TO SELL A HOUSE

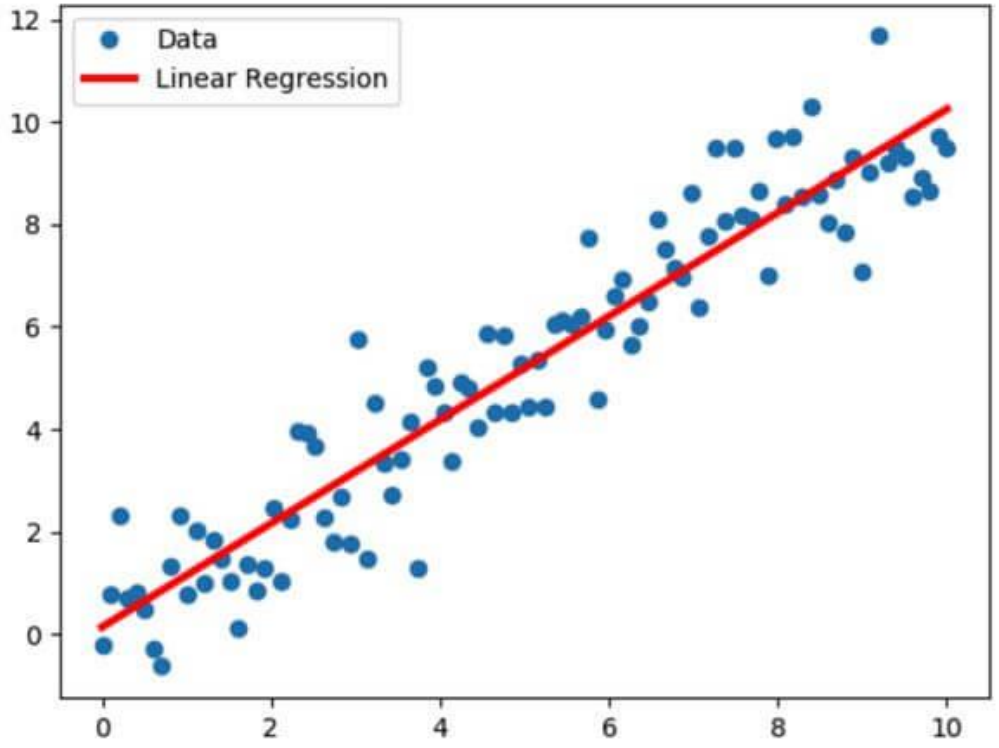
By Alejandro Harrison

Business Overview

- Company wants to advise King County customers how to renovate their houses in order to sell
- First need to identify best features of the house to renovate
- Looking at housing data from 2014-2015, 3 features identified:
  - Number of bathrooms
  - Total square footage
  - Overall grade rating

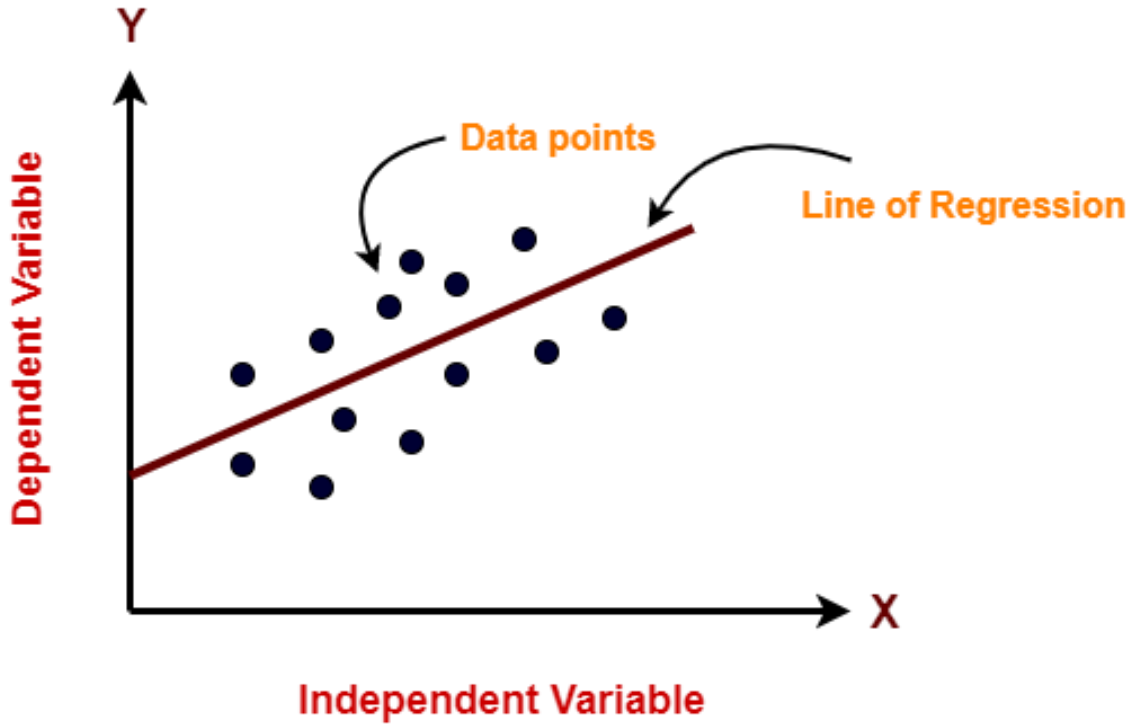
Method

- Used Linear Regression
- Using Linear Regression, able to identify which features were associated with increased home values
- But what is Linear Regression?



Linear Regression

- Way to calculate strength and direction of relationship between two or more variables
- Involves fitting a line of best fit to the data
- Can also be used to predict future values from new data



Why Use Linear Regression?

- Easier to understand and interpret results
- Gives important statistical and numerical information
- Allows you to see the strength of relationships
- Allows estimation of how much a variable will change as another variable(s) change

The Data

- Used King County housing dataset from 2014-2015
- 21,597 entries
- Price, bedrooms, bathrooms, etc.

#	Column	Non-Null Count	Dtype
0	id	21597 non-null	int64
1	date	21597 non-null	object
2	price	21597 non-null	float64
3	bedrooms	21597 non-null	int64
4	bathrooms	21597 non-null	float64
5	sqft_living	21597 non-null	int64
6	sqft_lot	21597 non-null	int64
7	floors	21597 non-null	float64
8	waterfront	19221 non-null	object
9	view	21534 non-null	object
10	condition	21597 non-null	object
11	grade	21597 non-null	object
12	sqft_above	21597 non-null	int64
13	sqft_basement	21597 non-null	object
14	yr_built	21597 non-null	int64
15	yr_renovated	17755 non-null	float64
16	zipcode	21597 non-null	int64
17	lat	21597 non-null	float64
18	long	21597 non-null	float64
19	sqft_living15	21597 non-null	int64
20	sqft_lot15	21597 non-null	int64

Data continued..

- Goal to analyze relationship of price with other variables
- Price changes based on other variable changes
- Coefficients that will reflect the price changes.

Results

- For linear regression, need to create and run a model, then get a summary of the results
- Relationship statistically significant
- Base house price is $20.46

OLS Regression Results

Dep. Variable:	price	**R-squared:**	0.642
Model:	OLS	**Adj. R-squared:**	0.642
Method:	Least Squares	**F-statistic:**	3528.
Date:	Thu, 25 Aug 2022	**Prob (F-statistic):**	0.00
Time:	16:11:09	**Log-Likelihood:**	-4155.3
No. Observations:	15762	**AIC:**	8329.
Df Residuals:	15753	**BIC:**	8398.
Df Model:	8		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	20.4636	0.236	86.531	0.000	20.000	20.927
bedrooms	-0.0360	0.004	-10.178	0.000	-0.043	-0.029
bathrooms	0.0918	0.006	15.884	0.000	0.080	0.103
sqft_living	0.3923	0.012	32.835	0.000	0.369	0.416
floors	0.0768	0.006	12.639	0.000	0.065	0.089
waterfront	0.5443	0.029	18.679	0.000	0.487	0.601
condition	0.0149	0.002	6.825	0.000	0.011	0.019
grade	0.2324	0.004	66.210	0.000	0.226	0.239
yr_built	-0.0063	0.000	-54.048	0.000	-0.006	-0.006

Omnibus:	34.709	**Durbin-Watson:**	1.973
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	39.196
Skew:	-0.067	**Prob(JB):**	3.08e-09
Kurtosis:	3.204	**Cond. No.**	1.86e+05

Coefficients

- Coefficients represent amount change in price for 1 unit change in variables shown
- Eliminated variables
- Variables left shown

bedrooms	-0.0360
bathrooms	0.0918
sqft_living	0.3923
floors	0.0768
waterfront	0.5443
condition	0.0149
grade	0.2324
yr_built	-0.0063

Coefficients Continued…

- Using a math equation we can see:
  - For each additional bedroom added our price will go down by about 3.5%
  - For each additional bathroom added, our house price will go up by about 9.6%
  - For each 1 unit increase in sqft_living, the price will increase by 48%
  - For each additional floor added, the price will increase by about 8%
  - For each increase in condition value ranking , the house price will increase by about 1.5%
  - For each increase in grade value ranking, the house price will increase by about 26.2%
  - For each year newer the house is, the price will decrease by about .63%

Best Coefficients

- Best coefficients to look at after eliminating other variables:
  - Number of bathrooms
  - Grade of the house
  - Living square footage

Bathrooms

- Add at least one entire bathroom
- Each 1 bathroom added, price goes up 9.6%
- Needs to be a full bathroom
- Includes shower, sink, bathtub, and toilet.

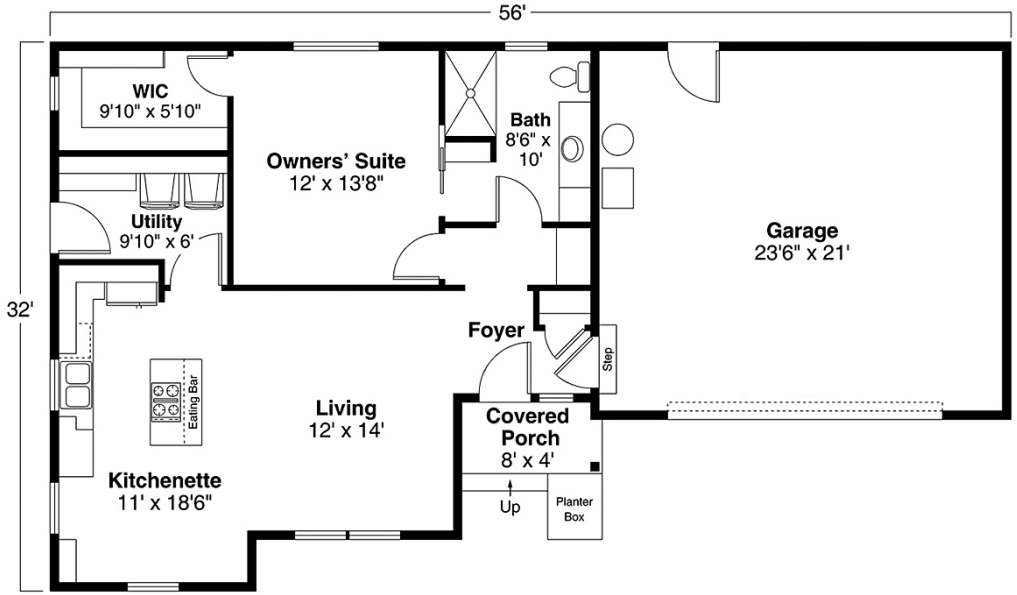
Grade Of House

- Based on construction and design of house.
- Higher ratings associated with more square footage, more custom designs, and more expensive materials
- Each Increase in grade value ranking, house price increase by about 26.2%

BUILDING GRADE
Represents the construction quality of improvements. Grades run from grade 1 to 13. Generally defined as:
1-3 Falls short of minimum building standards. Normally cabin or inferior structure.
4 Generally older, low quality construction. Does not meet code.
5 Low construction costs and workmanship. Small, simple design.
6 Lowest grade currently meeting building code. Low quality materials and simple designs.
7 Average grade of construction and design. Commonly seen in plats and older sub-divisions.
8 Just above average in construction and design. Usually better materials in both the exterior and interior finish work.
9 Better architectural design with extra interior and exterior design and quality.
10 Homes of this quality generally have high quality features. Finish work is better and more design quality is seen in the floor plans. Generally have a larger square footage.
11 Custom design and higher quality finish work with added amenities of solid woods, bathroom fixtures and more luxurious options.
12 Custom design and excellent builders. All materials are of the highest quality and all conveniences are present.
13 Generally custom designed and built. Mansion level. Large amount of highest quality cabinet work, wood trim, marble, entry ways etc.

Square Footage

- Increasing also increases grade rating
- Each 1 unit increase increases house price by 48%
- Add anywhere from 60-120 square feet for each bathroom
- 60 is average sized, 120 is on larger side.



Recommendations

- Add at least one full bathroom
- 60-120 square feet added per bathroom
- For maximum effect, 120 feet
- Use custom designs for bathroom
- Use higher end materials

Questions And Contact Info

- Questions?
- Any additional inquiries can be directed to linkedin:
  - https://www.linkedin.com/in/alejandro-harrison-948034108/