

Why Frisco?

Rapid growing city

- Relocation of corporate headquarters, including Dallas Cowboys World Headquarters, Toyota, PGA of America.
- High ranked school system
- Low crime rate: 4th lowest violent crime rate, sixth lowest property crime rate but most affordable cities among safe cities
- One of the Highest median household income (\$130,118)

People are moving to Frisco from

Inbound

Metros

L	Los Ang	eles, CA
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- 2 San Francisco, CA
- 3 Chicago, IL
- 4 New York, NY
- 5 Seattle, WA
- 6 Washington, DC
- 7 Lincoln, NE
- 8 San Diego, CA
- 9 Boston, MA
- 10 Portland, OR









Data Collection

Collect city house prices from Redfin from March 2021 through March 2023. Contains of 3048 datas variables with sold month, property type, address, city, zip, price, beds, baths, location, sqft. year built.

Collect house price index data from "Federal Housing Finance Agency" HPI defines the change of single family house price throughout years. However, weren't able to access Frisco's HPI and used division level which was west south central. Data from 2000 through 2022. Dates are recorded as the first date of each month.



F	G	Н	I	J	K	L
Œ	BEDS	BATHS	LOCATION	SQUAREFE	LOTSIZE	YEARBU
30996	4	4.5	Estates at	3715	10454	20:
48175	5	4.5	Northwoo	3353	10890	20.
75/000	4	3.5	Grayhawk	2775	7362	20
29900	5	4.5	Hollyhock	3757	8276	20
17755	5	4.5	Hollyhock	3688		203
94400	4	3.5	Hollyhock	3562	8276	20:
16400	5	4.5	Northwoo	3970	10890	20:
59900	5	4.5	Northwoo	3353	6882	20.
35000	4	4	Hollyhock	3132	7013	20
50000	4	4	Hollyhock	3153	7013	20
99000	3	2.5	Hollyhock	2612	11108	20
20000	3	2	Frisco Ran	1958	5227	20
23675	5	4	Northwoo	3562	8712	20
72815	4	3	Hollyhock	2761		20
19444	5	4.5	Hollyhock	3688		20.
47815	4	3	Estates at	2566	7841	203
29000	5	3.5	Grayhawk	3777	10019	20
59400	5	4.5	Hollyhock	3757	7841	20:
51061	5	5.5	Hollyhock	4617		20
16576	5	5.5	Estates at	4123	7841	20
52296	4	3.5	Hollyhock	3130		20.
84400	5	4.5	Hollyhock	3757	8276	203
31300	4	3	Estates at	3798	7841	20
02045	5	4	Estates at	4029	7841	20:

1. Frequency Analysis

1. Count houses segmented by zip code, number of baths, bedrooms.

Table 1 shows data are concentrated mostly in Zipcode 75033, 75034, 75035.

Table 2 shows Frisco houses mostly have 2 through 4.5 bathrooms.

75007 75033 75034 75035 75036 75056 75068 75071 75072 75078 78373 313 727 450 1149 559 9 90 4 2 5 1

Table 1. Number of Houses by Zip

1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7.5 9 10 5 4 921 491 364 579 428 299 67 95 40 12 2 1 1

Table 2. Number of bathrooms

2. Cross Table

- 1. Number of Bedrooms by Zipcode
- 2. Number of Baths by Zipcode
- 3. Number of Bedrooms by Zipcode.

Data Analysis

BEDS

ZIP 1 2 3 4 5 6 7

75007 0 9 195 94 15 0 0

75033 0 5 125 338 250 9 0

75034 0 5 123 150 158 13 1

75035 0 1 355 472 301 20 0

75036 1 86 125 239 107 1 0

75056 0 1 2 6 0 0 0

75068 0 0 47 36 6 1 0

75071 0 0 1 3 0 0 0

75072 0 0 1 1 0 0

75078 0 0 0 3 2 0 0

78373 0 0 0 0 1 0 0

Table 3. Number of Bedrooms by Zip

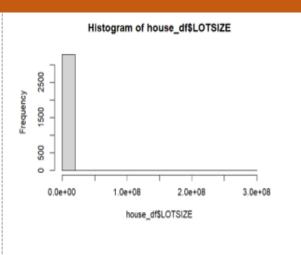
BA	THS	5													7	
ZIP	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7.5	9	10	•
75007	0	1	179	80	38	5	9	1	0	0	0	0	0	0	0	
75033	2	2	132	89	77	170	147	76	18	9	3	2	0	0	0	
75034	0	1	26	64	41	98	64	71	20	29	23	9	2	1	1	
75035	0	0	311	188	128	182	155	104	25	45	11	0	0	0	0	
75036	2	0	210	53	69	110	51	45	4	11	3	1	0	0	0	
75056	1	0	3	3	0	2	0	0	0	0	0	0	0	0	0	
75068	0	0	59	13	9	9	0	0	0	0	0	0	0	0	0	
75071	0	0	1	0	1	2	0	0	0	0	0	0	0	0	0	
75072	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	
75078	0	0	0	0	1	0	1	2	0	1	0	0	0	0	0	
78373	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
																4

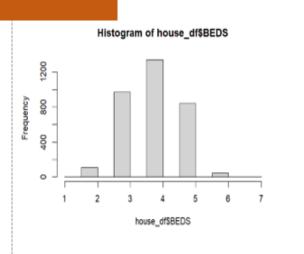
Table 4. Number of Baths by Zip

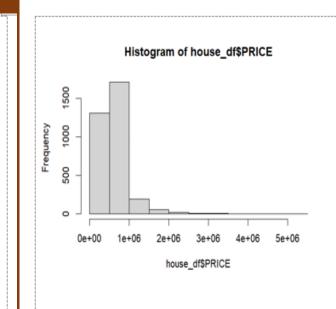
BE	EDS							
ZIP	1	2	3	4	5	6	7	
75007	0	9	195	94	15	0	0	
75033	0	5	125	338	250	9	0	
75034	0	5	123	150	158	13	1	
75035	0	1	355	472	301	20	0	
75036	1	86	125	239	107	1	0	
75056	0	1	2	6	0	0	0	
75068	0	0	47	36	6	1	0	
75071	0	0	1	3	0	0	0	
75072	0	0	1	1	0	0	0	
75078	0	0	0	3	2	0	0	
78373	0	0	0	0	1	0	0	

Table 3. Number of Bedrooms by Zip

3. Histogram trend and Scatter Plot







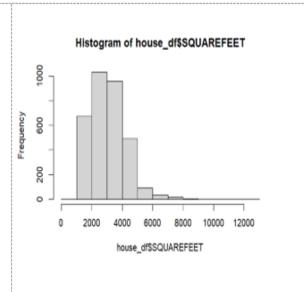
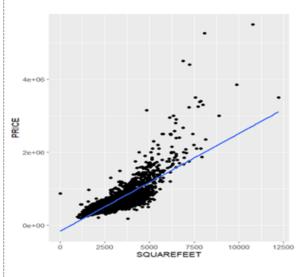
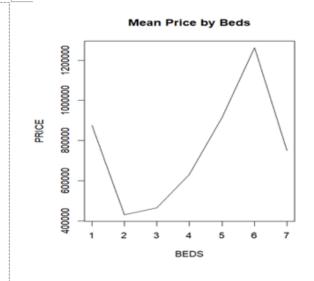


Figure 6. Histogram of different variable







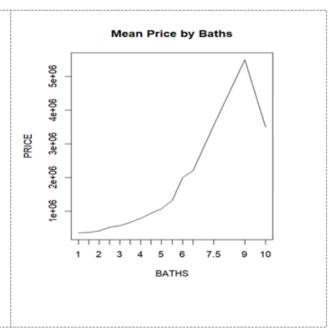
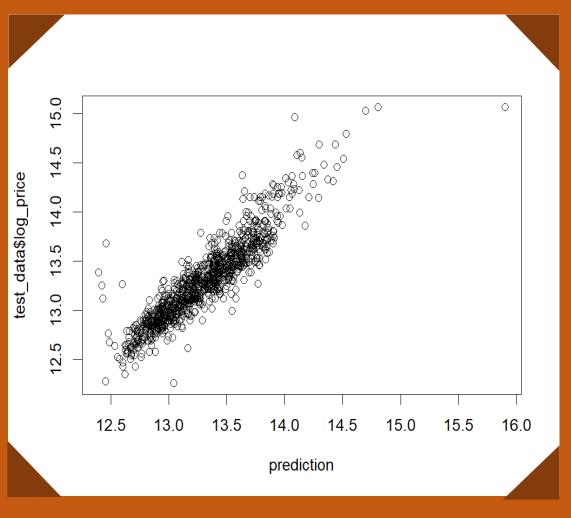


Figure 7. Price by different variable



Linear Regression

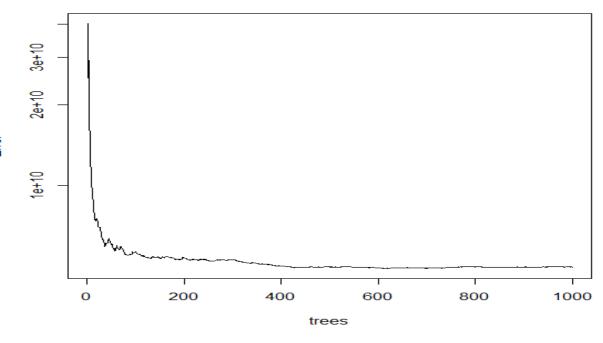


Coefficients in baths 3.0e², in sqarefeet, 2.672⁴ Residual standard error = 0.1559 on 2306 degress of freedom.

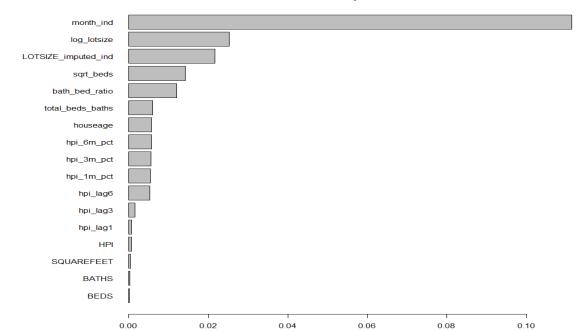
R-squared= 0.8591 Adjusted r squared = 0.8587 MSE= 0.0286

```
lm(formula = log_price ~ BATHS + SQUAREFEET + hpi_lag3 + hpi_3m_pct
    houseage + LOTSIZE_imputed_ind + log_lotsize, data = train_data)
Residuals:
              1Q Median
-1.65172 -0.09587 -0.00782 0.08553 1.03948
coefficients:
                     Estimate Std. Error t value Pr(>|t|)
(Intercept)
                    1.043e+01 1.172e-01 88.971 < 2e-16 ***
BATHS
SQUAREFEET
                    2.672e-04 6.823e-06 39.166 < 2e-16 ***
hpi_lag3
                    4.168e-03 1.212e-04 34.377 < 2e-16 ***
hpi_3m_pct
                    9.470e-01 8.784e-02 10.781 < 2e-16 ***
                   -6.067e-03 3.143e-04 -19.304 < 2e-16 ***
LOTSIZE_imputed_ind 2.348e-01 2.633e-02 8.917 < 2e-16 ***
                    1.037e-01 1.349e-02 7.690 2.17e-14 ***
log_lotsize
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.1559 on 2306 degrees of freedom
 (1 observation deleted due to missingness)
Multiple R-squared: 0.8591, Adjusted R-squared: 0.8587
F-statistic: 2008 on 7 and 2306 DF, p-value: < 2.2e-16
```

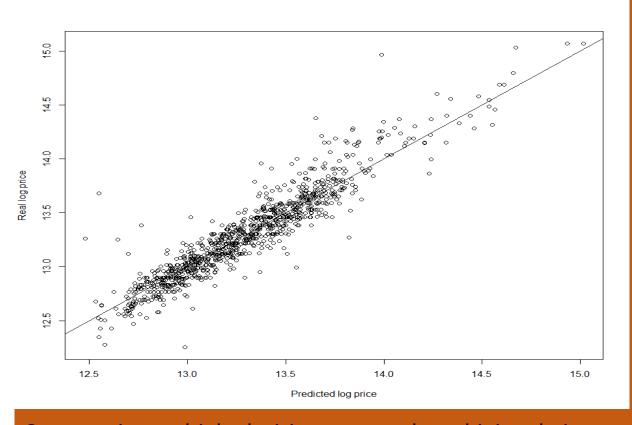
OOB Error Rate vs. Number of Trees



Variable Importance



Random Forest

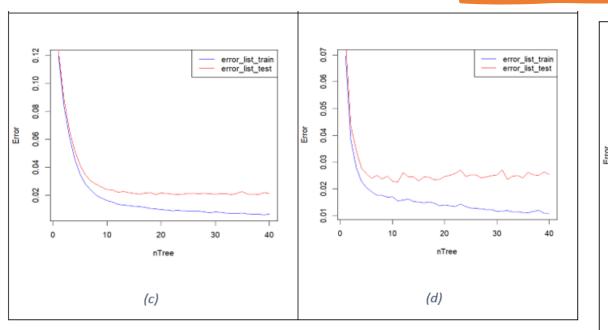


Constructing multiple decision trees and combining their predictions

Robust against overfitting, able to handle many predictors, provide variable importance measures

Found that mtry=7 and ntree=500 achieved low OOB error rate MSE = 0.022

Gradient Boosting



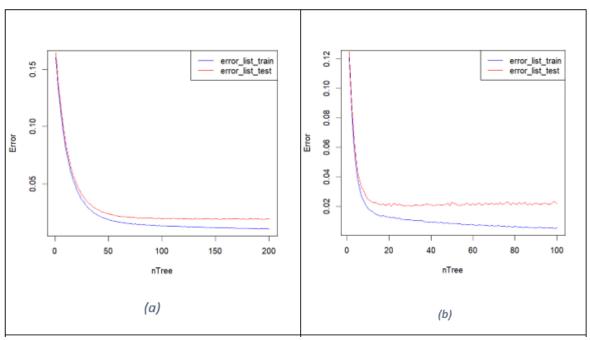
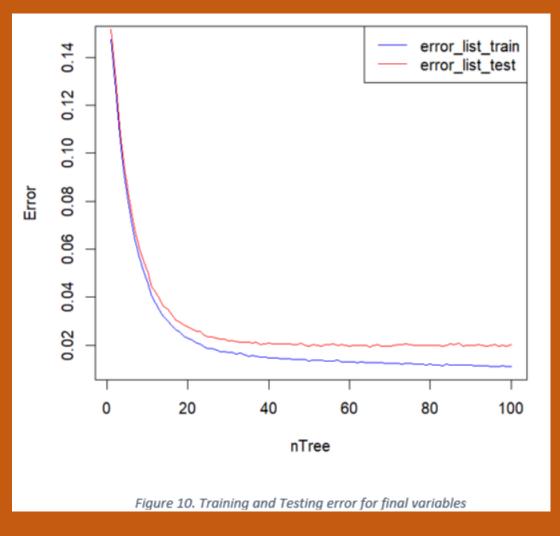


Figure 9. (a) max_depth=10, learning rate=0.1; (b) max_depth=20, learning rate=0.2

(c) max_depth=40, learning rate=0.2; (d) max_pepth=10, learning rate=0.5

Gradient Boosting cont.



Market Trend

Median Price by Month



Figure 11. Median Price trend

Conclusion





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