Kings_County_Housing_Price_Prediction -A Linear Regression Project

Overview:

Predicted suburban housing prices using Linear Regression on an existing dataset on **King county Washington** .

The purpose was to model the said data and analyse the results to assist builders on :

- what kind of property to build.
- What is the price range the property should be.
- What are the facility that sell the most and people seek to buy based on the available data.

The data includes homes sold between May 2014 and May 2015.

Exploratory Data Analysis:

The features and structure of the data showed the price that each house sold for and the prediction target as well a number of predictor variables such as number of bed rooms , bathrooms , sqft area of living , lot , floors, how many times the house has been viewed etc . Some of the points that the data revealed initially

- The newer built and renovated houses were sold the most
- The lower valued houses has been sold the maximum
- Average or better condition has an influence in the house being sold
- The house with view and water front has an higher price and lower volume of sales

Other Observations:

- There are three columns with null values , waterfront , view, yr_renovated which needs to be filled
- The date columns needs to be converted to datetime stamp from object
- The yr_renovated column needs to be converted to float from string

Feature Engineering

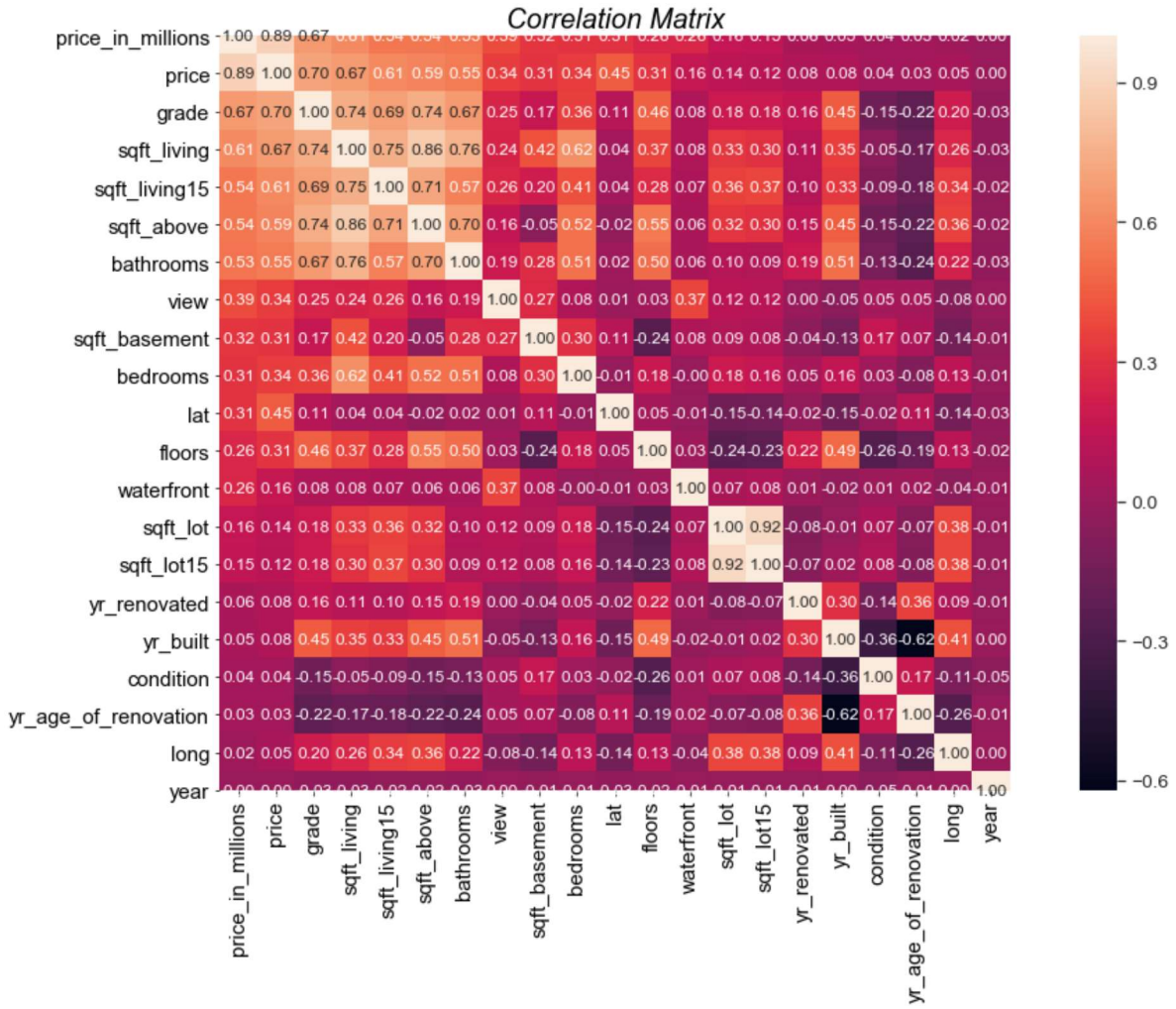
The Data Exploration was further carried out with feature engineering the main objective was to find out

- Engineer and transform the features and the target variable
- Shortlist few features
- Set base to Build a model based on which feature affected the price
- Further make and submit predictions

The following process were carried out :

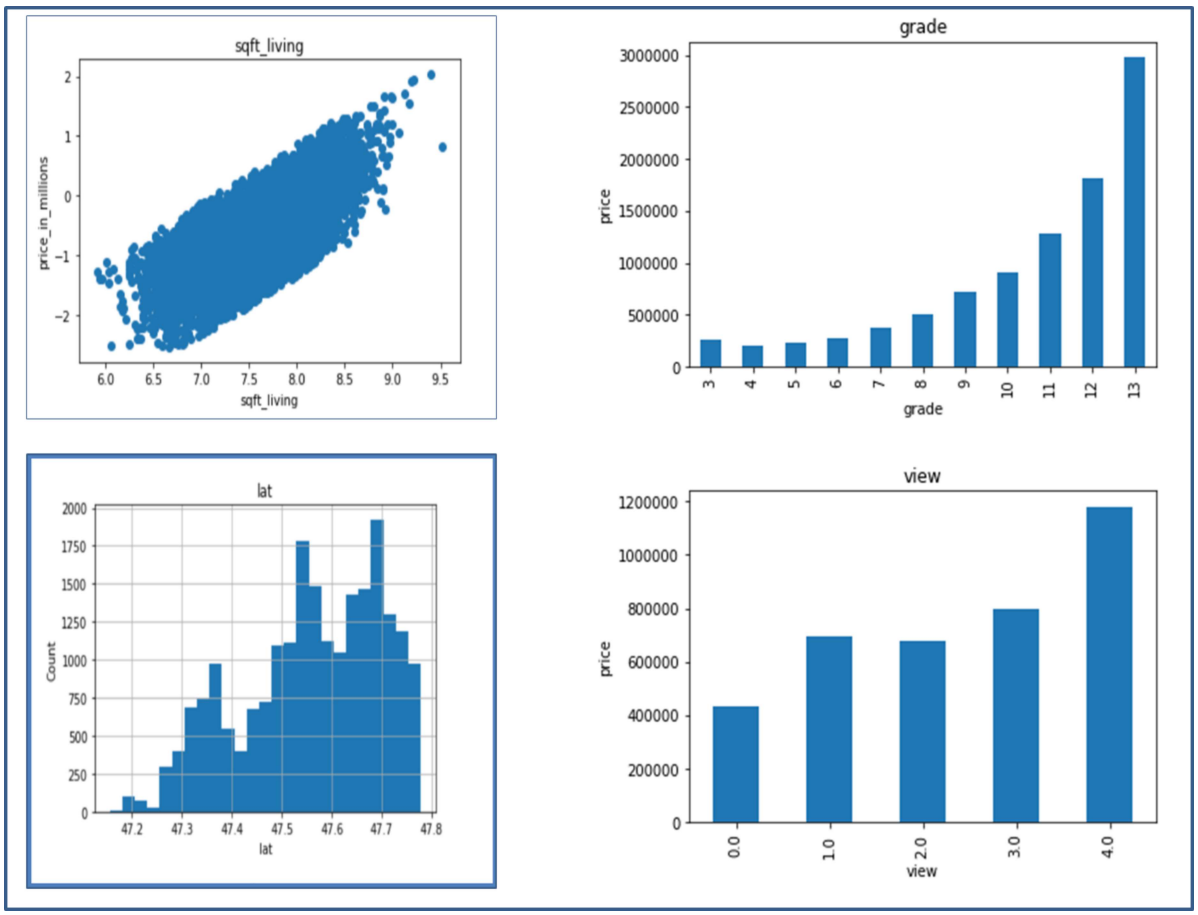
- Checking percentage of nan values and list of features which has missing value
- No Null values or missing value detected
- Finding relationship between each column having missing value and sales price
- Confirming all columns as Numerical variables
- Datetime variable and two types of Numerical Variables: Continous & Discreate Variable were worked on
- Finding distribution of continous feature / variable with histogram

- Logarithmic transformation: Applying log normal distribution for dependent(price_in_millions) and independent(others) feature to check the relationship
- Checking the Outliers in the features using Box Plot
- Dropping Outliers
- Feature Scaling: Transforming the train and test set, and add on the id and price variables
- Multicollinearity :using heat map for checking multi_collinearity between variables



Over all Observation: here we can see that there is a strong & positive monotonic relationship between the price_in_millions and other features like sqft_living , sqft_above & sqft_living15

The important features to focus on seem to be sqft_living, , grade , view , lat,



Lasso model was used to confirm the same

Linear Regression

The process carried out were :

- Engineer and transform the features and the target variable
- Importing file and using the selected features as the subset for feature interpretation
- Creating histogram and check the shape to see if it is uniform or not
- Check the linearity assumption for all chosen features with target variable using scatter plots
- Regression Analysis and Diagnostics for price_in_millions
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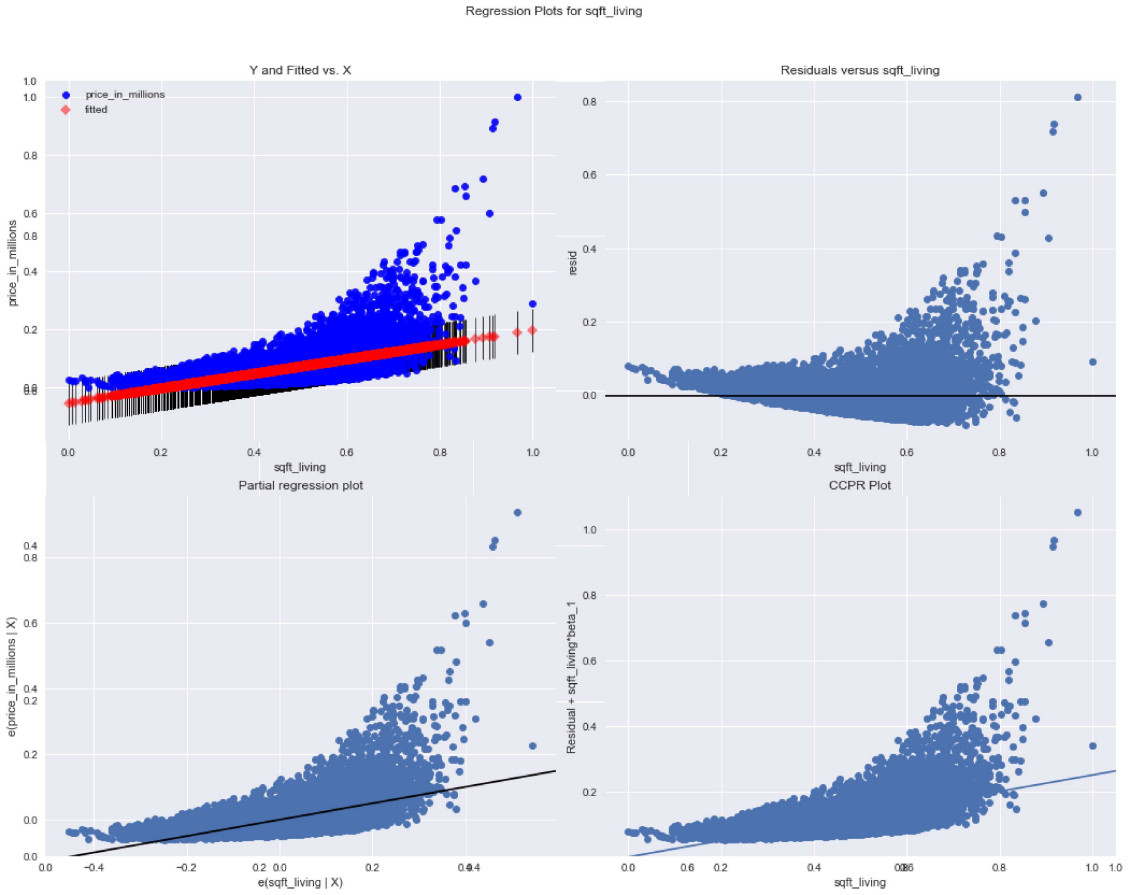


Observation

The features with highest r_squared were

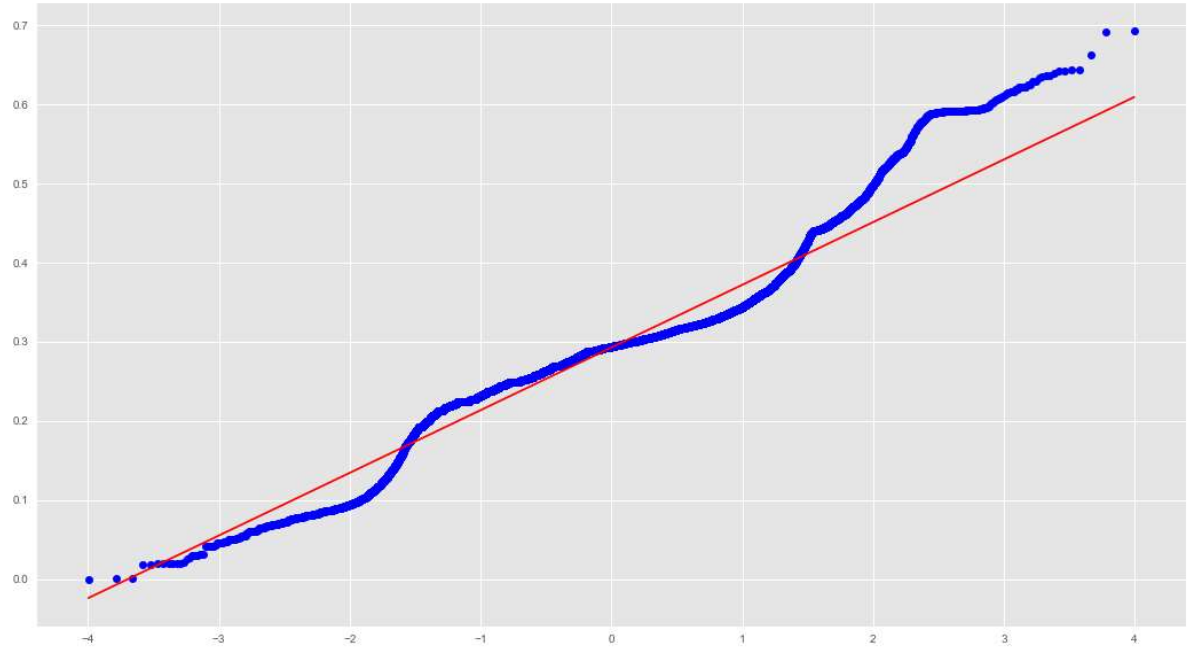
- sqft_living 0.374346
- view 0.154650
- grade 0.446158
- sqft_above 0.294497
- sqft_basement 0.103110
- sqft_living15 0.295749

Probability distribution

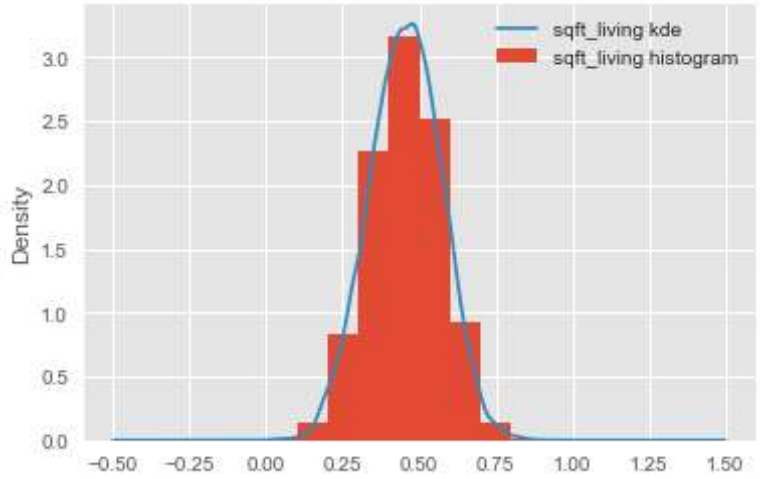
- Distribution plots are used to show a probality distribution.
- For a normal distribution, the ideal skewness and kurtosis value is approximately 0.
- Skewness is a measure of the asymmetry of the probability distribution of a random variable about its mean.
- Kurtosis is used to describe the extreme values in one versus the other tail of a distribution.

Normalization

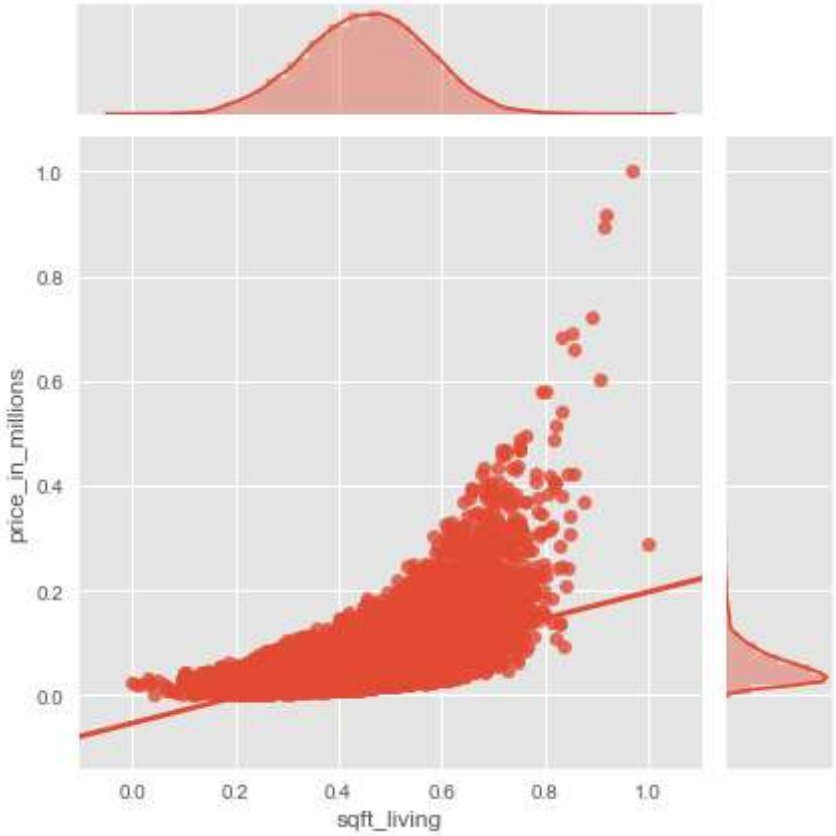
- As a general rule of thumb: If skewness is less than -1 or greater than 1, the distribution is highly skewed. If skewness is between -1 and -0.5 or between 0.5 and 1, the distribution is moderately skewed. If skewness is between -0.5 and 0.5, the distribution is approximately symmetric.
- Both skew and kurtosis can be analyzed through descriptive statistics. Acceptable values of skewness fall between − 3 and + 3, and kurtosis is appropriate from a range of − 10 to + 10 when utilizing SEM (Brown, 2006).



- **KDE - Plotting histogram _ to check the distribution of predictors**



- Testing linearity assumption
- Jointplot - Checking for Linearity



Interpretation final model5

- Based on the target variable : price_in_millions, the multi co-linearity and some other details lets interpret the statistical significance of Model5 - the P-Value, the overall F statistics, the R squared value etc
- The Adjusted R Square post penalizing R squared values that include non useful predictors is 0.587 which is same as the R squared which indicate that the model is a well fitted model and is not blowing the overall model performance out of proportion. Also its indicating the model has relevant features
- the intercept value in this case is -0.0710
- As we see the P values is Zero which is better than the targeted value of 0.05 and the f statistics value is large we can reject the null hypothesis as we can see the evidence that the selected features and the target variable have a linear relationship
- As we can see the T value of Sqft living -View & grade dominate the rejection of the null hypothesis and accept the alternate hypothesis with their high T values and 0 P value
- The pre transformation and post transformation values in these features did not show much difference so it can be confirmed that the features like Sqft living , grade and view play a vital role in influencing the price and sale of the property
- Considering that the co-linearity between these features are the least or negligible we can easily confirm the accuracy of the model
- Finally As we know linear regression is not the best model for this dataset it will be advisable to run other regressors to check better options

Thank You