Project 2

Ames Housing Data and Kaggle Challenge

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INTRODUCTION

Ames is a city in Story County, Iowa, United States approximately 30 miles north of Des Moines in central Iowa. It is best known as the home of Iowa State University, with leading Agriculture, Design, Engineering, and Veterinary Medicine colleges.

In this project, datasets obtains from the Ames Assessor's Office (through Kaggle) are used to create a regression model that predicts the price of houses in Ames, IA.

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PROBLEM STATEMENT

To build a regression model with the

lowest error

to predict Sales Price of houses sold in Ames

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DATASETS

Data set contains information from the Ames Assessor's Office used in computing assessed values for individual residential properties sold in Ames, IA from 2006 to 2010.

Source: https://www.kaggle.com/c/dsi-us-6-project-2-regression-challenge/

Train.csv	2051 Observations	81 variables
Test.csv	879 Observations	80 variables

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DATASETS

Train.csv	23	21	20	17
	Ordinal	Nominal	Continuous	Discrete

For model selection & fitting

Test.csv	23	21	19	17
	Ordinal	Nominal	Continuous	Discrete

For prediction of house price to submit to Kaggle

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WORKFLOW

Data Cleaning

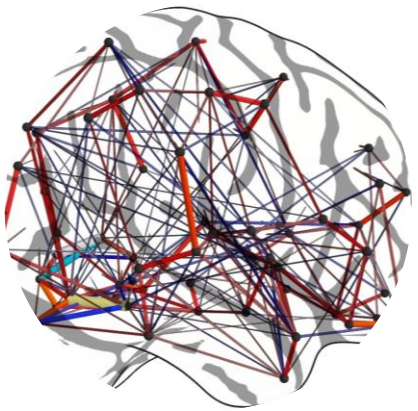
- Null handling
- Combine/remove
- Outlier removal
- EDA

One-Hot Encoding

- Encode category variable
- Ensure same shape for Train & Test

Feature Engineering

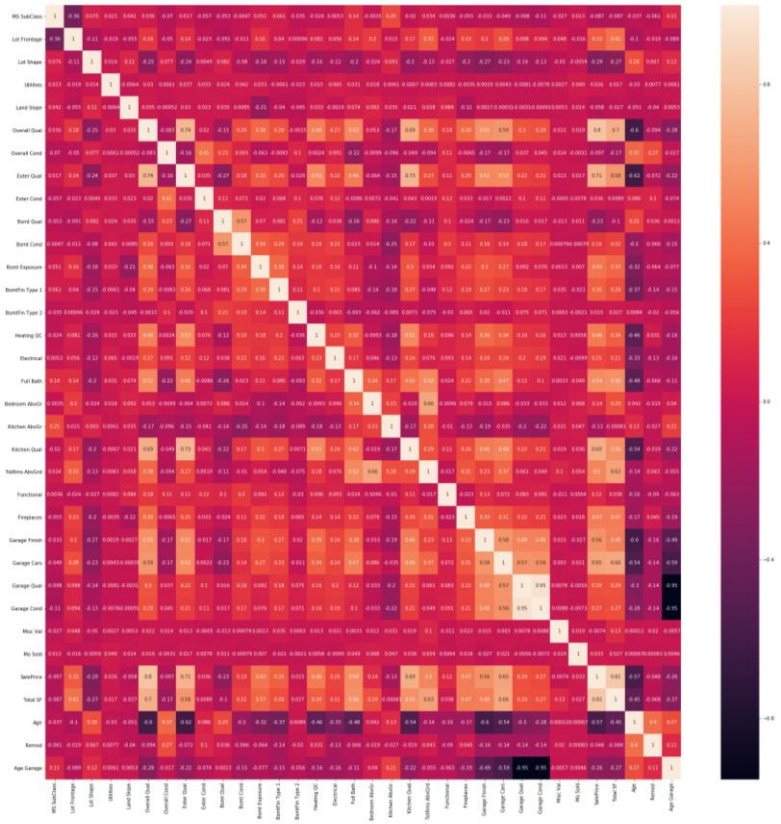
- Lasso Selection
- 30 variables



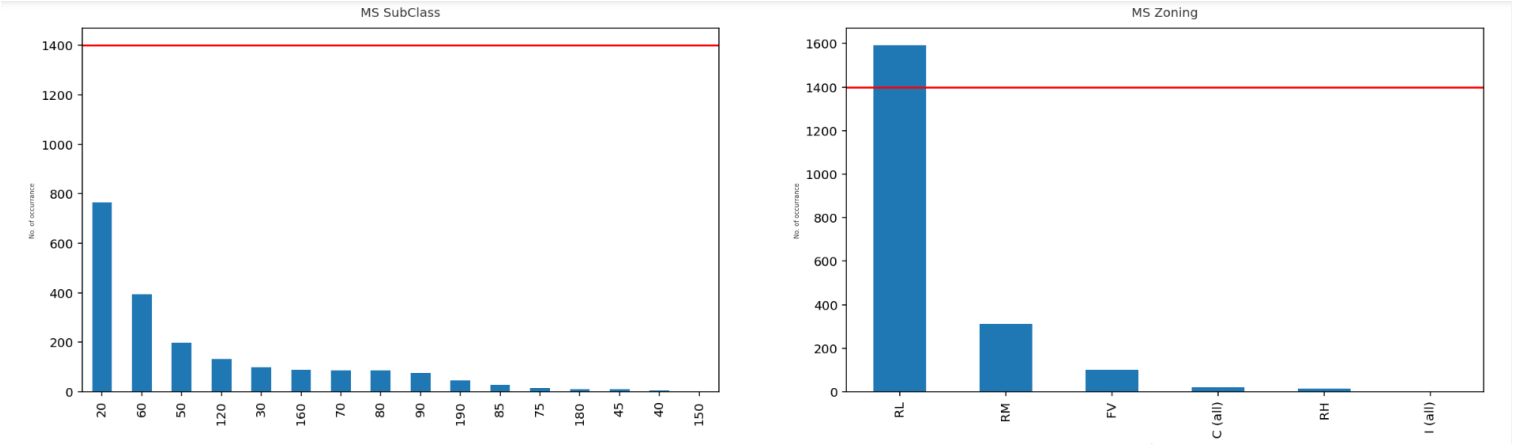
Modeling & Prediction

- 4 model: LR, Lasso, Ridge, Elastic
- Predict with LR

EDA



Correlation heatmap to eliminate variables



Plotting distribution histogram to eliminate skewed distributed variables

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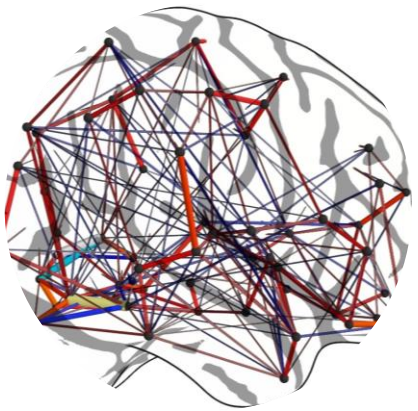

Modeling & Prediction

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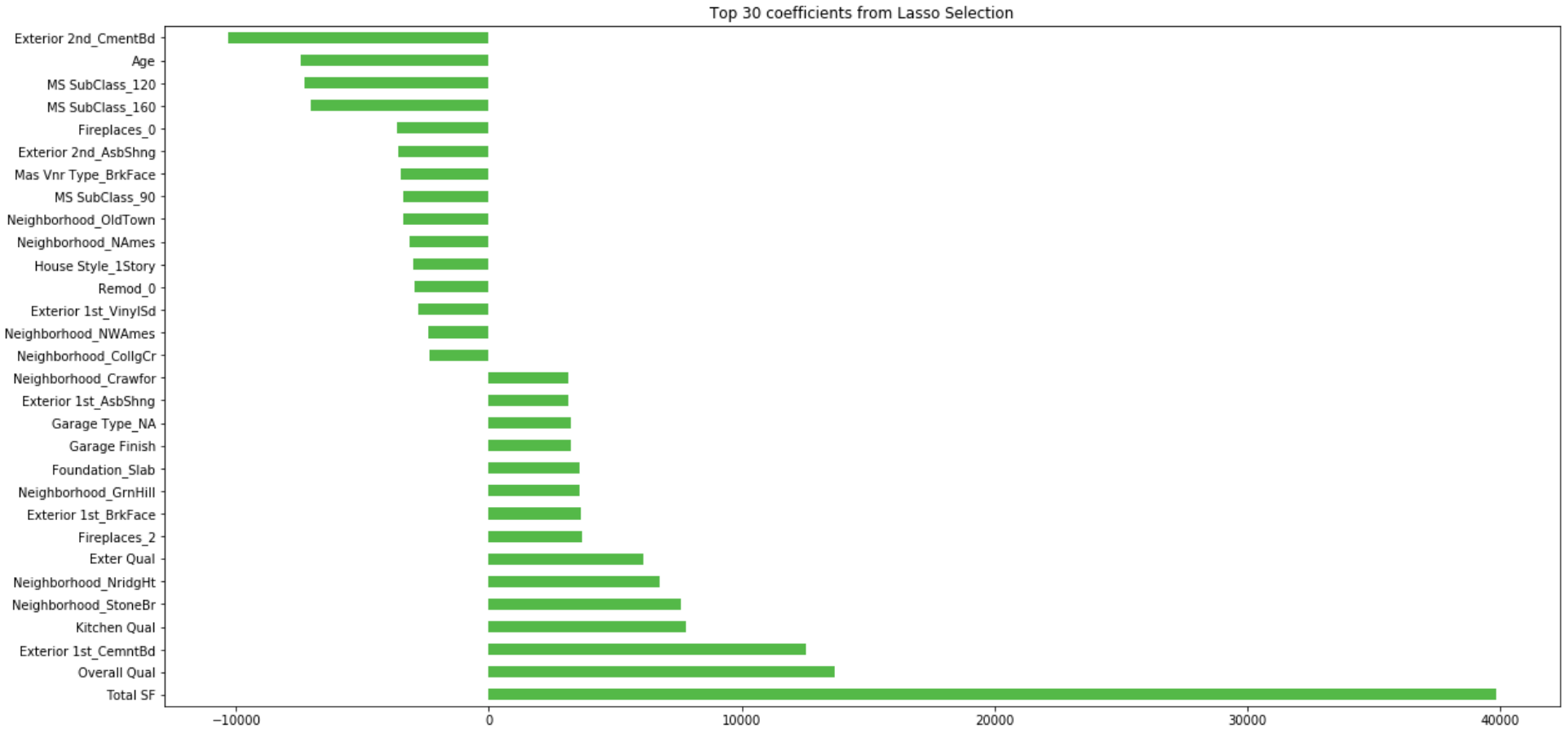
- Predict with LR

FEATURES ENGINEERING



Using Lasso to select top 15 +ve & -ve coefficients as final variables for model selection

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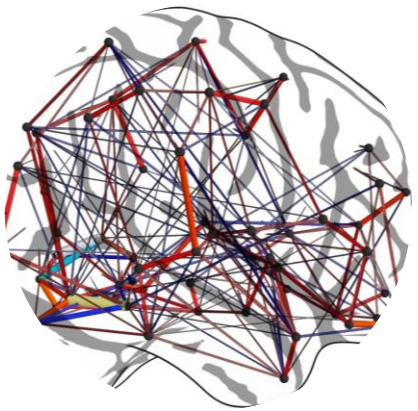

Modeling & Prediction

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MODEL SELECTION

Linear Regression

$$\text{minimize: } RSS = \sum_{i=1}^{n}(y_i - \hat{y}_i)^2 = \sum_{i=1}^{n}\left(y_i - \left(\beta_0 + \sum_{j=1}^{p}\beta_j x_j\right)\right)^2$$

Ridge

$$\sum_{i=1}^{n}\left(y_i - \beta_0 - \sum_{j=1}^{p}\beta_j x_{ij}\right)^2 + \lambda\sum_{j=1}^{p}\beta_j^2 = \text{RSS} + \lambda\sum_{j=1}^{p}\beta_j^2,$$

where $\lambda \geq 0$ is a *tuning parameter*, to be determined separately.

Elastic Net

$$\text{minimize: } RSS + Ridge + Lasso = \sum_{i=1}^{n}\left(y_i - \left(\beta_0 + \sum_{j=1}^{p}\beta_j x_j\right)\right)^2 + \alpha\rho\sum_{j=1}^{p}|\beta_j| + \alpha(1-\rho)\sum_{j=1}^{p}\beta_j^2$$

Lasso

$$\sum_{i=1}^{n}\left(y_i - \beta_0 - \sum_{j=1}^{p}\beta_j x_{ij}\right)^2 + \lambda\sum_{j=1}^{p}|\beta_j| = \text{RSS} + \lambda\sum_{j=1}^{p}|\beta_j|.$$

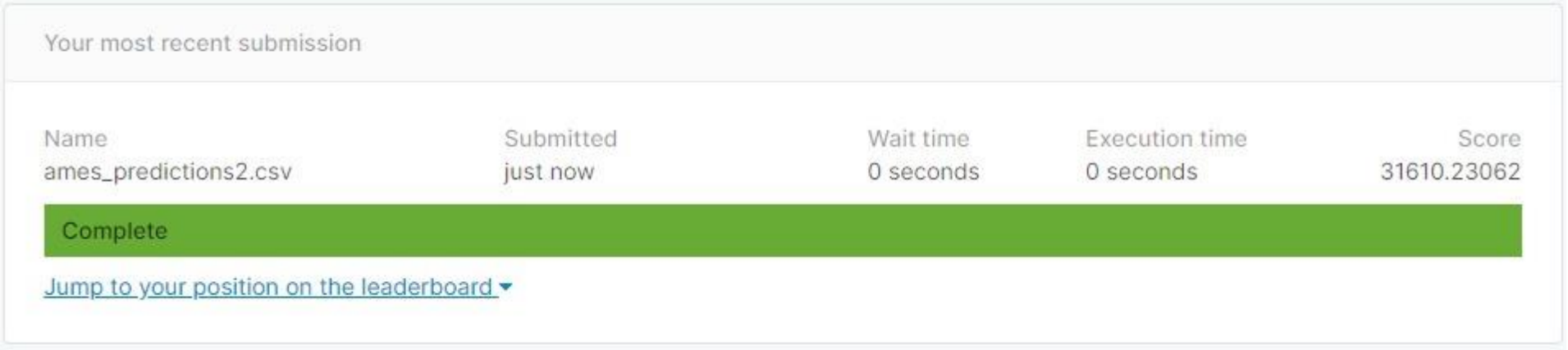
MODEL SELECTION

1. Train/Test Split: 0.25 test size
2. Validation of model by comparing scores of 4 models

Model	R2 Score
Linear Regression	0.8852429133130981
Ridge	0.8851807633561328
Lasso	0.8852429122211832
Elastic Net	0.8727541829079618

3. Select Lasso Regression and fit X, y (Before split data)
4. Predict with test data set

PREDICTION WITH LR

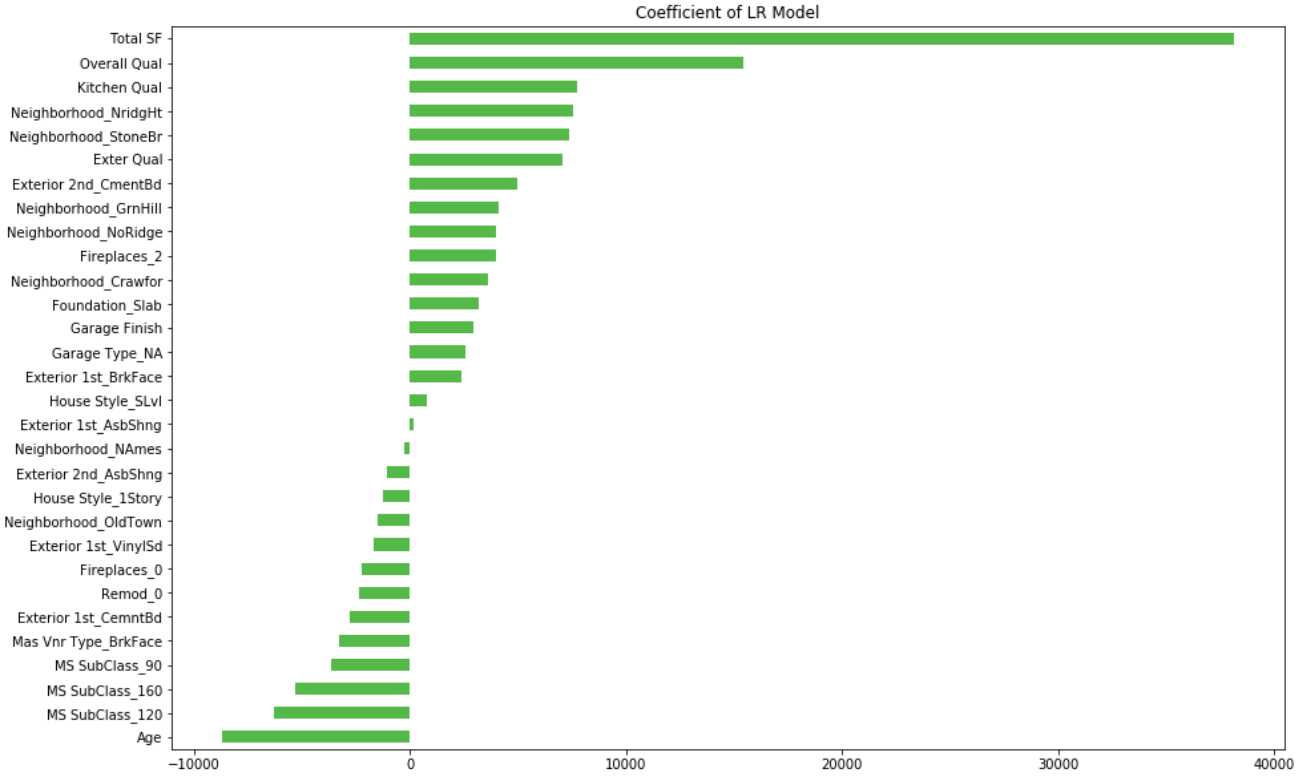


R2 Score	0.8871977269985987

SUMMARY

Covers 88.8% of the dataset

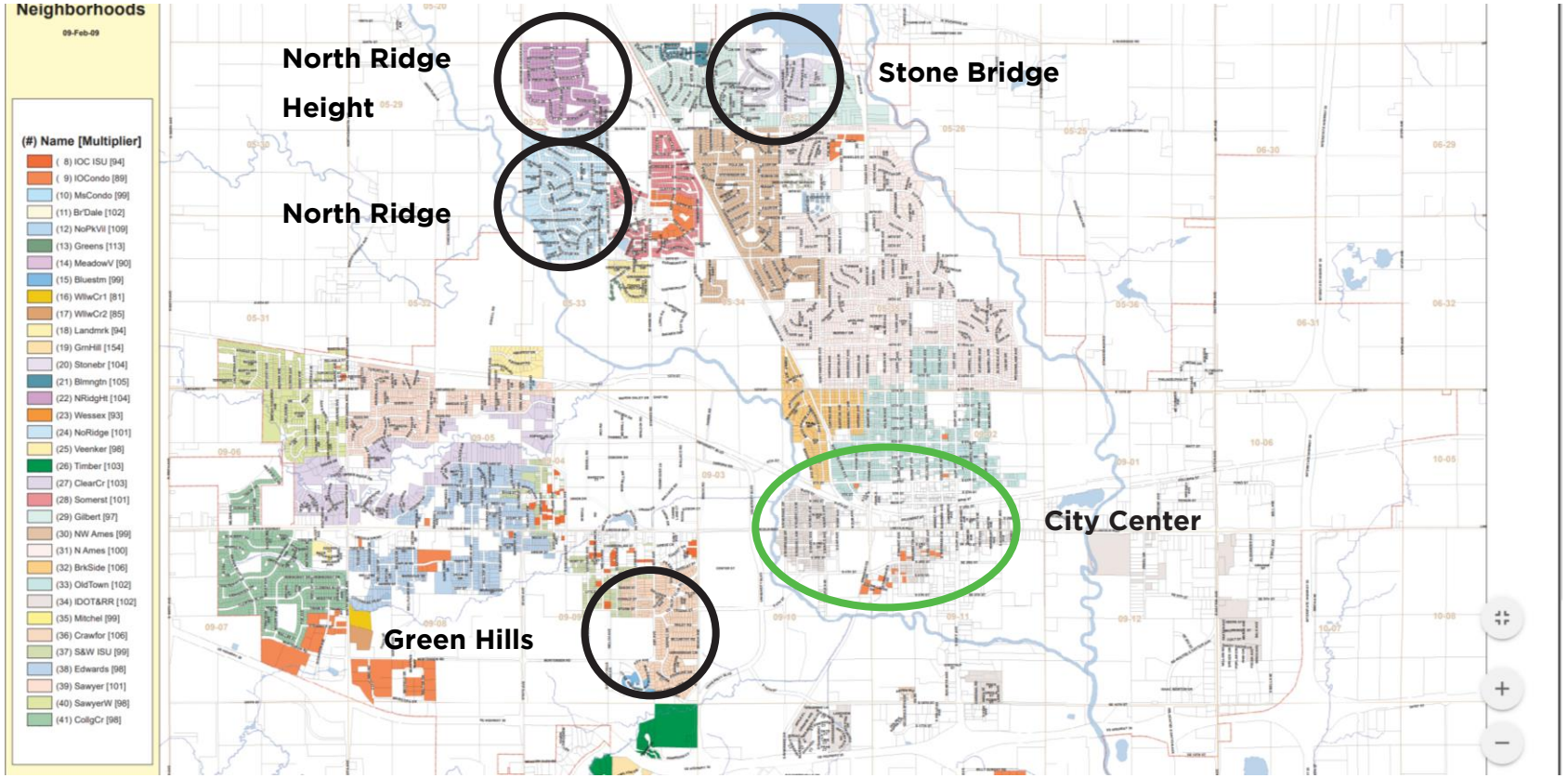
SUMMARY



- Total SF is the most significant variables that will affect the house price, followed by Overall Quality and Kitchen Quality
- Green Hills, Stone Bridge, North Ridge Height, North Ridge neighborhood houses affect sale prices the most among others in Ames
- Planned Unit Development (PUD) houses will decrease the sale price (MS SubClass 160 & 120)

SUMMARY

- Green Hills close to Iowa University
- North Ridge, North Ridge Height and Stone Bridge are in upper class neighborhood



THANK YOU

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