change_y

May 24, 2019

LotArea means Lot size in square feet of a house. This should be a important feature since the larger the house, the higher the price should be naively. So I come up with an approach to change the question to be predict house price per square feet. Then, my y becomes house price/ LotArea and my X need to remove the LotArea feature. I trained Lasso on this new X and y. The performance is not improved so I didn't continue this method.

In [1]:
```
import numpy as np
import pandas as pd
from matplotlib import pyplot as plt
import seaborn as sns

%matplotlib inline
```

In [3]:
```
raw_data = pd.read_csv('house-prices-advanced-regression-techniques/train.csv')
raw_data.head()
```

Out[3]:

	Id	MSSubClass	MSZoning	LotFrontage	LotArea	Street	Alley	LotShape	\
0	1	60	RL	65.0	8450	Pave	NaN	Reg	
1	2	20	RL	80.0	9600	Pave	NaN	Reg	
2	3	60	RL	68.0	11250	Pave	NaN	IR1	
3	4	70	RL	60.0	9550	Pave	NaN	IR1	
4	5	60	RL	84.0	14260	Pave	NaN	IR1	

	LandContour	Utilities	...	PoolArea	PoolQC	Fence	MiscFeature	MiscVal	\
0	Lvl	AllPub	...	0	NaN	NaN	NaN	0	
1	Lvl	AllPub	...	0	NaN	NaN	NaN	0	
2	Lvl	AllPub	...	0	NaN	NaN	NaN	0	
3	Lvl	AllPub	...	0	NaN	NaN	NaN	0	
4	Lvl	AllPub	...	0	NaN	NaN	NaN	0	

	MoSold	YrSold	SaleType	SaleCondition	SalePrice
0	2	2008	WD	Normal	208500
1	5	2007	WD	Normal	181500
2	9	2008	WD	Normal	223500
3	2	2006	WD	Abnorml	140000
4	12	2008	WD	Normal	250000

[5 rows x 81 columns]

```
In [4]: raw_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1460 entries, 0 to 1459
Data columns (total 81 columns):
Id               1460 non-null int64
MSSubClass       1460 non-null int64
MSZoning         1460 non-null object
LotFrontage      1201 non-null float64
LotArea          1460 non-null int64
Street           1460 non-null object
Alley            91 non-null object
LotShape         1460 non-null object
LandContour      1460 non-null object
Utilities        1460 non-null object
LotConfig        1460 non-null object
LandSlope        1460 non-null object
Neighborhood     1460 non-null object
Condition1       1460 non-null object
Condition2       1460 non-null object
BldgType         1460 non-null object
HouseStyle       1460 non-null object
OverallQual      1460 non-null int64
OverallCond      1460 non-null int64
YearBuilt        1460 non-null int64
YearRemodAdd     1460 non-null int64
RoofStyle        1460 non-null object
RoofMatl         1460 non-null object
Exterior1st      1460 non-null object
Exterior2nd      1460 non-null object
MasVnrType       1452 non-null object
MasVnrArea       1452 non-null float64
ExterQual        1460 non-null object
ExterCond        1460 non-null object
Foundation       1460 non-null object
BsmtQual         1423 non-null object
BsmtCond         1423 non-null object
BsmtExposure     1422 non-null object
BsmtFinType1     1423 non-null object
BsmtFinSF1       1460 non-null int64
BsmtFinType2     1422 non-null object
BsmtFinSF2       1460 non-null int64
BsmtUnfSF        1460 non-null int64
TotalBsmtSF      1460 non-null int64
Heating          1460 non-null object
HeatingQC        1460 non-null object
CentralAir       1460 non-null object
Electrical       1459 non-null object
```

```
1stFlrSF         1460 non-null int64
2ndFlrSF         1460 non-null int64
LowQualFinSF     1460 non-null int64
GrLivArea        1460 non-null int64
BsmtFullBath     1460 non-null int64
BsmtHalfBath     1460 non-null int64
FullBath         1460 non-null int64
HalfBath         1460 non-null int64
BedroomAbvGr     1460 non-null int64
KitchenAbvGr     1460 non-null int64
KitchenQual      1460 non-null object
TotRmsAbvGrd     1460 non-null int64
Functional       1460 non-null object
Fireplaces       1460 non-null int64
FireplaceQu      770 non-null object
GarageType       1379 non-null object
GarageYrBlt      1379 non-null float64
GarageFinish     1379 non-null object
GarageCars       1460 non-null int64
GarageArea       1460 non-null int64
GarageQual       1379 non-null object
GarageCond       1379 non-null object
PavedDrive       1460 non-null object
WoodDeckSF       1460 non-null int64
OpenPorchSF      1460 non-null int64
EnclosedPorch    1460 non-null int64
3SsnPorch        1460 non-null int64
ScreenPorch      1460 non-null int64
PoolArea         1460 non-null int64
PoolQC           7 non-null object
Fence            281 non-null object
MiscFeature      54 non-null object
MiscVal          1460 non-null int64
MoSold           1460 non-null int64
YrSold           1460 non-null int64
SaleType         1460 non-null object
SaleCondition    1460 non-null object
SalePrice        1460 non-null int64
dtypes: float64(3), int64(35), object(43)
memory usage: 924.0+ KB
```

```
In [5]: selected = raw_data.loc[:,['MSSubClass','LotFrontage','LotArea','OverallQual','Overall
```

```
In [8]: selected.head()
```

```
Out[8]:    MSSubClass  LotFrontage  LotArea  OverallQual  OverallCond  YearBuilt  \
        0          60         65.0     8450            7            5       2003
```

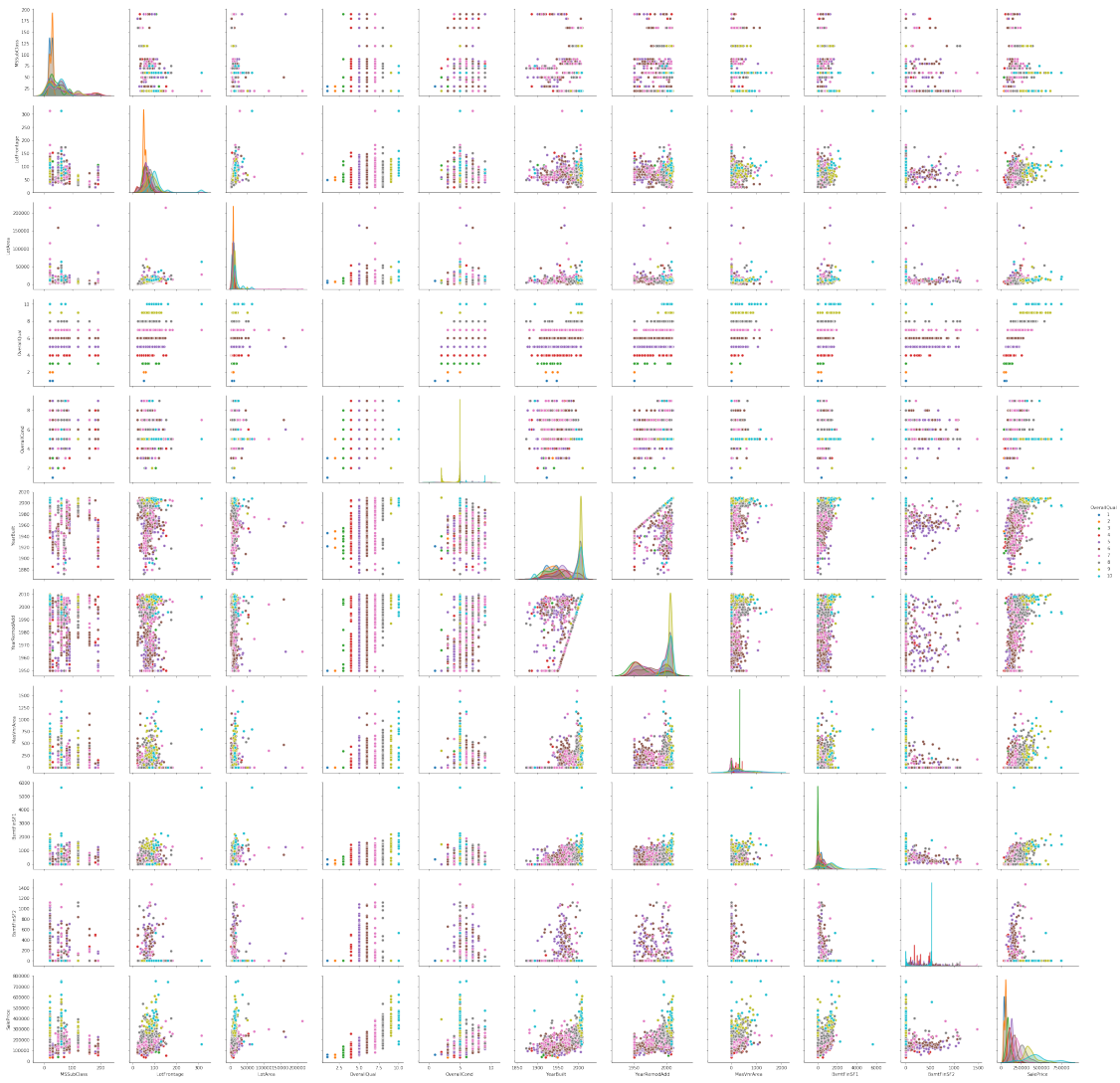
1	20	80.0	9600	6	8	1976
2	60	68.0	11250	7	5	2001
3	70	60.0	9550	7	5	1915
4	60	84.0	14260	8	5	2000

	YearRemodAdd	MasVnrArea	BsmtFinSF1	BsmtFinSF2	SalePrice
0	2003	196.0	706	0	208500
1	1976	0.0	978	0	181500
2	2002	162.0	486	0	223500
3	1970	0.0	216	0	140000
4	2000	350.0	655	0	250000

In [10]:
```
sns.pairplot(selected,height=3,hue = 'OverallQual')
```

```
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/statsmodels/nonparametric/kde.py:448: Ru
  X = X[np.logical_and(X > clip[0], X < clip[1])] # won't work for two columns.
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/statsmodels/nonparametric/kde.py:448: Ru
  X = X[np.logical_and(X > clip[0], X < clip[1])] # won't work for two columns.
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/numpy/core/_methods.py:135: RuntimeWarni
  keepdims=keepdims)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/numpy/core/_methods.py:127: RuntimeWarni
  ret = ret.dtype.type(ret / rcount)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/statsmodels/nonparametric/kde.py:488: Ru
  binned = fast_linbin(X, a, b, gridsize) / (delta * nobs)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/statsmodels/nonparametric/kdetools.py:34
  FAC1 = 2*(np.pi*bw/RANGE)**2
```

Out[10]: <seaborn.axisgrid.PairGrid at 0x1a26902668>



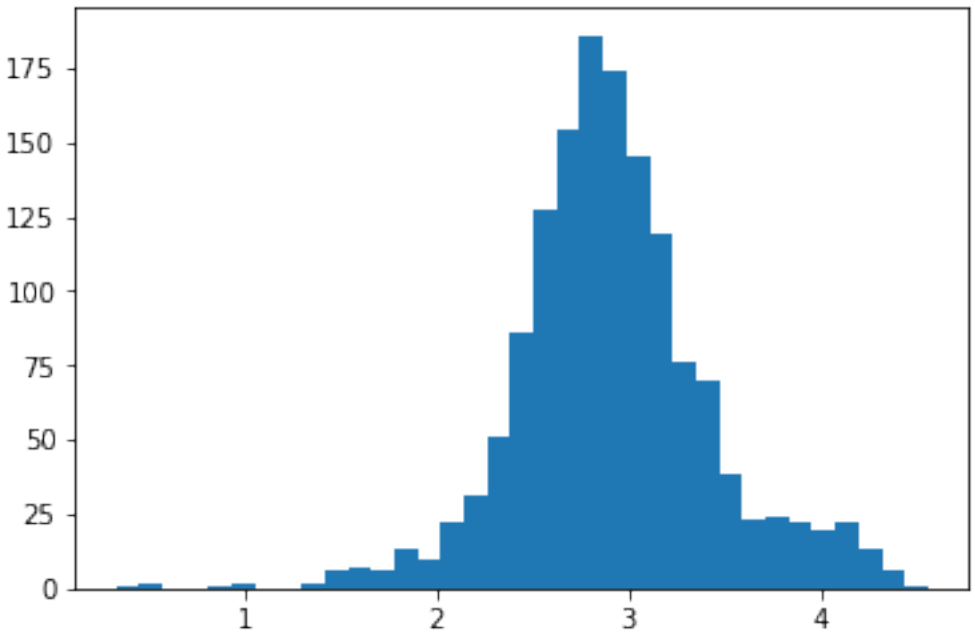
0.1 change the question to predict the price of each square feet

```
In [37]: raw_data['PricePerFeet'] = np.log(raw_data.SalePrice/raw_data.LotArea)

In [39]: plt.hist(raw_data.PricePerFeet,bins = 35)

Out[39]: (array([  1.,   2.,   0.,   0.,   1.,   2.,   0.,   0.,   2.,   6.,   7.,
                   6.,  13.,  10.,  22.,  31.,  51.,  86., 127., 154., 186., 174.,
                 145., 119.,  76.,  70.,  38.,  23.,  24.,  22.,  20.,  22.,  13.,
                   6.,   1.]),
          array([0.3296209 , 0.45042937, 0.57123783, 0.6920463 , 0.81285477,
                 0.93366324, 1.05447171, 1.17528018, 1.29608865, 1.41689712,
                 1.53770558, 1.65851405, 1.77932252, 1.90013099, 2.02093946,
                 2.14174793, 2.2625564 , 2.38336486, 2.50417333, 2.6249818 ,
```

```
        2.74579027, 2.86659874, 2.98740721, 3.10821568, 3.22902415,
        3.34983261, 3.47064108, 3.59144955, 3.71225802, 3.83306649,
        3.95387496, 4.07468343, 4.1954919 , 4.31630036, 4.43710883,
        4.5579173 ]),
 <a list of 35 Patch objects>)
```

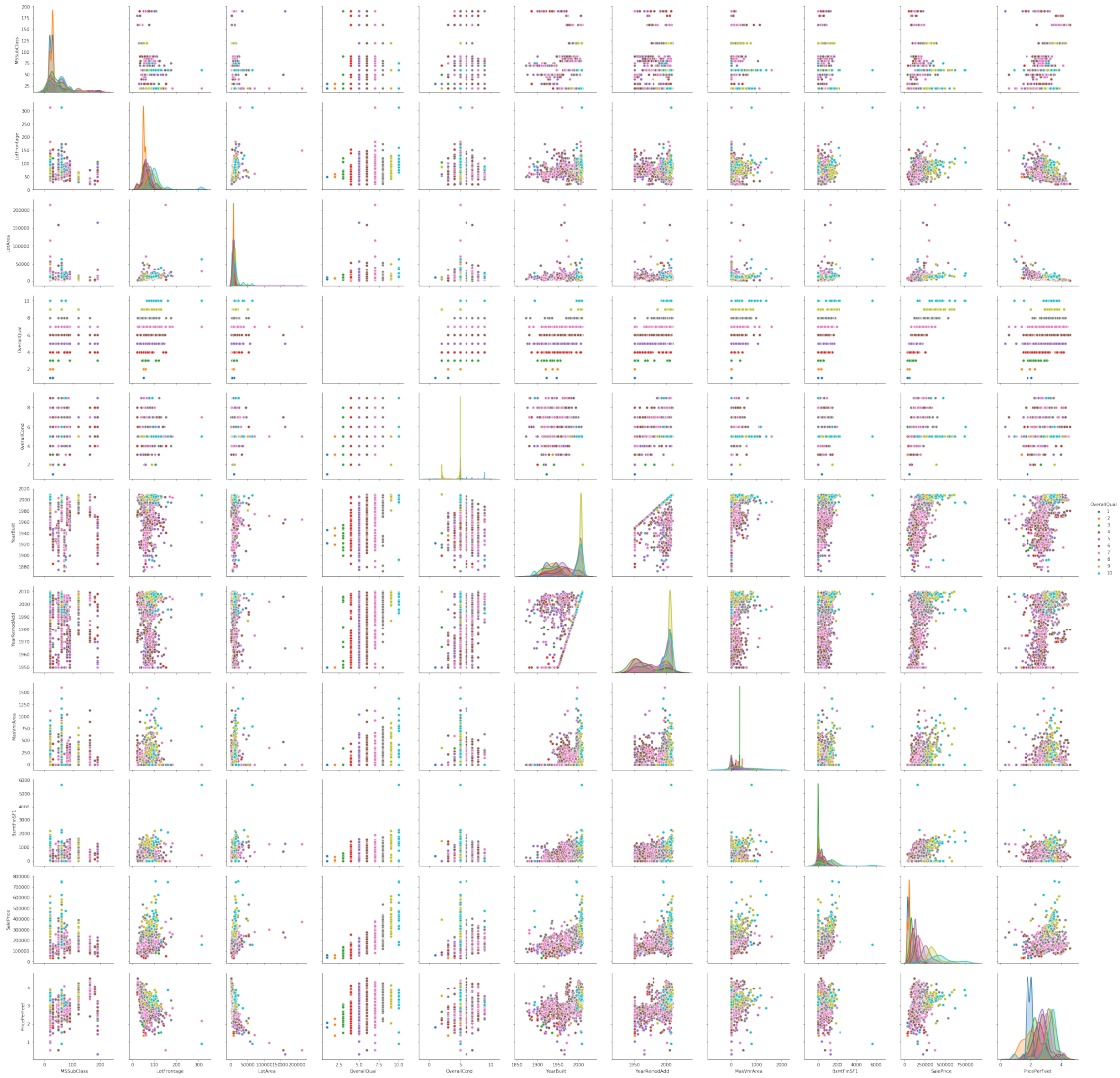



```
In [40]: selected = raw_data.loc[:,['MSSubClass','LotFrontage','LotArea','OverallQual','Overall

In [42]: sns.pairplot(selected,height=3,hue = 'OverallQual')

/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/statsmodels/nonparametric/kde.py:448: Ru
  X = X[np.logical_and(X > clip[0], X < clip[1])] # won't work for two columns.
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/statsmodels/nonparametric/kde.py:448: Ru
  X = X[np.logical_and(X > clip[0], X < clip[1])] # won't work for two columns.
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/numpy/core/_methods.py:135: RuntimeWarni
  keepdims=keepdims)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/numpy/core/_methods.py:127: RuntimeWarni
  ret = ret.dtype.type(ret / rcount)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/statsmodels/nonparametric/kde.py:488: Ru
  binned = fast_linbin(X, a, b, gridsize) / (delta * nobs)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/statsmodels/nonparametric/kdetools.py:34
  FAC1 = 2*(np.pi*bw/RANGE)**2


Out[42]: <seaborn.axisgrid.PairGrid at 0x1a312fceb8>
```

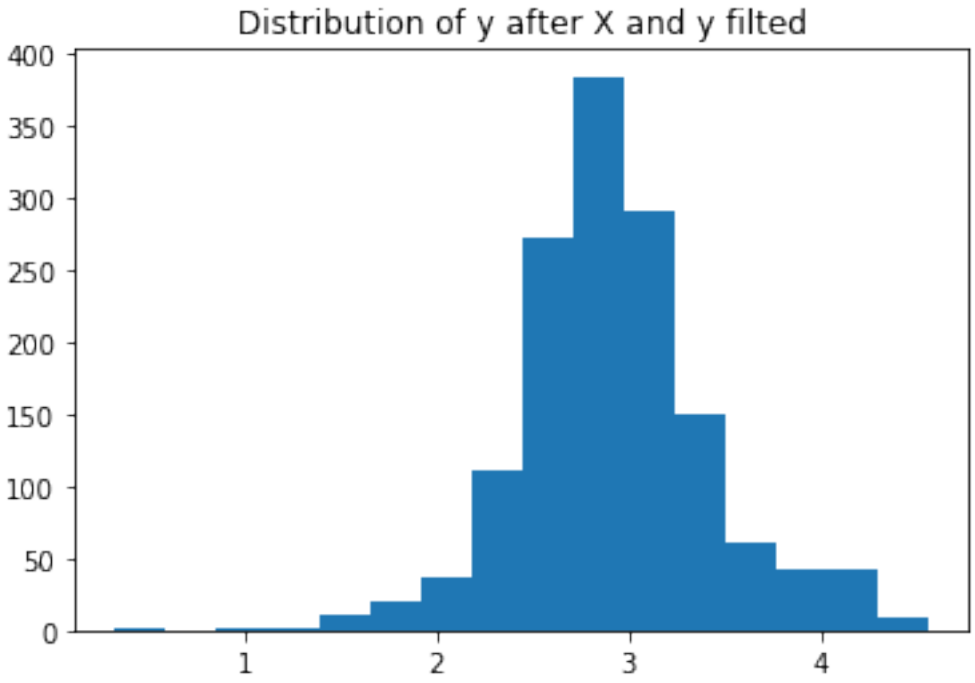


0.2 Redo Lasso with cleaned data and change y

```
In [43]: clean_data = pd.read_csv('clean_data.csv')
         y=clean_data['SalePrice']
         clean_data=clean_data.drop(['SalePrice'],axis=1) #drop the y in clean_data
         X = clean_data.iloc[:,1:] # drop the id column
         y_loged = np.log(y/X.LotArea) # log transform y
```

```
In [47]: # remove X outliers.
         X_filted = X[X['LotFrontage'] < 129]
         y_filted = y_loged[X['LotFrontage'] < 129]
         X_filted = X_filted.drop(['LotArea'],axis=1) #drop the LotArea in X because it's cons
         plt.hist(y_filted,bins=16)
         plt.title('Distribution of y after X and y filted')
```

Out[47]: Text(0.5,1,'Distribution of y after X and y filted')



0.3 fit into lasso

```
In [52]: from sklearn.model_selection import train_test_split
         from sklearn.linear_model import Lasso
         from sklearn.preprocessing import StandardScaler
         from sklearn.metrics import mean_squared_error
         from math import sqrt
         X_train, X_test, y_train, y_test = train_test_split(X_filted, y_filted, test_size=0.3
         scaler = StandardScaler()
         X_train_sc = scaler.fit_transform(X_train)
         X_test_sc = scaler.transform(X_test)
         clf = Lasso(random_state=42)
         clf.fit(X_train_sc,y_train)
         y_test_pred = clf.predict(X_test_sc)
         y_train_pred = clf.predict(X_train_sc)

         mse = mean_squared_error(y_test, y_test_pred)
         sqrt(mse)
```

```
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/preprocessing/data.py:625: DataC
  return self.partial_fit(X, y)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/base.py:462: DataConversionWarni
  return self.fit(X, **fit_params).transform(X)
```

```
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:9: DataConversionWa
  if __name__ == '__main__':
```

```
Out[52]: 0.5030524700097734
```

```
In [58]: from sklearn.model_selection import GridSearchCV
         parameters = { 'max_iter':[3,5,10,50,100],'alpha':[0.001,0.01,0.1,1, 10,100,1000]}
         ls = Lasso(random_state=42)
         clf = GridSearchCV(ls, parameters, cv=5)
         clf.fit(X_train_sc,y_train)
         y_test_pred = clf.predict(X_test_sc)
         y_train_pred = clf.predict(X_train_sc)
```

```
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
```

```
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
```

```
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
/Users/fanwenyu/anaconda3/lib/python3.6/site-packages/sklearn/linear_model/coordinate_descent.p
  ConvergenceWarning)
```

```
In [59]: clf.best_params_
```

```
Out[59]: {'alpha': 0.01, 'max_iter': 5}
```

```
In [60]: mse_test = mean_squared_error(y_test, y_test_pred)
         sqrt(mse_test)
```

```
Out[60]: 0.27444189034191757
```