.02	128532.69	154454.27	185403.18	150929.52	155622.01
1030	1031	1032	1033	1034	1035	1036
152298.48	106183.60	187800.39	152401.03	155564.16	110516.40	228733.68
1037	1038	1039	1040	1041	1042	1043
147923.82	120357.04	105259.34	136895.58	129266.07	138096.23	108010.00
1044	1045	1046	1047	1048	1049	1050
192224.19	224370.88	259435.89	297871.77	263002.47	213706.75	227682.18
1051	1052	1053	1054	1055	1056	1057
187886.23	210629.14	212335.11	266482.66	142232.52	168940.82	138298.46
1058	1059	1060	1061	1062	1063	1064
145400.79	216836.04	206265.57	198191.79	212202.41	126518.18	143818.88
1065	1066	1067	1068	1069	1070	1071
141507.55	134188.63	125874.95	126117.30	131394.76	131413.49	221388.43
1072	1073	1074	1075	1076	1077	1078
217250.05	203584.58	243502.50	279012.65	226845.84	223278.27	181746.67
1079	1080	1081	1082	1083	1084	1085
180641.51	180765.52	182719.36	176576.25	119550.23	120345.09	128419.20
1086	1087	1088	1089	1090	1091	1092
138991.98	131106.03	152754.83	148002.29	328340.91	145488.49	116827.55
1093	1094	1095	1096	1097	1098	1099
102090.40	116105.01	114833.81	105038.34	107541.93	164485.80	153005.68
1100	1101	1102	1103	1104	1105	1106
155102.96	150432.03	162088.95	164924.29	186558.48	153276.16	180919.16
1107	1108	1109	1110	1111	1112	1113
147308.08	186467.86	186726.54	131835.58	197180.79	161153.27	217328.37
1114	1115	1116	1117	1118	1119	1120
313313.07	119871.36	143909.95	154091.32	104869.27	85218.19	142259.35

1121	1122	1123	1124	1125	1126	1127
117911.88	119051.80	273854.71	164663.39	177905.51	188078.97	181721.65
1128	1129	1130	1131	1132	1133	1134
146611.24	145688.25	205434.57	248884.93	222421.50	258869.92	180101.56
1135	1136	1137	1138	1139	1140	1141
213923.28	296999.73	195058.76	268479.26	323935.56	163025.99	143545.54
1142	1143	1144	1145	1146	1147	1148
87198.45	89432.23	89090.19	90347.21	145411.33	169017.44	182800.10
1149	1150	1151	1152	1153	1154	1155
158125.68	122906.10	146407.53	147130.49	128940.18	124299.17	143758.72
1156	1157	1158	1159	1160	1161	1162
145280.90	161060.20	165874.35	196509.56	183398.01	187152.10	194113.87
1163	1164	1165	1166	1167	1168	1169
251093.61	259172.81	338089.77	167703.73	180485.31	416279.90	498463.46
1170	1171	1172	1173	1174	1175	1176
346833.87	437343.65	406664.51	304923.95	370237.96	155815.42	192626.85
1177	1178	1179	1180	1181	1182	1183
165036.43	258889.72	184852.69	158325.52	110643.64	176049.68	102122.87
1184	1185	1186	1187	1188	1189	1190
131574.03	103496.49	95176.80	103578.09	137043.23	146696.80	146050.53
1191	1192	1193	1194	1195	1196	1197
148264.62	410034.33	265391.18	256741.56	347094.36	343706.30	338766.74
1198	1199	1200	1201	1202	1203	1204
307832.38	298789.40	317514.53	335125.90	335816.94	265721.81	283728.47
1205	1206	1207	1208	1209	1210	1211
312365.15	301910.96	173203.20	180366.64	176000.07	269454.08	181855.25
1212	1213	1214	1215	1216	1217	1218
183127.46	200792.85	200406.29	165858.32	186472.28	195777.85	250985.05
1219	1220	1221	1222	1223	1224	1225
265360.03	275497.87	372497.34	316229.65	502758.76	298227.00	332657.10
1226	1227	1228	1229	1230	1231	1232
270441.45	259344.30	234432.49	210197.38	364916.62	198882.49	151249.44
1233	1234	1235	1236	1237	1238	1239
189786.18	151074.04	196473.23	190381.21	192183.25	198582.36	178107.17
1240	1241	1242	1243	1244	1245	1246
171973.73	163562.32	123912.12	140100.99	140679.64	128976.15	127457.45
1247	1248	1249	1250	1251	1252	1253
124829.53	133121.13	112143.79	129251.35	278035.36	343945.40	170699.58
1254	1255	1256	1257	1258	1259	1260
154886.87	174544.19	159483.82	207564.79	244443.41	158272.07	163882.55
1261	1262	1263	1264	1265	1266	1267
134692.49	155715.19	139162.74	127677.67	135065.31	143729.66	171887.08
1268	1269	1270	1271	1272	1273	1274
161316.02	149847.70	142687.16	122098.01	127264.90	151653.68	158038.63
1275	1276	1277	1278	1279	1280	1281
132211.72	154868.06	126659.13	139810.15	152523.30	143294.32	147902.87
1282	1283	1284	1285	1286	1287	1288
152682.35	152126.63	147854.45	139645.94	134211.26	160950.30	134242.38
1289	1290	1291	1292	1293	1294	1295
132875.20	133160.52	129892.29	225176.29	146432.95	180997.46	131047.34
1296	1297	1298	1299	1300	1301	1302
99432.47	88058.07	93827.39	145323.93	134444.98	151976.94	147539.48
1303	1304	1305	1306	1307	1308	1309
172679.43	174360.25	220891.09	140155.06	96454.36	137017.93	130345.10

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     1310      1311      1312      1313      1314      1315      1316
143940.66 121323.64 126138.18 164789.63 136251.74 133914.19 131876.94
     1317      1318      1319      1320      1321      1322      1323
137300.13 118839.44 143442.35 102465.38 107328.44 106559.11 111251.38
     1324      1325      1326      1327      1328      1329      1330
114563.05 141423.78  79579.10 119743.65  89416.99 161823.29 105759.94
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113186.08  77998.23 174654.86 111359.34 127156.43 106647.89 177920.76
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124224.73 124161.99  89453.29 111209.54 142066.79 161784.61 151392.88
     1345      1346      1347      1348      1349      1350      1351
107062.48 102776.61 154376.76 144118.79 136764.59 133243.41 157256.10
     1352      1353      1354      1355      1356      1357      1358
145350.93 153729.70 150431.92 111116.76 232900.76 158245.66 131963.02
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183912.12 138461.61 113035.79 182356.87 236956.72 162010.72 154594.19
     1366      1367      1368      1369      1370      1371      1372
133820.22 138402.37 249394.94 180619.41 218113.43 186796.16 223508.66
     1373      1374      1375      1376      1377      1378      1379
255359.55 210887.16 212977.92 192811.15 170010.53 143878.18 187084.97
     1380      1381      1382      1383      1384      1385      1386
185224.09 199821.53 204476.23 158304.16 162456.67 127511.86 207992.63
     1387      1388      1389      1390      1391      1392      1393
196938.87 208174.75 211958.13 252720.19 230752.24 215688.78 231896.89
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     1401      1402      1403      1404      1405      1406      1407
127800.69 180998.89 129148.76 233514.06 141147.26 141298.45 101101.18
     1408      1409      1410      1411      1412      1413      1414
110502.12 121627.79 144981.58 109294.05  72416.98 119677.63 133730.82
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171869.56 190373.10 191446.25 188799.98 205754.90  99766.60 121145.41
     1429      1430      1431      1432      1433      1434      1435
 67256.47  89747.89 145726.04  72900.63 114117.58  77002.48 290522.46
     1436      1437      1438      1439      1440      1441      1442
272371.05 176613.48 153158.75 219571.51 159688.43 190216.83 187355.73
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309274.39 320501.53 138229.06 179361.20 119451.39 131442.68 149713.94
     1450      1451      1452      1453      1454      1455      1456
 84177.50  87425.52 158922.10  88402.10  88386.65  89959.85  87849.91
     1457      1458      1459
155490.80 125059.48 202213.21
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sub = data.frame(Id = test$Id, SalePrice = sale)

write.csv(sub, file = "FrannieK_sub.csv", row.names = FALSE)
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