PROJECT 2

Ames Housing Analysis

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Introduction

With the ever-rising cost of living, essential needs are getting more expensive.

Shelter or house always contributed to the biggest part of spending.

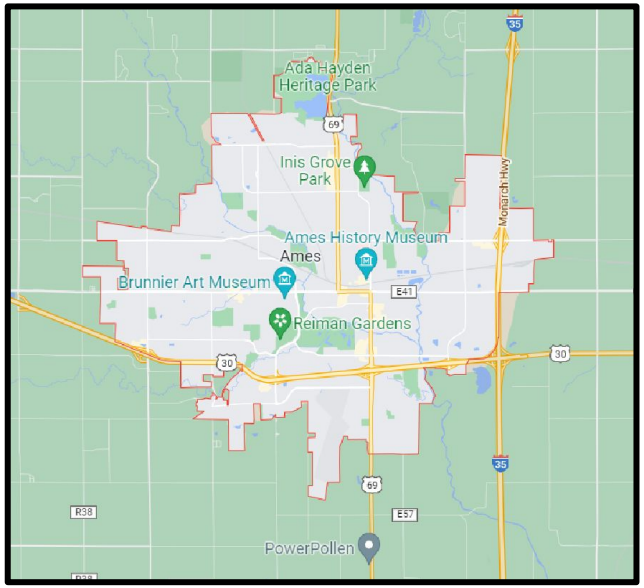
New home buyer at Ames, Iowa would like to own a home and invest at the same time

Houses are liability and asset at the same time. After purchasing as the price could increase in the future.

Problem Statement

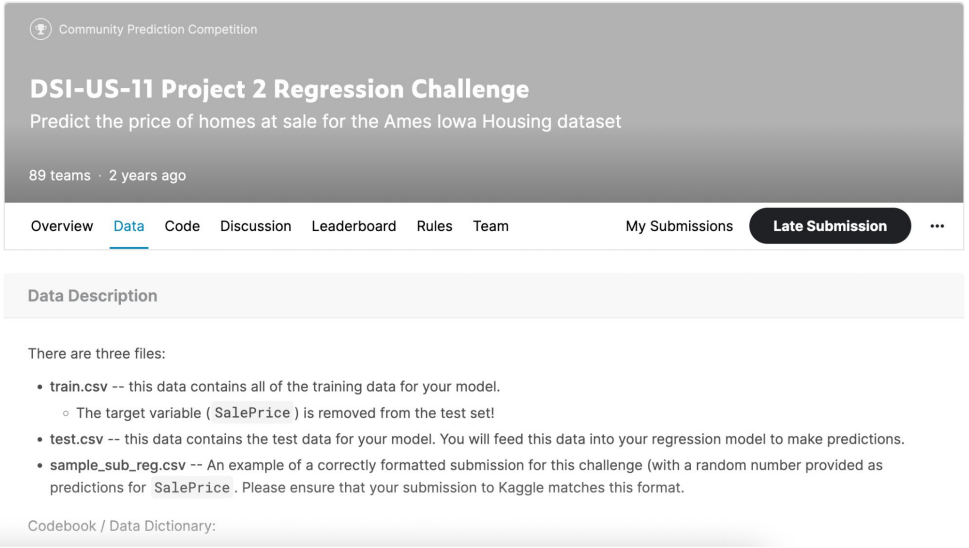
Ensuring new home buyers could yield highest return of investment from their new house purchase, the objective for our projects are:

1. To identify the best and worst permanent and non-permanent features affecting the sale price in Ames, Iowa.
2. To identify the non-permanent feature of house that could lead to high Sale Price after renovation.



Datasets Introduction

- House Transaction at Ames, Iowa between the year 2006 to 2010
- Consists of 80 columns of the house features and the transaction price
- Features have both continuous variables and discrete variables
- List of complete data dictionary [here]



Data Cleaning - Outliers

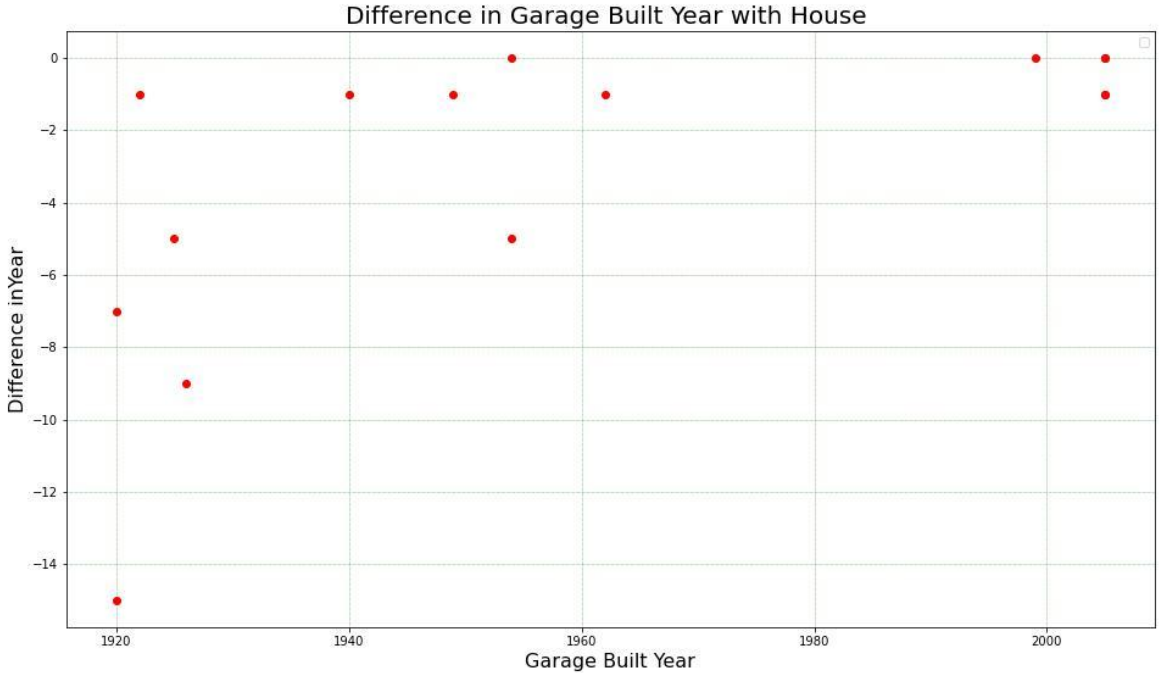
Error	Outliers	After Data Cleaning
Outliers in ‘Lot_Area’	159,000 sqft & 115,149 sqft	Removed from dataset

Data Cleaning

Error	Before data Cleaning	After Data Cleaning
'Year_Remod/Add' is earlier than 'Year_Built'	Id = 851 Year_Built = 2002 Year_Remod/Add = 2001	Id = 851 Year_Built = 2002 Year_Remod/Add = 2002
'Year_Sold' is earlier than 'Year_Built', 'Year_Remod/Add' & 'Garage_Yr_Blt'	Id = 2261 Garage_Yr_Blt = 2207 Yr_Sold = 2007	Id = 2261 Garage_Yr_Blt = 2007 Yr_Sold = 2007
	Id = 2181 Year_Remod/Add = 2009 Yr_Sold = 2007	Id = 2181 Year_Remod/Add = 2009 Yr_Sold = 2009
	Id = 1703 Year_Remod/Add = 2008 Yr_Sold = 2007	Id = 1703 Year_Remod/Add = 2008 Yr_Sold = 2008
'Garage_Yr_Blt' is earlier than 'Year_Built'	0.5% (11 units) of the datasets has 'Garate_Yr_Blt' earlier than 'Year_Built'	**Remained** (To clarify in later part)

Data Cleaning on 'Garage_Yr_Blt' is earlier than 'Year_Built'

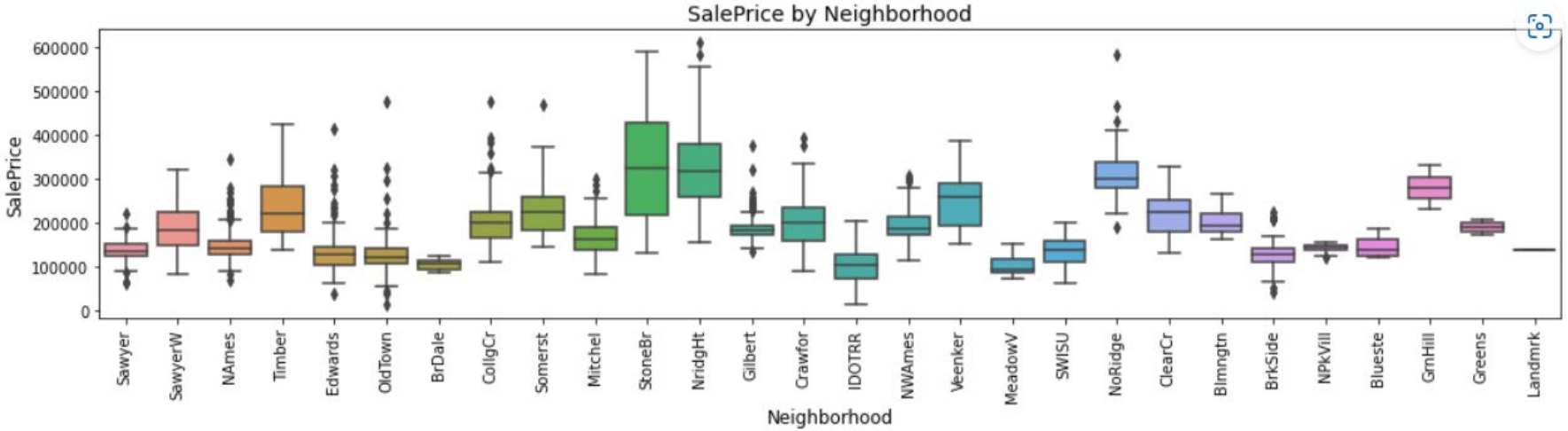
- 11 units has garage built before house
- 5 units built on 1920s
- 6 units built between 1930 - 2005
- More common in 1920s
- Homebuilders built garage first so they could live in it while financing and constructing the house *
- No changes on the data



Source:

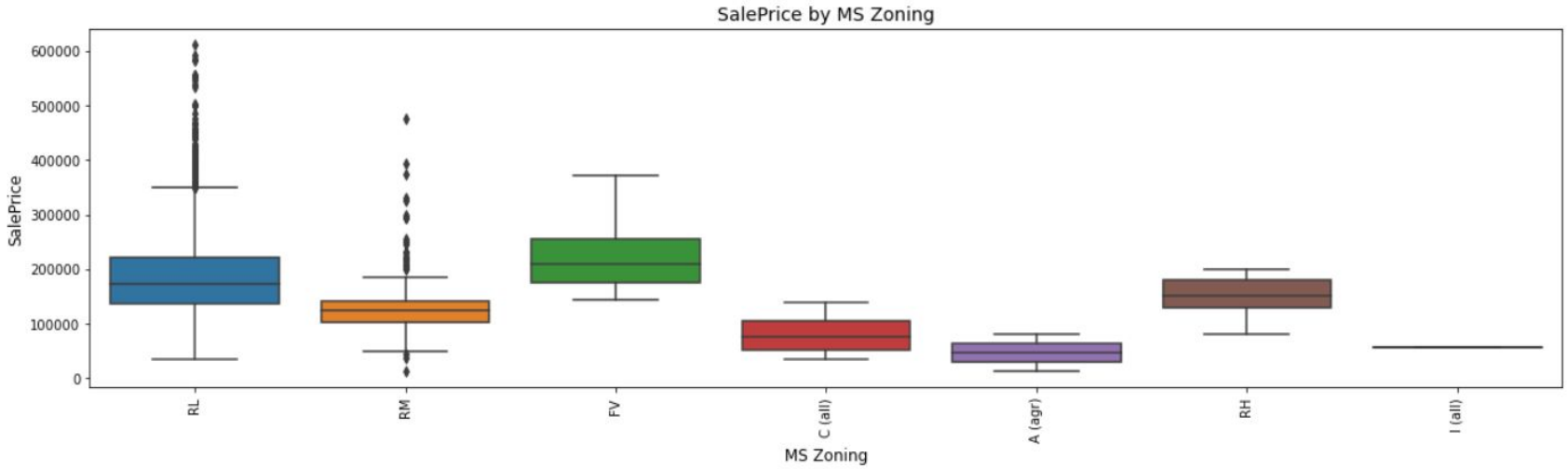
THE GARAGE: ITS HISTORY AND PRESERVATION

EDA & Visualisation



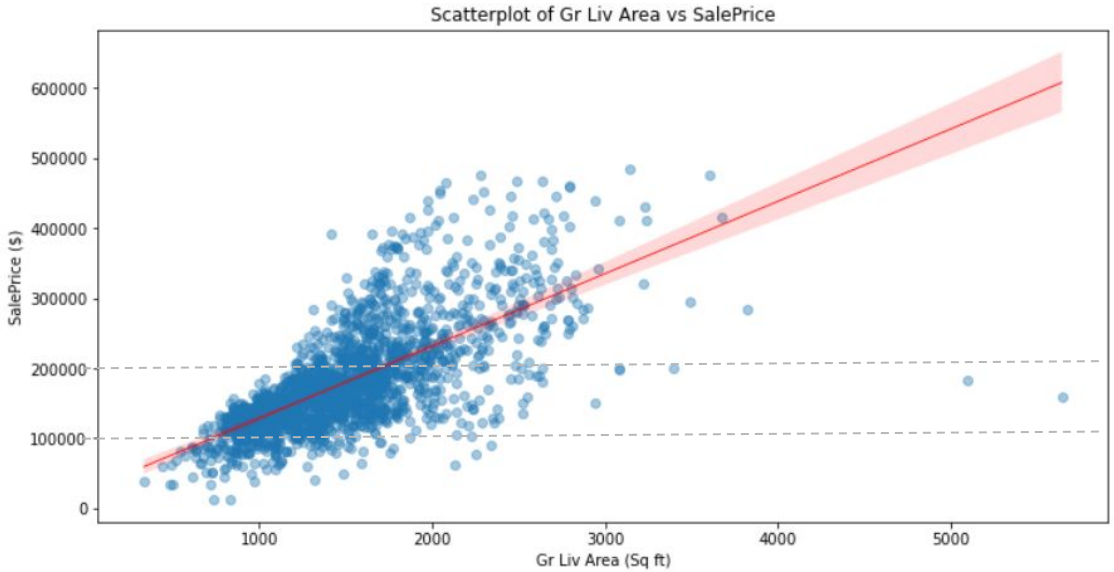
- Stone Brook and Northridge Heights: nearly similar median price, not exceed each others' interquartile ranges
- Stone Brook and Mitchell: interquartile ranges do not intersect on the sale price scale

EDA & Visualisation



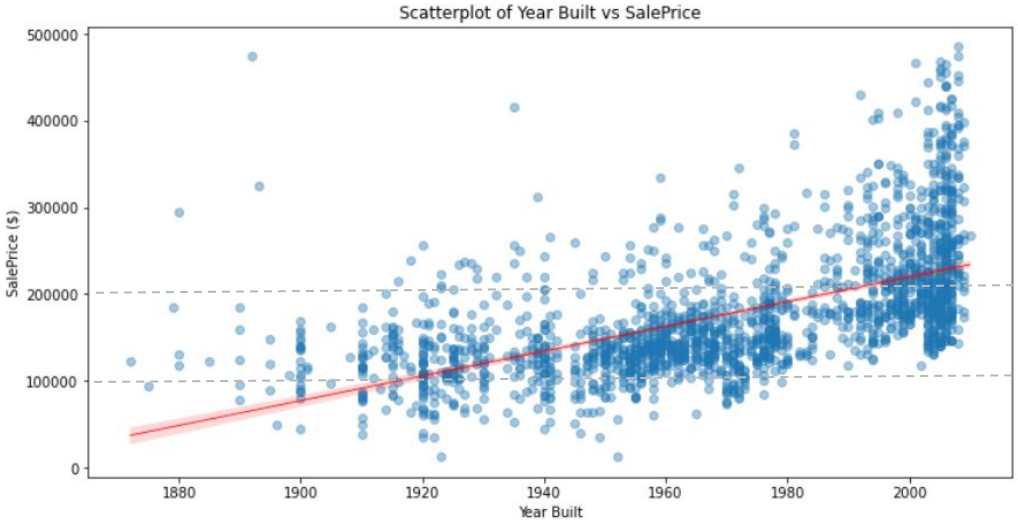
- The highest median: FV -- Floating Village Residential
- The lowest median: C(all) -- Commercial properties
- Outlier: RL -- Residential Low Density, probably due to poor zone and rich neighborhood

EDA & Visualisation



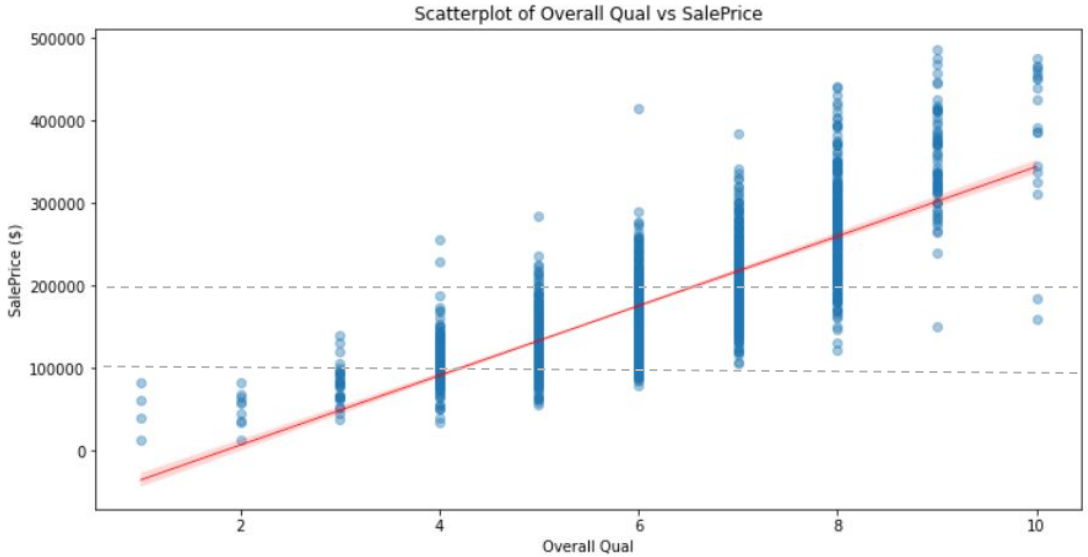
- Upward linear regression
- Sale price tend to increase when the ground living area increase
- clustered between about 1,000 to 2,000 square feet and at the price range of $100,000 to $200,000

EDA & Visualisation



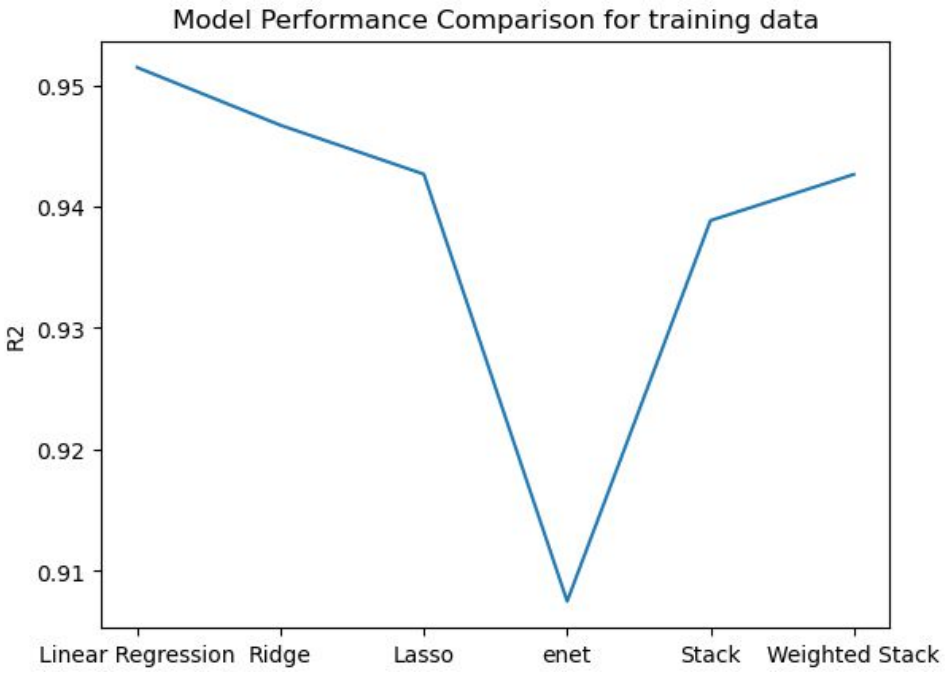
- Upward linear relationship
- More people tend to buy houses which were built after year 2000 and at the price range of $100,000 to $200,000

EDA & Visualisation



- Upward linear relationship
- tend to buy houses at the rating of 5-7 and at the price range of $100,000 to $200,000.

Models

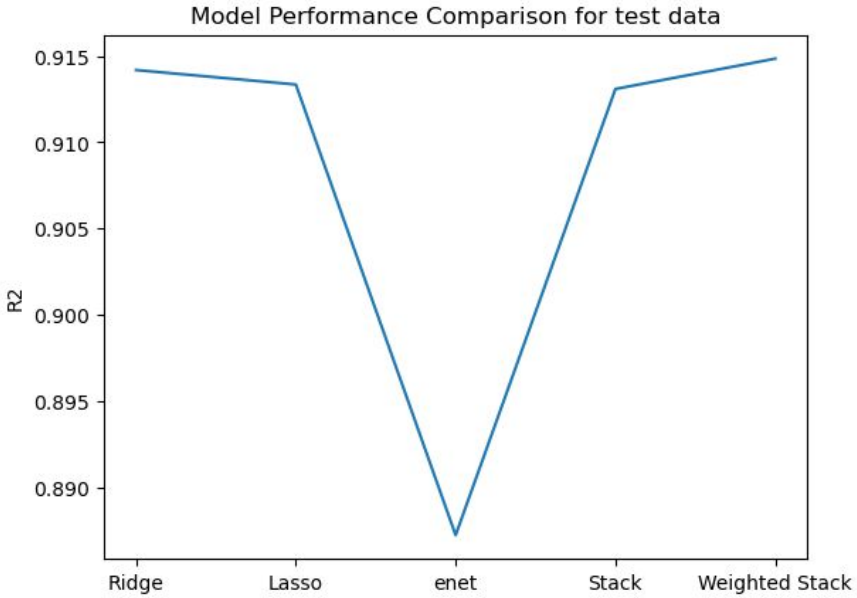


- Linear Regression, Ridge and Lasso were used for modelling
- Simple stacking of model to check if performance improves
- More tuning for ElasticNet

Simple Stack	mean(Ridge, Lasso, ElasticNet)
Weighted Stack	Ridge * 0.5 + Lasso * 0.3 + ElasticNet * 0.2

Models

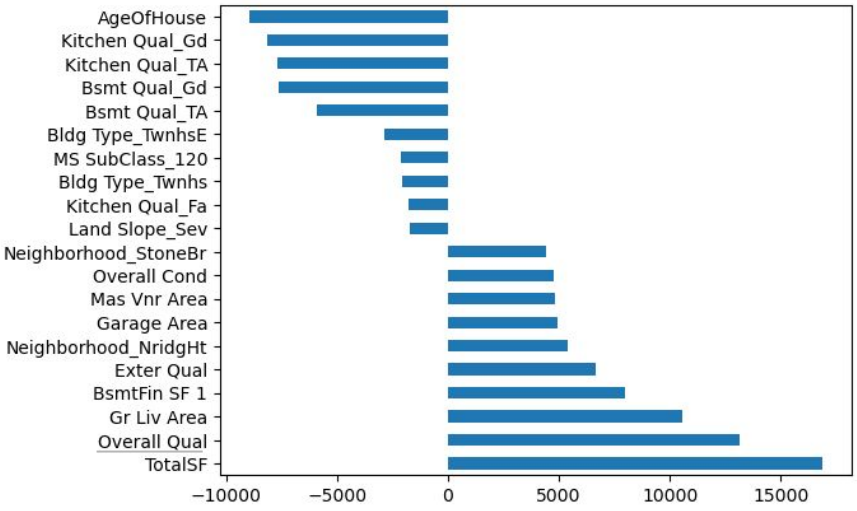
R2 Validation Score	
Linear Regression	$-6.31 * 10^{23}$
Ridge	0.914
Lasso	0.913
Enet	0.887
Stack	0.913
Weighted Stack	0.915



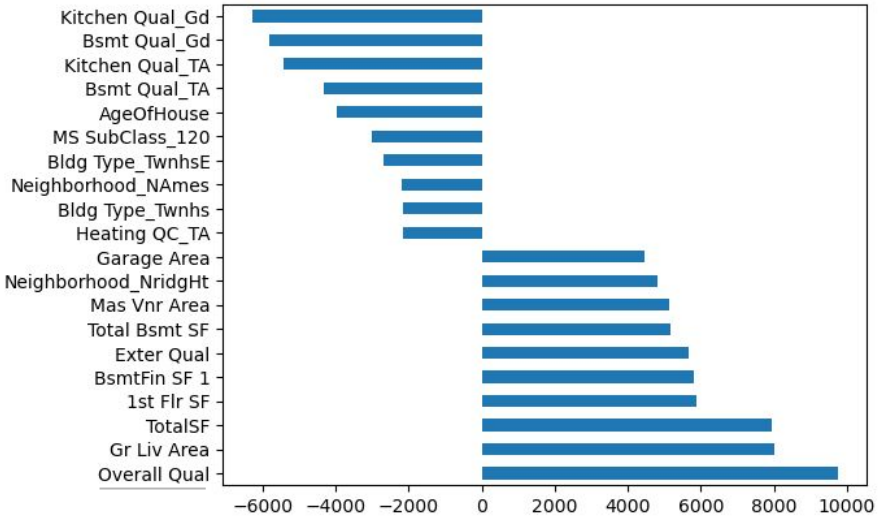
- Severe overfitting for the linear regression model seen in training vs test scores
- Regularised models do better out the training data set
- Slight improvement when the models are stacked

Findings

Lasso Coefficients



Ridge Coefficients



- Overall Quality of the house appears on both of Lasso and Ridge coefficients and has been given a very large coefficient. North Ridge and Stone Brook, Ground Living Area
- Age of house has a large negative coefficient
- **52.27%** of features got zeroed out in Lasso; Fireplace & Total Rooms

Conclusion

<table>
<tr><th>Problem Statements</th><th>Suggestions</th></tr>
<tr><td>Identify the best and worst permanent and non-permanent features affecting the sale price in Ames, Iowa</td><td>
<table>
<tr><th>Positive Coefficient</th><th>Negative Coefficient</th></tr>
<tr><td>Overall Quality</td><td>Age of house</td></tr>
<tr><td>Living Area</td><td>Average/Bad Kitchen</td></tr>
<tr><td>Neighborhood</td><td>Average/Bad Basement</td></tr>
</table>
</td></tr>
<tr><td>Ensuring new home buyers could yield highest return of investment from their new house purchase</td><td>

Proposal to get house with lower overall quality, and remake & remodel to improve overall quality
Northridge and Stone Brook; Northern part of Ames
Big Ground Area

</td></tr>
</table>

Recommendations

Model could include economic data such as interest rate and employment

Retrain models in the future in case of data drift

Expand datasets to other states of US

README.md - must always be named like this

Start with EDA notebook and save that file as csv file

Start with another notebook and use that csv file

Image and data to be saved in separate folders for neater

Pycarat can be used but need to use linear regression

To extract betas from the sklearn models.

Code is always inappropriate for a non-technical audience

Highlight model name and package name

Shap package

Omitted variable that is additional variables