## House Price Prediction using Regression (Lasso and Ridge Regularization) and Random Forest

Dataset Link: https://www.kaggle.com/c/house-prices-advanced-regression-techniques/

```
In []: %matplotlib inline
    import pandas as pd
    import numpy as np
    import matplotlib.pyplot as plt
    import seaborn as sns

from sklearn.linear_model import LinearRegression, Ridge, Lasso
    from sklearn.ensemble import RandomForestRegressor
    from sklearn.model_selection import cross_val_score, train_test_split, GridS
    from sklearn.preprocessing import PolynomialFeatures, StandardScaler, MinMax
    from sklearn.metrics import mean_squared_error
In []: df = pd.read_csv('/Users/gamingspectrum24/Documents/University Coursework/6t
    print(df.shape)

(1460, 81)
```

## **Cleaning Data**

```
In [ ]: df.head()
Out[]:
            Id MSSubClass MSZoning LotFrontage LotArea Street Alley LotShape LandCo
         0
             1
                         60
                                    RL
                                                65.0
                                                        8450
                                                                Pave
                                                                       NaN
                                                                                  Reg
             2
                         20
                                    RL
                                                80.0
                                                        9600
                                                                Pave
         1
                                                                       NaN
                                                                                  Reg
                                                                Pave
         2
             3
                         60
                                    RL
                                                68.0
                                                        11250
                                                                       NaN
                                                                                   IR1
         3
                         70
                                    RL
                                                60.0
                                                        9550
                                                                Pave
                                                                       NaN
                                                                                   IR1
         4
             5
                         60
                                    RL
                                                84.0
                                                       14260
                                                                Pave
                                                                       NaN
                                                                                   IR1
        5 rows × 81 columns
In [ ]: df.info()
```

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<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1460 entries, 0 to 1459
Data columns (total 81 columns):

| 4 LotArea 1460 non-null int64 5 Street 1460 non-null objec 6 Alley 91 non-null objec 7 LotShape 1460 non-null objec 8 LandContour 1460 non-null objec 10 LotConfig 1460 non-null objec 11 LandSlope 1460 non-null objec 12 Neighborhood 1460 non-null objec 13 Condition1 1460 non-null objec 14 Condition2 1460 non-null objec 15 BldgType 1460 non-null objec 16 HouseStyle 1460 non-null objec 17 OverallQual 1460 non-null int64 18 OverallCond 1460 non-null int64 19 YearBuilt 1460 non-null int64 19 YearRemodAdd 1460 non-null int64 20 YearRemodAdd 1460 non-null objec 22 RoofMatl 1460 non-null objec 23 Exterior1st 1460 non-null objec 24 Exterior2nd 1460 non-null objec 25 MasVnrType 588 non-null objec 26 MasVnrArea 1460 non-null objec 27 ExterQual 1460 non-null objec 28 ExterCond 1460 non-null objec 29 Foundation 1460 non-null objec 30 BsmtQual 1423 non-null objec 31 BsmtCond 1423 non-null objec 32 BsmtExposure 1422 non-null objec 33 BsmtFinType1 1423 non-null objec 34 BsmtFinSF1 1460 non-null int64 35 BsmtFinSF2 1460 non-null int64 36 BsmtFinSF2 1460 non-null int64 37 BsmtUnfSF 1460 non-null int64 38 TotalBsmtSF 1460 non-null int64 39 Heating 1460 non-null int64 40 HeatingQC 1460 non-null int64 41 CentralAir 1460 non-null int64 42 nofTrSF 1460 non-null int64 43 IstFIrSF 1460 non-null int64 44 2ndFIrSF 1460 non-null int64 45 LowQualFinSF 1460 non-null int64 46 GrLivArea 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64  | рата<br># | Columns (total | Non-Null Count    | Dtype     |
|--|-----------|----------------|-------------------|-----------|
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| 21 RoofStyle 1460 non-null objec 22 RoofMatl 1460 non-null objec 23 Exterior1st 1460 non-null objec 24 Exterior2nd 1460 non-null objec 25 MasVnrType 588 non-null objec 26 MasVnrArea 1452 non-null float 27 ExterQual 1460 non-null objec 28 ExterCond 1460 non-null objec 29 Foundation 1460 non-null objec 30 BsmtQual 1423 non-null objec 31 BsmtCond 1423 non-null objec 32 BsmtExposure 1422 non-null objec 33 BsmtFinType1 1423 non-null objec 34 BsmtFinSF1 1460 non-null int64 35 BsmtFinSF2 1460 non-null int64 35 BsmtFinSF2 1460 non-null int64 37 BsmtUnfSF 1460 non-null int64 38 TotalBsmtSF 1460 non-null int64 39 Heating 1460 non-null objec 41 CentralAir 1460 non-null objec 41 CentralAir 1460 non-null objec 42 Electrical 1459 non-null objec 43 1stFlrSF 1460 non-null int64 2ndFlrSF 1460 non-null int64 3ndFlaght 1460 non-null int64  |           |                |                   |           |
| 22 RoofMatl 1460 non-null objec 23 Exterior1st 1460 non-null objec 24 Exterior2nd 1460 non-null objec 25 MasVnrType 588 non-null objec 26 MasVnrArea 1452 non-null float 27 ExterQual 1460 non-null objec 28 ExterCond 1460 non-null objec 29 Foundation 1460 non-null objec 30 BsmtQual 1423 non-null objec 31 BsmtCond 1423 non-null objec 32 BsmtExposure 1422 non-null objec 33 BsmtFinType1 1423 non-null objec 34 BsmtFinSF1 1460 non-null int64 35 BsmtFinType2 1422 non-null objec 36 BsmtFinSF2 1460 non-null int64 37 BsmtUnfSF 1460 non-null int64 38 TotalBsmtSF 1460 non-null int64 39 Heating 1460 non-null objec 40 HeatingQC 1460 non-null objec 41 CentralAir 1460 non-null objec 42 Electrical 1459 non-null objec 43 1stFlrSF 1460 non-null int64 44 2ndFlrSF 1460 non-null int64 45 LowQualFinSF 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64   |           |                |                   |           |
| 23 Exterior1st 1460 non-null object 24 Exterior2nd 1460 non-null object 25 MasVnrType 588 non-null object 26 MasVnrArea 1452 non-null float 27 ExterQual 1460 non-null object 28 ExterCond 1460 non-null object 29 Foundation 1460 non-null object 30 BsmtQual 1423 non-null object 31 BsmtCond 1423 non-null object 32 BsmtExposure 1422 non-null object 33 BsmtFinType1 1423 non-null object 34 BsmtFinSF1 1460 non-null int64 35 BsmtFinType2 1422 non-null object 36 BsmtFinSF2 1460 non-null int64 37 BsmtUnfSF 1460 non-null int64 38 TotalBsmtSF 1460 non-null int64 39 Heating 1460 non-null object 40 HeatingQC 1460 non-null object 41 CentralAir 1460 non-null object 42 Electrical 1459 non-null object 43 1stFlrSF 1460 non-null int64 44 2ndFlrSF 1460 non-null int64 45 LowQualFinSF 1460 non-null int64 46 GrLivArea 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64   |           | •              |                   | -         |
| 24 Exterior2nd 1460 non-null objec 25 MasVnrType 588 non-null objec 26 MasVnrArea 1452 non-null float 27 ExterQual 1460 non-null objec 28 ExterCond 1460 non-null objec 29 Foundation 1460 non-null objec 30 BsmtQual 1423 non-null objec 31 BsmtCond 1423 non-null objec 32 BsmtExposure 1422 non-null objec 33 BsmtFinType1 1423 non-null objec 34 BsmtFinSF1 1460 non-null int64 35 BsmtFinType2 1422 non-null objec 36 BsmtFinSF2 1460 non-null int64 37 BsmtUnfSF 1460 non-null int64 38 TotalBsmtSF 1460 non-null int64 39 Heating 1460 non-null objec 40 HeatingQC 1460 non-null objec 41 CentralAir 1460 non-null objec 41 CentralAir 1460 non-null objec 42 Electrical 1459 non-null objec 43 1stFlrSF 1460 non-null int64 44 2ndFlrSF 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64 49 FullBath 1460 non-null int64  |           |                |                   | -         |
| 25 MasVnrType 588 non-null objec 26 MasVnrArea 1452 non-null float 27 ExterQual 1460 non-null objec 28 ExterCond 1460 non-null objec 29 Foundation 1460 non-null objec 30 BsmtQual 1423 non-null objec 31 BsmtCond 1423 non-null objec 32 BsmtExposure 1422 non-null objec 33 BsmtFinType1 1423 non-null objec 34 BsmtFinSF1 1460 non-null int64 35 BsmtFinType2 1422 non-null objec 36 BsmtFinSF2 1460 non-null int64 37 BsmtUnfSF 1460 non-null int64 38 TotalBsmtSF 1460 non-null int64 39 Heating 1460 non-null objec 40 HeatingQC 1460 non-null objec 41 CentralAir 1460 non-null objec 42 Electrical 1459 non-null objec 43 1stFlrSF 1460 non-null int64 2ndFlrSF 1460 non-null int64 4 2ndFlrSF 1460 non-null int64 4 2ndFlrSF 1460 non-null int64 4 5 LowQualFinSF 1460 non-null int64 4 8 BsmtHalfBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64 160 non-null in |           |                |                   | -         |
| 26 MasVnrArea 1452 non-null float 27 ExterQual 1460 non-null objec 28 ExterCond 1460 non-null objec 29 Foundation 1460 non-null objec 30 BsmtQual 1423 non-null objec 31 BsmtCond 1423 non-null objec 32 BsmtExposure 1422 non-null objec 33 BsmtFinType1 1423 non-null objec 34 BsmtFinSF1 1460 non-null int64 35 BsmtFinType2 1422 non-null objec 36 BsmtFinSF2 1460 non-null int64 37 BsmtUnfSF 1460 non-null int64 38 TotalBsmtSF 1460 non-null int64 39 Heating 1460 non-null objec 40 HeatingQC 1460 non-null objec 41 CentralAir 1460 non-null objec 42 Electrical 1459 non-null objec 43 1stFlrSF 1460 non-null int64 44 2ndFlrSF 1460 non-null int64 45 LowQualFinSF 1460 non-null int64 46 GrLivArea 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64   |           |                |                   | -         |
| ExterQual 1460 non-null object 28 ExterCond 1460 non-null object 29 Foundation 1460 non-null object 30 BsmtQual 1423 non-null object 31 BsmtCond 1423 non-null object 32 BsmtExposure 1422 non-null object 33 BsmtFinType1 1423 non-null object 34 BsmtFinSF1 1460 non-null int64 35 BsmtFinType2 1422 non-null object 36 BsmtFinSF2 1460 non-null int64 37 BsmtUnfSF 1460 non-null int64 38 TotalBsmtSF 1460 non-null int64 39 Heating 1460 non-null object 40 HeatingQC 1460 non-null object 41 CentralAir 1460 non-null object 42 Electrical 1459 non-null object 43 1stFlrSF 1460 non-null int64 44 2ndFlrSF 1460 non-null int64 45 LowQualFinSF 1460 non-null int64 46 GrLivArea 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64  |           |                |                   | -         |
| 28 ExterCond 1460 non-null objec 29 Foundation 1460 non-null objec 30 BsmtQual 1423 non-null objec 31 BsmtCond 1423 non-null objec 32 BsmtExposure 1422 non-null objec 33 BsmtFinType1 1423 non-null objec 34 BsmtFinSF1 1460 non-null int64 35 BsmtFinType2 1422 non-null objec 36 BsmtFinSF2 1460 non-null int64 37 BsmtUnfSF 1460 non-null int64 38 TotalBsmtSF 1460 non-null int64 39 Heating 1460 non-null objec 40 HeatingQC 1460 non-null objec 41 CentralAir 1460 non-null objec 42 Electrical 1459 non-null objec 43 1stFlrSF 1460 non-null int64 2ndFlrSF 1460 non-null int64 2ndFlrSF 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64   |           |                |                   | float64   |
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| 30 BsmtQual 31 BsmtCond 32 BsmtExposure 32 BsmtExposure 33 BsmtFinType1 34 BsmtFinSF1 35 BsmtFinSF2 36 BsmtFinSF2 37 BsmtUnfSF 38 TotalBsmtSF 39 Heating 40 HeatingQC 41 CentralAir 42 Iden non-null 43 IstFlrSF 44 IstFlrSF 44 Index non-null 45 LowQualFinSF 46 Iden non-null 47 BsmtFullBath 48 BsmtHalfBath 49 FullBath 44 Iden non-null 46 onon-null 46 onon-null 47 BsmtFullBath 48 BsmtHalfBath 49 FullBath 44 Iden non-null 46 onon-null 47 Inted 48 Inted 49 Inted 49 Inted 40 Inted 41 Inted 42 Inted 43 Inted 44 Inted 45 Inted 46 Inted 47 Inted 48 Inted 48 Inted 49 Inted 49 Inted 40 |           |                |                   | -         |
| 31 BsmtCond 1423 non-null object 32 BsmtExposure 1422 non-null object 33 BsmtFinType1 1423 non-null object 34 BsmtFinSF1 1460 non-null int64 35 BsmtFinSF2 1460 non-null int64 37 BsmtUnfSF 1460 non-null int64 38 TotalBsmtSF 1460 non-null int64 39 Heating 1460 non-null object 40 HeatingQC 1460 non-null object 41 CentralAir 1460 non-null object 42 Electrical 1459 non-null object 43 1stFlrSF 1460 non-null int64 44 2ndFlrSF 1460 non-null int64 45 LowQualFinSF 1460 non-null int64 46 GrLivArea 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64 49 FullBath 1460 non-null int64  |           |                |                   | -         |
| 32 BsmtExposure 1422 non-null objec 33 BsmtFinType1 1423 non-null objec 34 BsmtFinSF1 1460 non-null int64 35 BsmtFinType2 1422 non-null objec 36 BsmtFinSF2 1460 non-null int64 37 BsmtUnfSF 1460 non-null int64 38 TotalBsmtSF 1460 non-null int64 39 Heating 1460 non-null objec 40 HeatingQC 1460 non-null objec 41 CentralAir 1460 non-null objec 42 Electrical 1459 non-null objec 43 1stFlrSF 1460 non-null int64 2ndFlrSF 1460 non-null int64 2ndFlrSF 1460 non-null int64 45 LowQualFinSF 1460 non-null int64 46 GrLivArea 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64 49 FullBath 1460 non-null int64   |           |                |                   | object    |
| 33         BsmtFinType1         1423 non-null objec           34         BsmtFinSF1         1460 non-null int64           35         BsmtFinType2         1422 non-null objec           36         BsmtFinSF2         1460 non-null int64           37         BsmtUnfSF         1460 non-null int64           38         TotalBsmtSF         1460 non-null objec           40         Heating         1460 non-null objec           40         HeatingQC         1460 non-null objec           41         CentralAir         1460 non-null int64           42         Electrical         1459 non-null int64           43         1stFlrSF         1460 non-null int64           44         2ndFlrSF         1460 non-null int64           45         LowQualFinSF         1460 non-null int64           46         GrLivArea         1460 non-null int64           47         BsmtFullBath         1460 non-null int64           48         BsmtHalfBath         1460 non-null int64           49         FullBath         1460 non-null int64   |           |                |                   | object    |
| 34       BsmtFinSF1       1460 non-null int64         35       BsmtFinType2       1422 non-null objec         36       BsmtFinSF2       1460 non-null int64         37       BsmtUnfSF       1460 non-null int64         38       TotalBsmtSF       1460 non-null objec         40       Heating       1460 non-null objec         40       HeatingQC       1460 non-null objec         41       CentralAir       1460 non-null int64         42       Electrical       1459 non-null int64         43       1stFlrSF       1460 non-null int64         44       2ndFlrSF       1460 non-null int64         45       LowQualFinSF       1460 non-null int64         46       GrLivArea       1460 non-null int64         47       BsmtFullBath       1460 non-null int64         48       BsmtHalfBath       1460 non-null int64         49       FullBath       1460 non-null int64   |           |                |                   | object    |
| 35 BsmtFinType2 1422 non-null object 36 BsmtFinSF2 1460 non-null int64 37 BsmtUnfSF 1460 non-null int64 38 TotalBsmtSF 1460 non-null int64 39 Heating 1460 non-null object 40 HeatingQC 1460 non-null object 41 CentralAir 1460 non-null object 42 Electrical 1459 non-null object 43 1stFlrSF 1460 non-null int64 44 2ndFlrSF 1460 non-null int64 45 LowQualFinSF 1460 non-null int64 46 GrLivArea 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64  |           |                |                   | object    |
| 36       BsmtFinSF2       1460 non-null int64         37       BsmtUnfSF       1460 non-null int64         38       TotalBsmtSF       1460 non-null int64         39       Heating       1460 non-null objec         40       HeatingQC       1460 non-null objec         41       CentralAir       1460 non-null objec         42       Electrical       1459 non-null int64         43       1stFlrSF       1460 non-null int64         44       2ndFlrSF       1460 non-null int64         45       LowQualFinSF       1460 non-null int64         46       GrLivArea       1460 non-null int64         47       BsmtFullBath       1460 non-null int64         48       BsmtHalfBath       1460 non-null int64         49       FullBath       1460 non-null int64   |           |                |                   |           |
| 37 BsmtUnfSF 1460 non-null int64 38 TotalBsmtSF 1460 non-null int64 39 Heating 1460 non-null objec 40 HeatingQC 1460 non-null objec 41 CentralAir 1460 non-null objec 42 Electrical 1459 non-null objec 43 1stFlrSF 1460 non-null int64 44 2ndFlrSF 1460 non-null int64 45 LowQualFinSF 1460 non-null int64 46 GrLivArea 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64   |           |                |                   | object    |
| 38 TotalBsmtSF 1460 non-null int64 39 Heating 1460 non-null objec 40 HeatingQC 1460 non-null objec 41 CentralAir 1460 non-null objec 42 Electrical 1459 non-null objec 43 1stFlrSF 1460 non-null int64 44 2ndFlrSF 1460 non-null int64 45 LowQualFinSF 1460 non-null int64 46 GrLivArea 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64  |           |                |                   |           |
| 39 Heating 1460 non-null object 40 HeatingQC 1460 non-null object 41 CentralAir 1460 non-null object 42 Electrical 1459 non-null object 43 1stFlrSF 1460 non-null int64 44 2ndFlrSF 1460 non-null int64 45 LowQualFinSF 1460 non-null int64 46 GrLivArea 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64   |           |                |                   | int64     |
| 40 HeatingQC 1460 non-null object 41 CentralAir 1460 non-null object 42 Electrical 1459 non-null object 43 1stFlrSF 1460 non-null int64 44 2ndFlrSF 1460 non-null int64 45 LowQualFinSF 1460 non-null int64 46 GrLivArea 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64   |           |                |                   | int64     |
| 41 CentralAir 1460 non-null objec 42 Electrical 1459 non-null objec 43 1stFlrSF 1460 non-null int64 44 2ndFlrSF 1460 non-null int64 45 LowQualFinSF 1460 non-null int64 46 GrLivArea 1460 non-null int64 47 BsmtFullBath 1460 non-null int64 48 BsmtHalfBath 1460 non-null int64 49 FullBath 1460 non-null int64   |           | Heating        |                   | object    |
| 42       Electrical       1459 non-null       objec         43       1stFlrSF       1460 non-null       int64         44       2ndFlrSF       1460 non-null       int64         45       LowQualFinSF       1460 non-null       int64         46       GrLivArea       1460 non-null       int64         47       BsmtFullBath       1460 non-null       int64         48       BsmtHalfBath       1460 non-null       int64         49       FullBath       1460 non-null       int64   | 40        | HeatingQC      | 1460 non-null     | object    |
| 43       1stFlrSF       1460 non-null int64         44       2ndFlrSF       1460 non-null int64         45       LowQualFinSF       1460 non-null int64         46       GrLivArea       1460 non-null int64         47       BsmtFullBath 1460 non-null int64         48       BsmtHalfBath 1460 non-null int64         49       FullBath 1460 non-null int64   | 41        | CentralAir     | 1460 non-null     | object    |
| 44 2ndFlrSF 1460 non-null int64<br>45 LowQualFinSF 1460 non-null int64<br>46 GrLivArea 1460 non-null int64<br>47 BsmtFullBath 1460 non-null int64<br>48 BsmtHalfBath 1460 non-null int64<br>49 FullBath 1460 non-null int64  | 42        | Electrical     | 1459 non-null     | object    |
| 45 LowQualFinSF 1460 non-null int64<br>46 GrLivArea 1460 non-null int64<br>47 BsmtFullBath 1460 non-null int64<br>48 BsmtHalfBath 1460 non-null int64<br>49 FullBath 1460 non-null int64   | 43        | 1stFlrSF       | 1460 non-null     | int64     |
| 46 GrLivArea 1460 non-null int64<br>47 BsmtFullBath 1460 non-null int64<br>48 BsmtHalfBath 1460 non-null int64<br>49 FullBath 1460 non-null int64  | 44        | 2ndFlrSF       | 1460 non-null     | int64     |
| 47 BsmtFullBath 1460 non-null int64<br>48 BsmtHalfBath 1460 non-null int64<br>49 FullBath 1460 non-null int64  | 45        | LowQualFinSF   | 1460 non-null     | int64     |
| 48 BsmtHalfBath 1460 non-null int64<br>49 FullBath 1460 non-null int64   | 46        | GrLivArea      | 1460 non-null     | int64     |
| 49 FullBath 1460 non-null int64  | 47        | BsmtFullBath   | 1460 non-null     | int64     |
|  | 48        | BsmtHalfBath   | 1460 non-null     | int64     |
|  | 49        | FullBath       |                   | int64     |
|  |           |                |                   | int64     |
|  |           |                |                   |           |

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