In [93]:

```
import pandas as pd
```

In [94]:

```
import numpy as np
```

In [95]:

```
import matplotlib.pyplot as plt
```

In [96]:

```
import datetime
```

In [97]:

```
from sklearn.tree import DecisionTreeRegressor
```

In [98]:

```
from sklearn.metrics import mean_absolute_error
```

In [99]:

```
from sklearn.model_selection import train_test_split
```

In [100]:

```
from sklearn.ensemble import RandomForestRegressor
```

In [101]:

```
from sklearn.impute import SimpleImputer
```

In [102]:

```
from sklearn.model_selection import cross_val_score
```

In [103]:

```
pd.set_option('display.max_columns',100)
```

In [104]:

```
home_data = pd.read_csv('/Users/kabloom/Documents/docs/Data Science/Assignments
 submitted/train.csv')
```

In [105]:

```
home_data.head()
```

Out[105]:

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

In [108]:

```
round(home_data['LotArea'].mean())
```

Out[108]:

```
10517
```

In [109]:

```
datetime.datetime.now().year-home_data['YearBuilt'].max()
```

Out[109]:

```
9
```

In [110]:

```
home_data['YearBuilt'].min()
```

Out[110]:

```
1872
```

In [111]:

```
home_data['YearRemodAdd'].min()
```

Out[111]:

```
1950
```

In [112]:

```
home_data['YearRemodAdd'].max()
```

Out[112]:

```
2010
```

In [113]:

```
home_data['YrSold'].min()
```

Out[113]:

```
2006
```

In [114]:

```
home_data['YrSold'].max()
```

Out[114]:

```
2010
```

In [115]:

```
home_data.YrSold.value_counts()
```

Out[115]:

```
2009    338
2007    329
2006    314
2008    304
2010    175
Name: YrSold, dtype: int64
```

In [116]:

```
home_data.groupby('YrSold').MoSold.value_counts().head()
```

Out[116]:

```
YrSold  MoSold
2006    7         67
        6         48
        5         38
        4         27
        3         25
Name: MoSold, dtype: int64
```

In [117]:

```
Y=home_data.SalePrice
```

In [118]:

```
Y.head()
```

Out[118]:

```
0    208500
1    181500
2    223500
3    140000
4    250000
Name: SalePrice, dtype: int64
```

In [119]:

```
home_features=['LotArea','YearBuilt','1stFlrSF','2ndFlrSF','FullBath','BedroomAbvGr','TotRmsAbvGrd']
```

In [120]:

```
X=home_data[home_features]
```

In [121]:

```
X.head()
```

Out[121]:

	LotArea	YearBuilt	1stFlrSF	2ndFlrSF	FullBath	BedroomAbvGr	TotRmsAbvGrd
0	8450	2003	856	854	2	3	8
1	9600	1976	1262	0	2	3	6
2	11250	2001	920	866	2	3	6
3	9550	1915	961	756	1	3	7
4	14260	2000	1145	1053	2	4	9

In [122]:

```
X.describe()
```

Out[122]:

	LotArea	YearBuilt	1stFlrSF	2ndFlrSF	FullBath	BedroomAbvGr	T
count	1460.000000	1460.000000	1460.000000	1460.000000	1460.000000	1460.000000	
mean	10516.828082	1971.267808	1162.626712	346.992466	1.565068	2.866438	
std	9981.264932	30.202904	386.587738	436.528436	0.550916	0.815778	
min	1300.000000	1872.000000	334.000000	0.000000	0.000000	0.000000	
25%	7553.500000	1954.000000	882.000000	0.000000	1.000000	2.000000	
50%	9478.500000	1973.000000	1087.000000	0.000000	2.000000	3.000000	
75%	11601.500000	2000.000000	1391.250000	728.000000	2.000000	3.000000	
max	215245.000000	2010.000000	4692.000000	2065.000000	3.000000	8.000000	

In [123]:

```
#Applied Decision Tree Regressor
home_data_model=DecisionTreeRegressor(random_state=1)
train_X,val_X,train_Y,val_Y=train_test_split(X,Y,random_state=1)
home_data_model.fit(train_X,train_Y)
```

Out[123]:

```
DecisionTreeRegressor(criterion='mse', max_depth=None, max_features=
None,
           max_leaf_nodes=None, min_impurity_decrease=0.0,
           min_impurity_split=None, min_samples_leaf=1,
           min_samples_split=2, min_weight_fraction_leaf=0.0,
           presort=False, random_state=1, splitter='best')
```

In [124]:

```
def get_mae(max_leaf_nodes, train_X, val_X, train_Y, val_Y):
    model=DecisionTreeRegressor(max_leaf_nodes=max_leaf_nodes,random_state=0)
    model.fit(train_X,train_Y)
    preds_val=model.predict(val_X)
    mae=mean_absolute_error(val_Y,preds_val)
    return(mae)
```

In [125]:

```
#Checking error value by tweaking
best_tree_size=0
mean_abs_error=1000000.00
for max_leaf_nodes in [5,50,500,5000]:
    my_mae=get_mae(max_leaf_nodes,train_x,val_x,train_y,val_y)
    print("Max leaf Nodes : %d \t\t Mean Absolute Error : %d" %(max_leaf_nodes,m
y_mae))
    if(mean_abs_error>my_mae):
        mean_abs_error=my_mae
        best_tree_size=max_leaf_nodes
print(best_tree_size)
```

```
---------------------------------------------------------------------
-------
NameError                                 Traceback (most recent cal
l last)
<ipython-input-125-6736b31caefa> in <module>
      3 mean_abs_error=1000000.00
      4 for max_leaf_nodes in [5,50,500,5000]:
----> 5     my_mae=get_mae(max_leaf_nodes,train_x,val_x,train_y,val_
y)
      6     print("Max leaf Nodes : %d \t\t Mean Absolute Error : %
d" %(max_leaf_nodes,my_mae))
      7     if(mean_abs_error>my_mae):

NameError: name 'train_x' is not defined
```

In [126]:

```
model=DecisionTreeRegressor(max_leaf_nodes=500,random_state=0)
model.fit(train_x,train_y)
preds_val=model.predict(val_x)
mae=mean_absolute_error(val_y,preds_val)
mae
```

```
---------------------------------------------------------------------------
-------
NameError                                 Traceback (most recent cal
l last)
<ipython-input-126-7aac52cdaf7e> in <module>
      1 model=DecisionTreeRegressor(max_leaf_nodes=500,random_state=
0)
----> 2 model.fit(train_x,train_y)
      3 preds_val=model.predict(val_x)
      4 mae=mean_absolute_error(val_y,preds_val)
      5 mae

NameError: name 'train_x' is not defined
```

In [127]:

```
#Creating Random Forest Model with full training data
full_training_data = pd.read_csv('/Users/kabloom/Documents/docs/Data Science/Ass
ignments submitted/train.csv')
```

In [128]:

```
y_full=full_training_data.SalePrice
```

In [129]:

```
home_features_full=['LotArea','YearBuilt','1stFlrSF','2ndFlrSF','FullBath','Bedr
oomAbvGr','TotRmsAbvGrd']
```

In [130]:

```
x_full=full_training_data[home_features_full]
```

In [131]:

```
f_model=RandomForestRegressor(random_state=1)
f_model.fit(x_full,y_full)
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/ensemble/forest.py:24
6: FutureWarning: The default value of n_estimators will change from
10 in version 0.20 to 100 in 0.22.
  "10 in version 0.20 to 100 in 0.22.", FutureWarning)
```

Out[131]:

```
RandomForestRegressor(bootstrap=True, criterion='mse', max_depth=Non
e,
           max_features='auto', max_leaf_nodes=None,
           min_impurity_decrease=0.0, min_impurity_split=None,
           min_samples_leaf=1, min_samples_split=2,
           min_weight_fraction_leaf=0.0, n_estimators=10, n_jobs=Non
e,
           oob_score=False, random_state=1, verbose=0, warm_start=Fa
lse)
```

In [132]:

```
full_test_data = pd.read_csv('/Users/kabloom/Documents/docs/Data Science/Assignm
ents submitted/test.csv')
home_features_test=['LotArea','YearBuilt','1stFlrSF','2ndFlrSF','FullBath','Bedr
oomAbvGr','TotRmsAbvGrd']
x_test=full_test_data[home_features_test]
pred_test=f_model.predict(x_test)
pred_test
```

Out[132]:

```
array([112945. , 149770. , 178100. , ..., 141674.1, 130350. , 22883
0. ])
```

In [133]:

```
output = pd.DataFrame({'Id':full_test_data.Id,'SalePrice':pred_test})
```

In [134]:

```
output.to_csv('tripathishivam35HomeData.csv',index=False)
```

In [135]:

```
missing_val_count_by_column=(full_test_data.isnull().sum())
#print(missing_val_count_by_column[missing_val_count_by_column > 0])
```

In [136]:

```
#Get Model Score from Dropping Columns with Missing values
cols_with_missing = [col for col in X_train.columns
                                 if X_train[col].isnull().any()]
reduced_X_train = X_train.drop(cols_with_missing, axis=1)
reduced_X_test  = X_test.drop(cols_with_missing, axis=1)
print("Mean Absolute Error from dropping columns with Missing Values:")
print(score_dataset(reduced_X_train, reduced_X_test, y_train, y_test))
```

```
---------------------------------------------------------------------
-------
NameError                                 Traceback (most recent cal
l last)
<ipython-input-136-f7d17914449f> in <module>
      1 #Get Model Score from Dropping Columns with Missing values
----> 2 cols_with_missing = [col for col in X_train.columns
      3                                  if X_train[col].isnull().an
y()]
      4 reduced_X_train = X_train.drop(cols_with_missing, axis=1)
      5 reduced_X_test  = X_test.drop(cols_with_missing, axis=1)

NameError: name 'X_train' is not defined
```

In [137]:

```
#Get Model Score from Imputation
my_imputer = SimpleImputer()
imputed_X_train = my_imputer.fit_transform(X_train)
imputed_X_test = my_imputer.transform(X_test)
print("Mean Absolute Error from Imputation:")
print(score_dataset(imputed_X_train, imputed_X_test, y_train, y_test))
```

```
---------------------------------------------------------------------
-------
NameError                                 Traceback (most recent cal
l last)
<ipython-input-137-1ee8a805eb5c> in <module>
      1 #Get Model Score from Imputation
      2 my_imputer = SimpleImputer()
----> 3 imputed_X_train = my_imputer.fit_transform(X_train)
      4 imputed_X_test = my_imputer.transform(X_test)
      5 print("Mean Absolute Error from Imputation:")

NameError: name 'X_train' is not defined
```

In [138]:

```
#Get Score from imputation with extra columns showing what was imputed
imputed_X_train_plus = X_train.copy()
imputed_X_test_plus = X_test.copy()

cols_with_missing = (col for col in X_train.columns
                                 if X_train[col].isnull().any())
for col in cols_with_missing:
    imputed_X_train_plus[col + '_was_missing'] = imputed_X_train_plus[col].isnul
l()
    imputed_X_test_plus[col + '_was_missing'] = imputed_X_test_plus[col].isnull
()

# Imputation
my_imputer = SimpleImputer()
imputed_X_train_plus = my_imputer.fit_transform(imputed_X_train_plus)
imputed_X_test_plus = my_imputer.transform(imputed_X_test_plus)

print("Mean Absolute Error from Imputation while Track What Was Imputed:")
print(score_dataset(imputed_X_train_plus, imputed_X_test_plus, y_train, y_test))
```

```
---------------------------------------------------------------------
-------
NameError                                 Traceback (most recent cal
l last)
<ipython-input-138-8053f0f85c9d> in <module>
      1 #Get Score from imputation with extra columns showing what w
as imputed
----> 2 imputed_X_train_plus = X_train.copy()
      3 imputed_X_test_plus = X_test.copy()
      4
      5 cols_with_missing = (col for col in X_train.columns

NameError: name 'X_train' is not defined
```

In [139]:

```
train_data = pd.read_csv('/Users/kabloom/Documents/docs/Data Science/Assignments
submitted/train.csv')
test_data = pd.read_csv('/Users/kabloom/Documents/docs/Data Science/Assignments
 submitted/test.csv')

# Drop houses where the target is missing
train_data.dropna(axis=0, subset=['SalePrice'], inplace=True)

target = train_data.SalePrice

# Since missing values isn't the focus of this tutorial, we use the simplest
# possible approach, which drops these columns.
# For more detail (and a better approach) to missing values, see
# https://www.kaggle.com/dansbecker/handling-missing-values
cols_with_missing = [col for col in train_data.columns
                                 if train_data[col].isnull().any()]
candidate_train_predictors = train_data.drop(['Id', 'SalePrice'] + cols_with_mis
sing, axis=1)
candidate_test_predictors = test_data.drop(['Id'] + cols_with_missing, axis=1)

# "cardinality" means the number of unique values in a column.
# We use it as our only way to select categorical columns here. This is convenie
nt, though
# a little arbitrary.
low_cardinality_cols = [cname for cname in candidate_train_predictors.columns if
                                candidate_train_predictors[cname].nunique() < 10
and
                                candidate_train_predictors[cname].dtype == "obje
ct"]
numeric_cols = [cname for cname in candidate_train_predictors.columns if
                                candidate_train_predictors[cname].dtype in ['int
64', 'float64']]
my_cols = low_cardinality_cols + numeric_cols
train_predictors = candidate_train_predictors[my_cols]
test_predictors = candidate_test_predictors[my_cols]
```

In [140]:

```
train_predictors.dtypes.sample(10)
one_hot_encoded_training_predictors = pd.get_dummies(train_predictors)
one_hot_encoded_training_predictors.head()
```

Out[140]:

	MSSubClass	LotArea	OverallQual	OverallCond	YearBuilt	YearRemodAdd	BsmtFinSF1	B
0	60	8450	7	5	2003	2003	706	
1	20	9600	6	8	1976	1976	978	
2	60	11250	7	5	2001	2002	486	
3	70	9550	7	5	1915	1970	216	
4	60	14260	8	5	2000	2000	655	

5 rows × 159 columns

In [141]:

```
from sklearn.model_selection import cross_val_score
from sklearn.ensemble import RandomForestRegressor

def get_mae(X, y):
    # multiple by -1 to make positive MAE score instead of neg value returned as
sklearn convention
    return -1 * cross_val_score(RandomForestRegressor(50),
                                X, y,
                                scoring = 'neg_mean_absolute_error').mean()

predictors_without_categoricals = train_predictors.select_dtypes(exclude=['objec
t'])

mae_without_categoricals = get_mae(predictors_without_categoricals, target)

mae_one_hot_encoded = get_mae(one_hot_encoded_training_predictors, target)

print('Mean Absolute Error when Dropping Categoricals: ' + str(int(mae_without_c
ategoricals)))
print('Mean Abslute Error with One-Hot Encoding: ' + str(int(mae_one_hot_encoded
)))
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/model_selection/_spli
t.py:2053: FutureWarning: You should specify a value for 'cv' instea
d of relying on the default value. The default value will change fro
m 3 to 5 in version 0.22.
  warnings.warn(CV_WARNING, FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/model_selection/_spli
t.py:2053: FutureWarning: You should specify a value for 'cv' instea
d of relying on the default value. The default value will change fro
m 3 to 5 in version 0.22.
  warnings.warn(CV_WARNING, FutureWarning)

Mean Absolute Error when Dropping Categoricals: 18631
Mean Abslute Error with One-Hot Encoding: 18361
```

In [142]:

```
#Applying Gradient Boosting Regressor
bstt = ensm.GradientBoostingRegressor
(loss='ls', criterion='mse',max_depth=4, random_state=0,n_estimators=100, learni
ng_rate=0.1)
```

```
  File "<ipython-input-142-9a11800276d3>", line 3
    (loss='ls', criterion='mse',max_depth=4, random_state=0,n_estima
tors=100, learning_rate=0.1)
         ^
SyntaxError: invalid syntax
```

In [ ]:

```
# New Tutorail Pandas Housing Data
```

In [150]:

```
train=pd.read_csv('/Users/kabloom/Documents/docs/Data Science/Assignments submitted/train.csv',na_values='#NAME?')
```

In [151]:

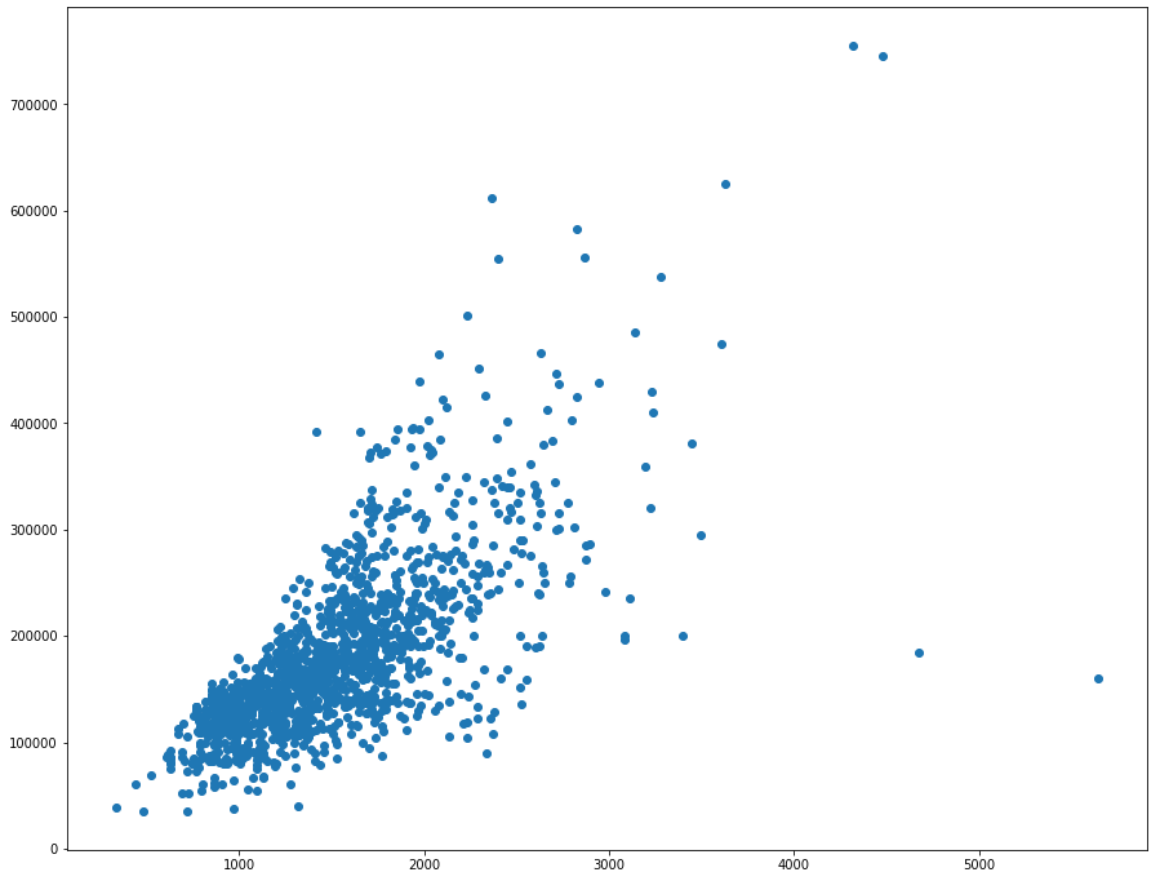
```
test=pd.read_csv('/Users/kabloom/Documents/docs/Data Science/Assignments submitted/test.csv',na_values='#NAME?')
```

In [152]:

```
plt.figure(figsize=(15,12))
plt.scatter(x=train.GrLivArea,y=train.SalePrice)
```

Out[152]:

```
<matplotlib.collections.PathCollection at 0x1a1f482b38>
```



In [153]:

```
train.drop(train[(train['GrLivArea'] >4000) & (train['SalePrice']>600000)].index,inplace=True)
```

In [154]:

```
train.shape,test.shape
```

Out[154]:

```
((1458, 81), (1459, 80))
```

In [155]:

```
full=pd.concat([train,test],ignore_index=True,sort=False)
full.drop('Id',axis=1,inplace=True)
full.shape
```

Out[155]:

```
(2917, 80)
```

In [156]:

```
missing_values=full.isnull().sum()
```

In [157]:

```
missing_values[missing_values>0].sort_values(ascending=False)
```

Out[157]:

```
PoolQC          2908
MiscFeature     2812
Alley           2719
Fence           2347
SalePrice       1459
FireplaceQu     1420
LotFrontage      486
GarageYrBlt      159
GarageFinish     159
GarageQual       159
GarageCond       159
GarageType       157
BsmtCond          82
BsmtExposure      82
BsmtQual          81
BsmtFinType2      80
BsmtFinType1      79
MasVnrType        24
MasVnrArea        23
MSZoning           4
BsmtFullBath       2
BsmtHalfBath       2
Functional         2
Utilities          2
BsmtFinSF2         1
BsmtUnfSF          1
BsmtFinSF1         1
TotalBsmtSF        1
SaleType           1
KitchenQual        1
Exterior2nd        1
Exterior1st        1
GarageCars         1
GarageArea         1
Electrical         1
dtype: int64
```

In [158]:

```
full.groupby(['Neighborhood'])[['LotFrontage']].agg(['mean','median','count'])
```

Out[158]:

	LotFrontage		
	mean	median	count
Neighborhood			
Blmngtn	46.900000	43.0	20
Blueste	27.300000	24.0	10
BrDale	21.500000	21.0	30
BrkSide	55.789474	51.0	95
ClearCr	88.150000	80.5	20
CollgCr	71.336364	70.0	220
Crawfor	69.951807	70.0	83
Edwards	66.910112	65.0	178
Gilbert	74.207207	64.0	111
IDOTRR	62.241379	60.0	87
MeadowV	25.606061	21.0	33
Mitchel	75.144444	74.0	90
NAmes	75.210667	73.0	375
NPkVill	28.142857	24.0	21
NWAmes	81.517647	80.0	85
NoRidge	90.076923	88.5	52
NridgHt	84.184049	92.0	163
OldTown	61.777293	60.0	229
SWISU	59.068182	60.0	44
Sawyer	74.551020	72.0	98
SawyerW	70.669811	67.0	106
Somerst	64.549383	72.5	162
StoneBr	62.173913	60.0	46
Timber	81.157895	82.0	57
Veenker	72.000000	80.0	16

In [159]:

```
full['LotAreaCut']=pd.qcut(full.LotArea,10)
full.groupby([full['LotAreaCut']])[['LotFrontage']].agg(['mean','median','count'
])
```

Out[159]:

	LotFrontage		
	mean	median	count
LotAreaCut			
(1299.999, 4921.8]	35.741036	34.0	251
(4921.8, 7007.2]	55.460674	52.0	267
(7007.2, 7949.0]	62.959839	62.0	249
(7949.0, 8740.4]	67.113725	65.0	255
(8740.4, 9452.0]	69.959184	70.0	245
(9452.0, 10148.8]	73.988235	75.0	255
(10148.8, 11000.0]	73.636364	75.0	253
(11000.0, 12196.8]	83.371681	82.0	226
(12196.8, 14285.8]	84.973684	85.0	228
(14285.8, 215245.0]	93.732673	90.0	202

In [160]:

```
full['LotFrontage']= full.groupby(['LotAreaCut','Neighborhood'])['LotFrontage'].
transform(lambda x : x.fillna(x.median()))
full['LotFrontage']= full.groupby(['LotAreaCut'])['LotFrontage'].transform(lambd
a x : x.fillna(x.median()))
```

In [161]:

```
missing_values = full.isnull().sum()

missing_values[missing_values>0].sort_values(ascending = False)
```

Out[161]:

```
PoolQC          2908
MiscFeature     2812
Alley           2719
Fence           2347
SalePrice       1459
FireplaceQu     1420
GarageYrBlt      159
GarageFinish     159
GarageQual       159
GarageCond       159
GarageType       157
BsmtCond          82
BsmtExposure      82
BsmtQual          81
BsmtFinType2      80
BsmtFinType1      79
MasVnrType        24
MasVnrArea        23
MSZoning           4
BsmtFullBath       2
BsmtHalfBath       2
Functional         2
Utilities          2
BsmtUnfSF          1
BsmtFinSF2         1
TotalBsmtSF        1
BsmtFinSF1         1
SaleType           1
KitchenQual        1
GarageCars         1
Exterior2nd        1
Exterior1st        1
GarageArea         1
Electrical         1
dtype: int64
```

In [162]:

```
columns = ["MasVnrArea", "BsmtUnfSF", "TotalBsmtSF", "GarageCars", "BsmtFinSF2",
"BsmtFinSF1", "GarageArea"]
for col in columns:
    full[col].fillna(0,inplace= True)
```

In [163]:

```
columns1 = ["PoolQC" , "MiscFeature", "Alley", "Fence", "FireplaceQu", "GarageQu
al", "GarageCond", "GarageFinish",
"GarageYrBlt", "GarageType", "BsmtExposure", "BsmtCond", "BsmtQual", "BsmtFinTyp
e2", "BsmtFinType1", "MasVnrType"]
for col1 in columns1:
    full[col1].fillna('None',inplace = True)
```

In [164]:

```
columns2 = ["MSZoning", "BsmtFullBath", "BsmtHalfBath", "Utilities", "Functiona
l",
            "Electrical", "KitchenQual", "SaleType","Exterior1st", "Exterior2nd"
]

for col2 in columns2:
    full[col2].fillna(full[col2].mode()[0],inplace = True)
```

In [165]:

```
full.isnull().sum()[full.isnull().sum()>0]
```

Out[165]:

```
SalePrice    1459
dtype: int64
```

In [166]:

```
numeric_features = full.select_dtypes(include=[np.number])
numeric_features.columns
```

Out[166]:

```
Index(['MSSubClass', 'LotFrontage', 'LotArea', 'OverallQual', 'Overa
llCond',
       'YearBuilt', 'YearRemodAdd', 'MasVnrArea', 'BsmtFinSF1', 'Bsm
tFinSF2',
       'BsmtUnfSF', 'TotalBsmtSF', '1stFlrSF', '2ndFlrSF', 'LowQualF
inSF',
       'GrLivArea', 'BsmtFullBath', 'BsmtHalfBath', 'FullBath', 'Hal
fBath',
       'BedroomAbvGr', 'KitchenAbvGr', 'TotRmsAbvGrd', 'Fireplaces',
       'GarageCars', 'GarageArea', 'WoodDeckSF', 'OpenPorchSF',
       'EnclosedPorch', '3SsnPorch', 'ScreenPorch', 'PoolArea', 'Mis
cVal',
       'MoSold', 'YrSold', 'SalePrice'],
      dtype='object')
```

In [167]:

```
Numstr = ["MSSubClass","BsmtFullBath","BsmtHalfBath","HalfBath","BedroomAbvGr",
"KitchenAbvGr","MoSold",
          "YrSold","YearBuilt","YearRemodAdd","LowQualFinSF","GarageYrBlt"]

for i in Numstr:
    full[i]=full[i].astype(str)
```

In [168]:

```
full.groupby(['MSSubClass'])[['SalePrice']].agg(['mean','median','count'])
```

Out[168]:

	SalePrice		
	mean	median	count
MSSubClass			
120	200779.080460	192000.0	87
150	NaN	NaN	0
160	138647.380952	146000.0	63
180	102300.000000	88500.0	10
190	129613.333333	128250.0	30
20	185224.811567	159250.0	536
30	95829.724638	99900.0	69
40	156125.000000	142500.0	4
45	108591.666667	107500.0	12
50	143302.972222	132000.0	144
60	236513.811448	215000.0	297
70	166772.416667	156000.0	60
75	192437.500000	163500.0	16
80	169736.551724	166500.0	58
85	147810.000000	140750.0	20
90	133541.076923	135980.0	52

In [169]:

```
def map_values():
    full["oMSSubClass"] = full.MSSubClass.map({'180':1,
                                        '30':2, '45':2,
                                        '190':3, '50':3, '90':3,
                                        '85':4, '40':4, '160':4,
                                        '70':5, '20':5, '75':5, '80':5, '150':5,
                                        '120': 6, '60':6})

    full["oMSZoning"] = full.MSZoning.map({'C (all)':1, 'RH':2, 'RM':2, 'RL':3,
'FV':4})
    full["oNeighborhood"] = full.Neighborhood.map({'MeadowV':1,
                                                   'IDOTRR':2, 'BrDale':2,
                                                   'OldTown':3, 'Edwards':3, 'BrkSid
e':3,
                                                   'Sawyer':4, 'Blueste':4, 'SWISU':
4, 'NAmes':4,
                                                   'NPkVill':5, 'Mitchel':5,
                                                   'SawyerW':6, 'Gilbert':6, 'NWAme
s':6,
                                                   'Blmngtn':7, 'CollgCr':7, 'ClearC
r':7, 'Crawfor':7,
                                                   'Veenker':8, 'Somerst':8, 'Timbe
r':8,
                                                   'StoneBr':9,
                                                   'NoRidge':10, 'NridgHt':10})

    full["oCondition1"] = full.Condition1.map({'Artery':1,
                                           'Feedr':2, 'RRAe':2,
                                           'Norm':3, 'RRAn':3,
                                           'PosN':4, 'RRNe':4,
                                           'PosA':5 ,'RRNn':5})

    full["oBldgType"] = full.BldgType.map({'2fmCon':1, 'Duplex':1, 'Twnhs':1, '1
Fam':2, 'TwnhsE':2})

    full["oHouseStyle"] = full.HouseStyle.map({'1.5Unf':1,
                                           '1.5Fin':2, '2.5Unf':2, 'SFoyer':2,
                                           '1Story':3, 'SLvl':3,
                                           '2Story':4, '2.5Fin':4})

    full["oExterior1st"] = full.Exterior1st.map({'BrkComm':1,
                                             'AsphShn':2, 'CBlock':2, 'AsbShng':
2,
                                             'WdShing':3, 'Wd Sdng':3, 'MetalSd'
:3, 'Stucco':3, 'HdBoard':3,
                                             'BrkFace':4, 'Plywood':4,
                                             'VinylSd':5,
                                             'CemntBd':6,
                                             'Stone':7, 'ImStucc':7})

    full["oMasVnrType"] = full.MasVnrType.map({'BrkCmn':1, 'None':1, 'BrkFace':2
, 'Stone':3})

    full["oExterQual"] = full.ExterQual.map({'Fa':1, 'TA':2, 'Gd':3, 'Ex':4})

    full["oFoundation"] = full.Foundation.map({'Slab':1,
                                           'BrkTil':2, 'CBlock':2, 'Stone':2,
                                           'Wood':3, 'PConc':4})
```

```
    full["oBsmtQual"] = full.BsmtQual.map({'Fa':2, 'None':1, 'TA':3, 'Gd':4, 'E
x':5})

    full["oBsmtExposure"] = full.BsmtExposure.map({'None':1, 'No':2, 'Av':3, 'M
n':3, 'Gd':4})

    full["oHeating"] = full.Heating.map({'Floor':1, 'Grav':1, 'Wall':2, 'OthW':3
, 'GasW':4, 'GasA':5})

    full["oHeatingQC"] = full.HeatingQC.map({'Po':1, 'Fa':2, 'TA':3, 'Gd':4, 'E
x':5})

    full["oKitchenQual"] = full.KitchenQual.map({'Fa':1, 'TA':2, 'Gd':3, 'Ex':4
})

    full["oFunctional"] = full.Functional.map({'Maj2':1, 'Maj1':2, 'Min1':2, 'Mi
n2':2, 'Mod':2, 'Sev':2, 'Typ':3})

    full["oFireplaceQu"] = full.FireplaceQu.map({'None':1, 'Po':1, 'Fa':2, 'TA':
3, 'Gd':4, 'Ex':5})

    full["oGarageType"] = full.GarageType.map({'CarPort':1, 'None':1,
                                               'Detchd':2,
                                               '2Types':3, 'Basment':3,
                                               'Attchd':4, 'BuiltIn':5})

    full["oGarageFinish"] = full.GarageFinish.map({'None':1, 'Unf':2, 'RFn':3,
'Fin':4})

    full["oPavedDrive"] = full.PavedDrive.map({'N':1, 'P':2, 'Y':3})

    full["oSaleType"] = full.SaleType.map({'COD':1, 'ConLD':1, 'ConLI':1, 'ConL
w':1, 'Oth':1, 'WD':1,
                                           'CWD':2, 'Con':3, 'New':3})

    full["oSaleCondition"] = full.SaleCondition.map({'AdjLand':1, 'Abnorml':2,
'Alloca':2, 'Family':2, 'Normal':3, 'Partial':4})



    return "Done!"
```

In [170]:

```
map_values()
```

Out[170]:

```
'Done!'
```

In [171]:

```
full.drop("LotAreaCut",axis=1,inplace=True)

full.drop(['SalePrice'],axis=1,inplace=True)
```

In [172]:

```
full.shape
```

Out[172]:

```
(2917, 101)
```

In [173]:

```
full[['YearBuilt','YearRemodAdd','GarageYrBlt']].head()
```

Out[173]:

	YearBuilt	YearRemodAdd	GarageYrBlt
0	2003	2003	2003.0
1	1976	1976	1976.0
2	2001	2002	2001.0
3	1915	1970	1998.0
4	2000	2000	2000.0

In [174]:

```
from sklearn.base import BaseEstimator,clone,TransformerMixin,RegressorMixin
```

In [175]:

```
class labenc(BaseEstimator,TransformerMixin):
    def __init__(self):
        pass
    def fit(self,X,y=None):
        return self
    def transform(self,X):
        label = LabelEncoder()
        X['YearBuilt']=label.fit_transform(X['YearBuilt'])
        X['YearRemodAdd']=label.fit_transform(X['YearRemodAdd'])
        X['GarageYrBlt']=label.fit_transform(X['GarageYrBlt'])
        return X
```

In [176]:

```
class skewness(BaseEstimator,TransformerMixin):
    def __init__(self,skew=0.5):
        self.skew = skew
    def fit(self,X,y=None):
        return self
    def transform(self,X):
        X_numeric=X.select_dtypes(exclude=["object"])
        skewness = X_numeric.apply(lambda x: skew(x))
        skewness_features = skewness[abs(skewness) >= self.skew].index
        X[skewness_features] = np.log1p(X[skewness_features])
        return X
```

In [177]:

```
from sklearn.pipeline import make_pipeline,Pipeline
```

In [178]:

```
class dummies(BaseEstimator,TransformerMixin):
    def __init__(self):
        pass
    def fit(self,X,y=None):
        return self
    def transform(self,X):
        X = pd.get_dummies(X)
        return X
```

In [179]:

```
pipeline = Pipeline([('labenc',labenc()),('skewness',skewness(skew =1)),('dummie
s',dummies())])
```

In [180]:

```
from sklearn.preprocessing import LabelEncoder,Imputer,OneHotEncoder,RobustScale
r,StandardScaler,Imputer
from scipy.stats import skew
```

In [181]:

```
full_copy = full.copy()
data_pipeline = pipeline.fit_transform(full_copy)
```

In [182]:

```
data_pipeline.shape
```

Out[182]:

```
(2917, 406)
```

In [183]:

```
data_pipeline.head()
```

Out[183]:

	LotFrontage	LotArea	OverallQual	OverallCond	YearBuilt	YearRemodAdd	MasVnrArea	E
0	4.189655	9.042040	7	5	110	53	5.283204	
1	4.394449	9.169623	6	8	83	26	0.000000	
2	4.234107	9.328212	7	5	108	52	5.093750	
3	4.110874	9.164401	7	5	25	20	0.000000	
4	4.442651	9.565284	8	5	107	50	5.860786	

5 rows × 406 columns

In [184]:

```
robust_scaler = RobustScaler()
```

In [185]:

```
n_train = train.shape[0]
n_train
```

Out[185]:

```
1458
```

In [186]:

```
X= data_pipeline[:n_train]
y = train.SalePrice
test_X = data_pipeline[n_train:]
X.shape,y.shape,test_X.shape
```

Out[186]:

```
((1458, 406), (1458,), (1459, 406))
```

In [187]:

```
X_scaled = robust_scaler.fit(X).transform(X)
y_log = np.log(train.SalePrice)
test_X_scaled = robust_scaler.transform(test_X)
```

In [188]:

```
X_scaled.shape,y_log.shape,test_X.shape
```

Out[188]:

```
((1458, 406), (1458,), (1459, 406))
```

In [189]:

```
from sklearn.linear_model import LinearRegression,BayesianRidge,ElasticNet,Lasso
,SGDRegressor,Ridge
```

In [190]:

```
lasso = Lasso(alpha = 0.001)
lasso.fit(X_scaled,y_log)
y_pred_lasso = lasso.predict(test_X_scaled)
```

In [191]:

```
FI_lasso = pd.DataFrame({"Feature Importance":lasso.coef_}, index=data_pipeline.
columns)
FI_lasso.sort_values("Feature Importance",ascending=False)
```

Out[191]:

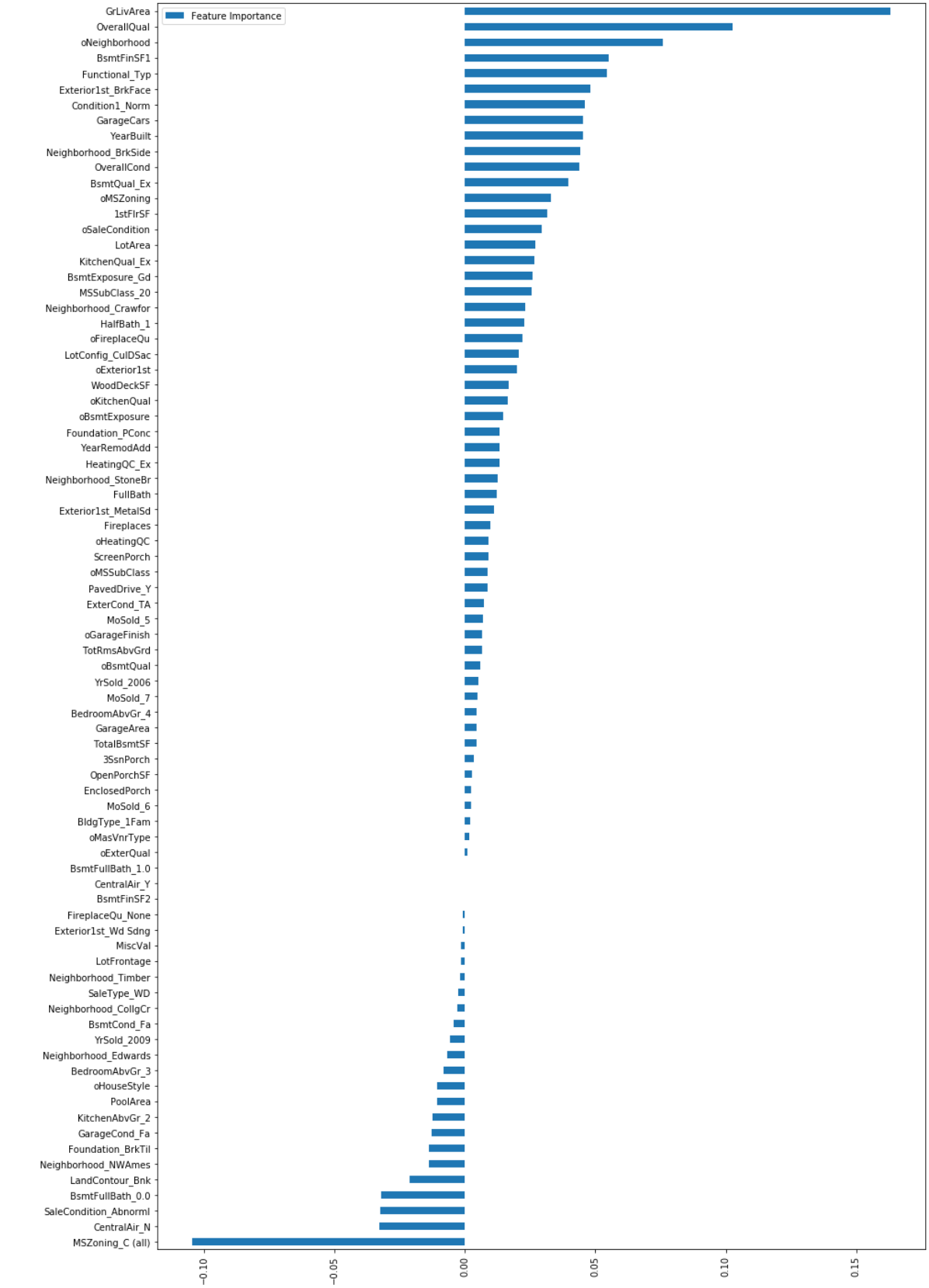
	Feature Importance
GrLivArea	0.163010
OverallQual	0.102665
oNeighborhood	0.076002
BsmtFinSF1	0.055243
Functional_Typ	0.054297
Exterior1st_BrkFace	0.048122
Condition1_Norm	0.045894
GarageCars	0.045438
YearBuilt	0.045378
Neighborhood_BrkSide	0.044335
OverallCond	0.043769
BsmtQual_Ex	0.039762
oMSZoning	0.032991
1stFlrSF	0.031554
oSaleCondition	0.029414
LotArea	0.026918
KitchenQual_Ex	0.026612
BsmtExposure_Gd	0.025852
MSSubClass_20	0.025700
Neighborhood_Crawfor	0.023158
HalfBath_1	0.022972
oFireplaceQu	0.022057
LotConfig_CulDSac	0.020708
oExterior1st	0.020122
WoodDeckSF	0.016964
oKitchenQual	0.016402
oBsmtExposure	0.014838
Foundation_PConc	0.013472
YearRemodAdd	0.013453
HeatingQC_Ex	0.013290
...	...
BsmtQual_Gd	-0.000000
RoofMatl_Membran	0.000000
RoofMatl_CompShg	0.000000
RoofMatl_ClyTile	-0.000000
RoofStyle_Shed	0.000000

	Feature Importance
RoofStyle_Mansard	0.000000
ExterCond_Po	-0.000000
BsmtFinSF2	-0.000072
FireplaceQu_None	-0.000635
Exterior1st_Wd Sdng	-0.000671
MiscVal	-0.001562
LotFrontage	-0.001595
Neighborhood_Timber	-0.001829
SaleType_WD	-0.002551
Neighborhood_CollgCr	-0.002945
BsmtCond_Fa	-0.004276
YrSold_2009	-0.005709
Neighborhood_Edwards	-0.006648
BedroomAbvGr_3	-0.008201
oHouseStyle	-0.010532
PoolArea	-0.010542
KitchenAbvGr_2	-0.012274
GarageCond_Fa	-0.012713
Foundation_BrkTil	-0.013611
Neighborhood_NWAmes	-0.013618
LandContour_Bnk	-0.021147
BsmtFullBath_0.0	-0.032013
SaleCondition_Abnorml	-0.032362
CentralAir_N	-0.032854
MSZoning_C (all)	-0.104515

406 rows × 1 columns

In [192]:

```
FI_lasso[FI_lasso["Feature Importance"]!=0].sort_values("Feature Importance").pl
ot(kind="barh",figsize=(15,25))
plt.xticks(rotation=90)
plt.show()
```


Feature Importance
GrLivArea
OverallQual
oNeighborhood
BsmtFinSF1
Functional_Typ
Exterior1st_BrkFace
Condition1_Norm
GarageCars
YearBuilt
Neighborhood_BrkSide
OverallCond
BsmtQual_Ex
oMSZoning
1stFlrSF
oSaleCondition
LotArea
KitchenQual_Ex
BsmtExposure_Gd
MSSubClass_20
Neighborhood_Crawfor
HalfBath_1
oFireplaceQu
LotConfig_CulDSac
oExterior1st
WoodDeckSF
oKitchenQual
oBsmtExposure
Foundation_PConc
YearRemodAdd
HeatingQC_Ex
Neighborhood_StoneBr
FullBath
Exterior1st_MetalSd
Fireplaces
oHeatingQC
ScreenPorch
oMSSubClass
PavedDrive_Y
ExterCond_TA
MoSold_5
oGarageFinish
TotRmsAbvGrd
oBsmtQual
YrSold_2006
MoSold_7
BedroomAbvGr_4
GarageArea
TotalBsmtSF
3SsnPorch
OpenPorchSF
EnclosedPorch
MoSold_6
BldgType_1Fam
oMasVnrType
oExterQual
BsmtFullBath_1.0
CentralAir_Y
BsmtFinSF2
FireplaceQu_None
Exterior1st_Wd Sdng
MiscVal
LotFrontage
Neighborhood_Timber
SaleType_WD
Neighborhood_CollgCr
BsmtCond_Fa
YrSold_2009
Neighborhood_Edwards
BedroomAbvGr_3
oHouseStyle
PoolArea
KitchenAbvGr_2
GarageCond_Fa
Foundation_BrkTil
Neighborhood_NWAmes
LandContour_Bnk
BsmtFullBath_0.0
SaleCondition_Abnorml
CentralAir_N
MSZoning_C (all)
−0.10
−0.05
0.00
0.05
0.10
0.15

In [193]:

```
class add_feature(BaseEstimator, TransformerMixin):
    def __init__(self,additional=1):
        self.additional = additional

    def fit(self,X,y=None):
        return self

    def transform(self,X):
        if self.additional==1:
            X["TotalHouse"] = X["TotalBsmtSF"] + X["1stFlrSF"] + X["2ndFlrSF"]
            X["TotalArea"] = X["TotalBsmtSF"] + X["1stFlrSF"] + X["2ndFlrSF"] +
X["GarageArea"]

        else:
            X["TotalHouse"] = X["TotalBsmtSF"] + X["1stFlrSF"] + X["2ndFlrSF"]
            X["TotalArea"] = X["TotalBsmtSF"] + X["1stFlrSF"] + X["2ndFlrSF"] +
X["GarageArea"]

            X["+_TotalHouse_OverallQual"] = X["TotalHouse"] * X["OverallQual"]
            X["+_GrLivArea_OverallQual"] = X["GrLivArea"] * X["OverallQual"]
            X["+_oMSZoning_TotalHouse"] = X["oMSZoning"] * X["TotalHouse"]
            X["+_oMSZoning_OverallQual"] = X["oMSZoning"] + X["OverallQual"]
            X["+_oMSZoning_YearBuilt"] = X["oMSZoning"] + X["YearBuilt"]
            X["+_oNeighborhood_TotalHouse"] = X["oNeighborhood"] * X["TotalHous
e"]
            X["+_oNeighborhood_OverallQual"] = X["oNeighborhood"] + X["OverallQu
al"]
            X["+_oNeighborhood_YearBuilt"] = X["oNeighborhood"] + X["YearBuilt"]
            X["+_BsmtFinSF1_OverallQual"] = X["BsmtFinSF1"] * X["OverallQual"]

            X["-_oFunctional_TotalHouse"] = X["oFunctional"] * X["TotalHouse"]
            X["-_oFunctional_OverallQual"] = X["oFunctional"] + X["OverallQual"]
            X["-_LotArea_OverallQual"] = X["LotArea"] * X["OverallQual"]
            X["-_TotalHouse_LotArea"] = X["TotalHouse"] + X["LotArea"]
            X["-_oCondition1_TotalHouse"] = X["oCondition1"] * X["TotalHouse"]
            X["-_oCondition1_OverallQual"] = X["oCondition1"] + X["OverallQual"]


            X["Bsmt"] = X["BsmtFinSF1"] + X["BsmtFinSF2"] + X["BsmtUnfSF"]
            X["Rooms"] = X["FullBath"]+X["TotRmsAbvGrd"]
            X["PorchArea"] = X["OpenPorchSF"]+X["EnclosedPorch"]+X["3SsnPorch"]+
X["ScreenPorch"]
            X["TotalPlace"] = X["TotalBsmtSF"] + X["1stFlrSF"] + X["2ndFlrSF"] +
X["GarageArea"] + X["OpenPorchSF"]+X["EnclosedPorch"]+X["3SsnPorch"]+X["ScreenPo
rch"]


            return X
```

In [194]:

```
pipeline = Pipeline([('labenc',labenc()),('add_feature', add_feature(additional=
2)),
                     ('skewness',skewness(skew =1)),('dummies',dummies())])

full_pipe = pipeline.fit_transform(full)
full_pipe.shape
```

Out[194]:

```
(2917, 427)
```

In [195]:

```
n_train=train.shape[0]
X = full_pipe[:n_train]
test_X = full_pipe[n_train:]
y= train.SalePrice

X_scaled = robust_scaler.fit(X).transform(X)
y_log = np.log(train.SalePrice)
test_X_scaled = robust_scaler.transform(test_X)
```

In [196]:

```
print(X_scaled.shape)
```

```
(1458, 427)
```

In [197]:

```
from sklearn.decomposition import PCA,KernelPCA
```

In [198]:

```
pca = PCA(0.95)

#pca = PCA(n_components = 426)
X_scaled = pca.fit_transform(X_scaled)
#X_scaled = pca.inverse_transform(lower_dimension_pca)
var1 = np.round(pca.explained_variance_ratio_*100, decimals = 1)
var1
```

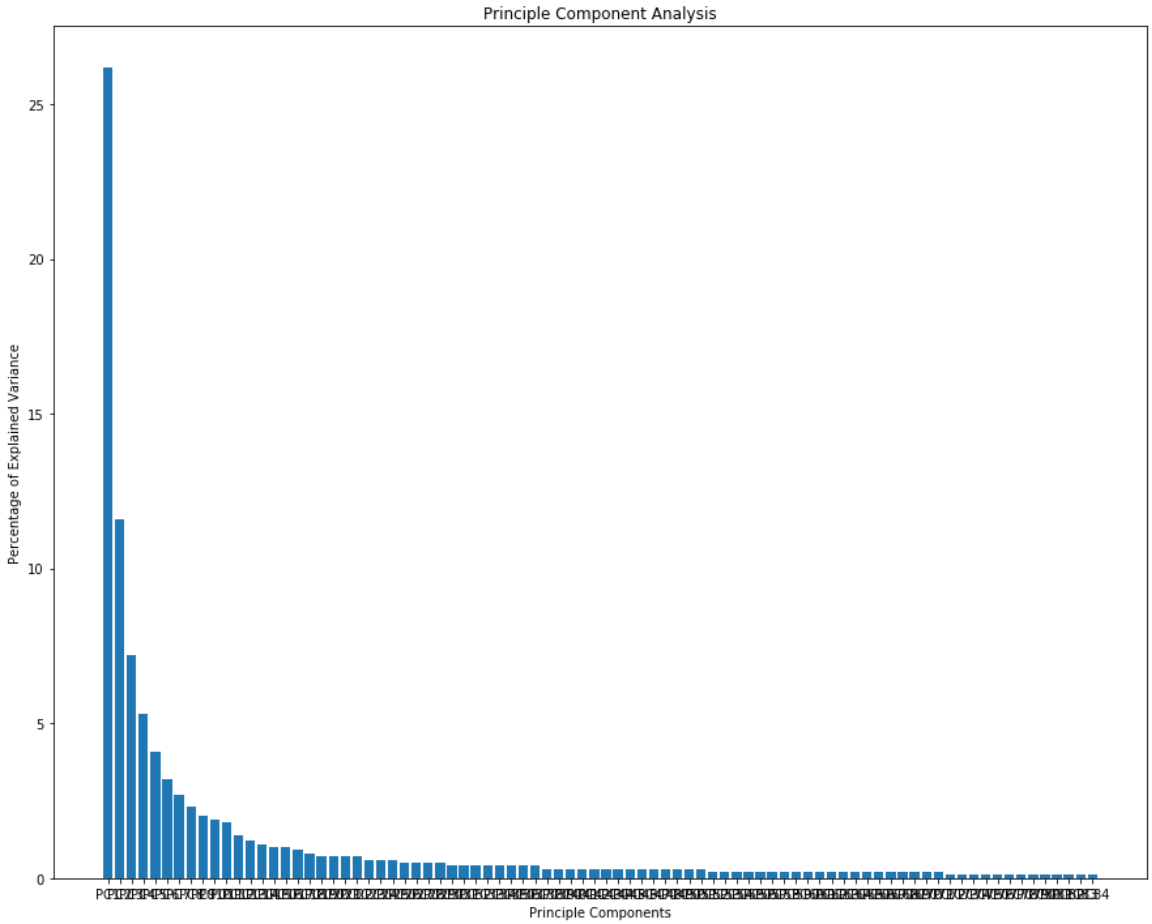
Out[198]:

```
array([26.2, 11.6,  7.2,  5.3,  4.1,  3.2,  2.7,  2.3,  2. ,  1.9,
1.8,
        1.4,  1.2,  1.1,  1. ,  1. ,  0.9,  0.8,  0.7,  0.7,  0.7,
0.7,
        0.6,  0.6,  0.6,  0.5,  0.5,  0.5,  0.5,  0.4,  0.4,  0.4,
0.4,
        0.4,  0.4,  0.4,  0.4,  0.3,  0.3,  0.3,  0.3,  0.3,  0.3,
0.3,
        0.3,  0.3,  0.3,  0.3,  0.3,  0.3,  0.3,  0.2,  0.2,  0.2,
0.2,
        0.2,  0.2,  0.2,  0.2,  0.2,  0.2,  0.2,  0.2,  0.2,  0.2,
0.2,
        0.2,  0.2,  0.2,  0.2,  0.2,  0.1,  0.1,  0.1,  0.1,  0.1,
0.1,
        0.1,  0.1,  0.1,  0.1,  0.1,  0.1,  0.1])
```

In [199]:

```
label =['PC' + str(x) for x in range(1,len(var1)+1)]
plt.figure(figsize=(15,12))
plt.bar(x=range(1,len(var1)+1), height = var1 ,tick_label = label)

plt.ylabel("Percentage of Explained Variance")
plt.xlabel("Principle Components")
plt.title("Principle Component Analysis")
plt.show()
```



In [200]:

```
test_X_scaled = pca.fit_transform(test_X_scaled)
var = np.round(pca.explained_variance_ratio_*100, decimals = 1)
var
```

Out[200]:

```
array([27.3, 12.1,  6.9,  5.7,  4. ,  3.3,  2.8,  2.3,  2.1,  2. ,
1.7,
       1.3,  1.1,  1. ,  1. ,  0.9,  0.8,  0.8,  0.7,  0.7,  0.6,
0.6,
       0.5,  0.5,  0.5,  0.5,  0.5,  0.5,  0.4,  0.4,  0.4,  0.4,
0.4,
       0.4,  0.4,  0.3,  0.3,  0.3,  0.3,  0.3,  0.3,  0.3,  0.3,
0.3,
       0.3,  0.3,  0.3,  0.3,  0.2,  0.2,  0.2,  0.2,  0.2,  0.2,
0.2,
       0.2,  0.2,  0.2,  0.2,  0.2,  0.2,  0.2,  0.2,  0.2,  0.2,
0.2,
       0.2,  0.2,  0.2,  0.2,  0.1,  0.1,  0.1,  0.1,  0.1,  0.1,
0.1,
       0.1,  0.1,  0.1,  0.1,  0.1,  0.1])
```

In [201]:

```
X_scaled.shape, test_X_scaled.shape
```

Out[201]:

```
((1458, 84), (1459, 83))
```

In [202]:

```
# Define Root Mean Square Error
def rmse_cv(model,X,y):
    rmse = np.sqrt(-cross_val_score(model,X,y,scoring="neg_mean_squared_error",c
v=5))
    return rmse
```

In [203]:

```
from sklearn.ensemble import ExtraTreesRegressor,GradientBoostingRegressor,Rando
mForestRegressor,VotingClassifier
from sklearn.svm import LinearSVR,SVR
from sklearn.kernel_ridge import KernelRidge
from xgboost import XGBRegressor
```

In [204]:

```
models = [LinearRegression(),
              Ridge(),
              Lasso(alpha=0.01,max_iter=10000),
              RandomForestRegressor(),
              GradientBoostingRegressor(),
              SVR(),
              LinearSVR(),
              ElasticNet(alpha = 0.001,max_iter=10000),
              SGDRegressor(max_iter=1000, tol = 1e-3),
              BayesianRidge(),
              KernelRidge(alpha=0.6,kernel='polynomial',degree = 2,coef0=2.5),
              ExtraTreesRegressor(),
              XGBRegressor()]

names = ['LR','Ridge','Lasso','RF','GBR','SVR','LSVR','ENet','SGDR','BayRidge',
'Kernel','XTreeR','XGBR']
```

In [205]:

```
for model,name in zip(models,names):
    score = rmse_cv(model,X_scaled,y_log)
    print("{}: {:.6f}, {:4f}".format(name,score.mean(),score.std()))
```

```
LR: 0.127207, 0.012788
Ridge: 0.127144, 0.012795
Lasso: 0.130874, 0.011881

/anaconda3/lib/python3.7/site-packages/sklearn/ensemble/forest.py:24
6: FutureWarning: The default value of n_estimators will change from
10 in version 0.20 to 100 in 0.22.
  "10 in version 0.20 to 100 in 0.22.", FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/ensemble/forest.py:24
6: FutureWarning: The default value of n_estimators will change from
10 in version 0.20 to 100 in 0.22.
  "10 in version 0.20 to 100 in 0.22.", FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/ensemble/forest.py:24
6: FutureWarning: The default value of n_estimators will change from
10 in version 0.20 to 100 in 0.22.
  "10 in version 0.20 to 100 in 0.22.", FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/ensemble/forest.py:24
6: FutureWarning: The default value of n_estimators will change from
10 in version 0.20 to 100 in 0.22.
  "10 in version 0.20 to 100 in 0.22.", FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/ensemble/forest.py:24
6: FutureWarning: The default value of n_estimators will change from
10 in version 0.20 to 100 in 0.22.
  "10 in version 0.20 to 100 in 0.22.", FutureWarning)

RF: 0.141926, 0.008570
GBR: 0.129264, 0.009111

/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:196: Futu
reWarning: The default value of gamma will change from 'auto' to 'sc
ale' in version 0.22 to account better for unscaled features. Set ga
mma explicitly to 'auto' or 'scale' to avoid this warning.
  "avoid this warning.", FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:196: Futu
reWarning: The default value of gamma will change from 'auto' to 'sc
ale' in version 0.22 to account better for unscaled features. Set ga
mma explicitly to 'auto' or 'scale' to avoid this warning.
  "avoid this warning.", FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:196: Futu
reWarning: The default value of gamma will change from 'auto' to 'sc
ale' in version 0.22 to account better for unscaled features. Set ga
mma explicitly to 'auto' or 'scale' to avoid this warning.
  "avoid this warning.", FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:196: Futu
reWarning: The default value of gamma will change from 'auto' to 'sc
ale' in version 0.22 to account better for unscaled features. Set ga
mma explicitly to 'auto' or 'scale' to avoid this warning.
  "avoid this warning.", FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:196: Futu
reWarning: The default value of gamma will change from 'auto' to 'sc
ale' in version 0.22 to account better for unscaled features. Set ga
mma explicitly to 'auto' or 'scale' to avoid this warning.
  "avoid this warning.", FutureWarning)


SVR: 0.129020, 0.012752
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:922: Conv
ergenceWarning: Liblinear failed to converge, increase the number of
iterations.
  "the number of iterations.", ConvergenceWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:922: Conv
ergenceWarning: Liblinear failed to converge, increase the number of
iterations.
  "the number of iterations.", ConvergenceWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:922: Conv
ergenceWarning: Liblinear failed to converge, increase the number of
iterations.
  "the number of iterations.", ConvergenceWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:922: Conv
ergenceWarning: Liblinear failed to converge, increase the number of
iterations.
  "the number of iterations.", ConvergenceWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:922: Conv
ergenceWarning: Liblinear failed to converge, increase the number of
iterations.
  "the number of iterations.", ConvergenceWarning)

LSVR: 0.130379, 0.012712
ENet: 0.125751, 0.013029
SGDR: 0.135695, 0.014213
BayRidge: 0.125546, 0.013013
Kernel: 0.117835, 0.008849

/anaconda3/lib/python3.7/site-packages/sklearn/ensemble/forest.py:24
6: FutureWarning: The default value of n_estimators will change from
10 in version 0.20 to 100 in 0.22.
  "10 in version 0.20 to 100 in 0.22.", FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/ensemble/forest.py:24
6: FutureWarning: The default value of n_estimators will change from
10 in version 0.20 to 100 in 0.22.
  "10 in version 0.20 to 100 in 0.22.", FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/ensemble/forest.py:24
6: FutureWarning: The default value of n_estimators will change from
10 in version 0.20 to 100 in 0.22.
  "10 in version 0.20 to 100 in 0.22.", FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/ensemble/forest.py:24
6: FutureWarning: The default value of n_estimators will change from
10 in version 0.20 to 100 in 0.22.
  "10 in version 0.20 to 100 in 0.22.", FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/ensemble/forest.py:24
6: FutureWarning: The default value of n_estimators will change from
10 in version 0.20 to 100 in 0.22.
  "10 in version 0.20 to 100 in 0.22.", FutureWarning)

XTreeR: 0.142756, 0.010216
```

```
/anaconda3/lib/python3.7/site-packages/xgboost/core.py:587: FutureWa
rning: Series.base is deprecated and will be removed in a future ver
sion
  if getattr(data, 'base', None) is not None and \
/anaconda3/lib/python3.7/site-packages/xgboost/core.py:587: FutureWa
rning: Series.base is deprecated and will be removed in a future ver
sion
  if getattr(data, 'base', None) is not None and \
/anaconda3/lib/python3.7/site-packages/xgboost/core.py:587: FutureWa
rning: Series.base is deprecated and will be removed in a future ver
sion
  if getattr(data, 'base', None) is not None and \
/anaconda3/lib/python3.7/site-packages/xgboost/core.py:587: FutureWa
rning: Series.base is deprecated and will be removed in a future ver
sion
  if getattr(data, 'base', None) is not None and \
/anaconda3/lib/python3.7/site-packages/xgboost/core.py:587: FutureWa
rning: Series.base is deprecated and will be removed in a future ver
sion
  if getattr(data, 'base', None) is not None and \

XGBR: 0.129692, 0.009626
```

In [208]:

```
from sklearn.model_selection import cross_val_score,KFold,GridSearchCV,Randomize
dSearchCV,StratifiedKFold,train_test_split
class grid():
    def __init__(self,model):
        self.model = model
    def grid_get(self,X,y,param_grid):
        grid_search = GridSearchCV(self.model,param_grid,cv=5,scoring='neg_mean_
squared_error')
        grid_search.fit(X,y)
        print(grid_search.best_params_,np.sqrt(-grid_search.best_score_))
        grid_search.cv_results_['mean_test_score'] = np.sqrt(-grid_search.cv_res
ults_['mean_test_score'])
        print(pd.DataFrame(grid_search.cv_results_)[['params','mean_test_score',
'std_test_score']])

class random():
    def __init__(self,model):
        self.model = model
    def random_get(self,X,y,param_grid):
        random_search = RandomizedSearchCV(self.model,param_grid,random_state= 0
,
                                           n_iter = 10,scoring='neg_mean_squared
_error')
        random_search.fit(X,y)
        print(random_search.best_params_,np.sqrt(-random_search.best_score_))
        random_search.cv_results_['mean_test_score'] = np.sqrt(-random_search.cv
_results_['mean_test_score'])
        print(pd.DataFrame(random_search.cv_results_)[['params','mean_test_scor
e','std_test_score']])
```

In [209]:

```
grid(Lasso()).grid_get(X_scaled,y_log,{'alpha':[0.01,0.001,0.0001,0.0002,0.0003,
0.0004,0.0005,0.0006,0.0007,0.0009],
                                       'max_iter':[10000]})
```

```
{'alpha': 0.001, 'max_iter': 10000} 0.12590997865928494
                                params  mean_test_score  std_test_s
core
0    {'alpha': 0.01, 'max_iter': 10000}         0.131410        0.00
3112
1   {'alpha': 0.001, 'max_iter': 10000}         0.125910        0.00
3366
2  {'alpha': 0.0001, 'max_iter': 10000}         0.127476        0.00
3325
3  {'alpha': 0.0002, 'max_iter': 10000}         0.127158        0.00
3325
4  {'alpha': 0.0003, 'max_iter': 10000}         0.126879        0.00
3330
5  {'alpha': 0.0004, 'max_iter': 10000}         0.126638        0.00
3335
6  {'alpha': 0.0005, 'max_iter': 10000}         0.126438        0.00
3337
7  {'alpha': 0.0006, 'max_iter': 10000}         0.126278        0.00
3340
8  {'alpha': 0.0007, 'max_iter': 10000}         0.126149        0.00
3342
9  {'alpha': 0.0009, 'max_iter': 10000}         0.125958        0.00
3357

/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split0_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split1_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split2_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split3_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split4_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('mean_train_
score'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('std_train_s
core'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
```

In [210]:

```
random(Lasso()).random_get(X_scaled,y_log,{'alpha':[0.01,0.001,0.0001,0.0002,0.0003,0.0004,0.0005,0.0006,0.0007,0.0009]})
```

```
{'alpha': 0.001} 0.12589791575759118
              params  mean_test_score  std_test_score
0    {'alpha': 0.01}         0.131757        0.002214
1   {'alpha': 0.001}         0.125898        0.002171
2  {'alpha': 0.0001}         0.127435        0.002091
3  {'alpha': 0.0002}         0.127098        0.002098
4  {'alpha': 0.0003}         0.126817        0.002108
5  {'alpha': 0.0004}         0.126582        0.002120
6  {'alpha': 0.0005}         0.126390        0.002131
7  {'alpha': 0.0006}         0.126233        0.002143
8  {'alpha': 0.0007}         0.126120        0.002152
9  {'alpha': 0.0009}         0.125958        0.002167

/anaconda3/lib/python3.7/site-packages/sklearn/model_selection/_split.py:2053: FutureWarning: You should specify a value for 'cv' instead of relying on the default value. The default value will change from 3 to 5 in version 0.22.
  warnings.warn(CV_WARNING, FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:125: FutureWarning: You are accessing a training score ('split0_train_score'), which will not be available by default any more in 0.21. If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:125: FutureWarning: You are accessing a training score ('split1_train_score'), which will not be available by default any more in 0.21. If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:125: FutureWarning: You are accessing a training score ('split2_train_score'), which will not be available by default any more in 0.21. If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:125: FutureWarning: You are accessing a training score ('mean_train_score'), which will not be available by default any more in 0.21. If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:125: FutureWarning: You are accessing a training score ('std_train_score'), which will not be available by default any more in 0.21. If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
```

In [211]:

```
grid(Ridge()).grid_get(X_scaled,y_log,
                       {'alpha':[10,20,25,30,35,40,45,50,55,57,60,65,70,75,80,10
0],'max_iter':[10000]})
```

```
{'alpha': 100, 'max_iter': 10000} 0.12547326886690283
                              params  mean_test_score  std_test_sco
re
0    {'alpha': 10, 'max_iter': 10000}         0.127292        0.0033
28
1    {'alpha': 20, 'max_iter': 10000}         0.126863        0.0033
27
2    {'alpha': 25, 'max_iter': 10000}         0.126684        0.0033
26
3    {'alpha': 30, 'max_iter': 10000}         0.126524        0.0033
26
4    {'alpha': 35, 'max_iter': 10000}         0.126382        0.0033
25
5    {'alpha': 40, 'max_iter': 10000}         0.126255        0.0033
24
6    {'alpha': 45, 'max_iter': 10000}         0.126141        0.0033
23
7    {'alpha': 50, 'max_iter': 10000}         0.126039        0.0033
22
8    {'alpha': 55, 'max_iter': 10000}         0.125948        0.0033
20
9    {'alpha': 57, 'max_iter': 10000}         0.125914        0.0033
20
10   {'alpha': 60, 'max_iter': 10000}         0.125867        0.0033
19
11   {'alpha': 65, 'max_iter': 10000}         0.125794        0.0033
18
12   {'alpha': 70, 'max_iter': 10000}         0.125730        0.0033
17
13   {'alpha': 75, 'max_iter': 10000}         0.125672        0.0033
15
14   {'alpha': 80, 'max_iter': 10000}         0.125621        0.0033
14
15  {'alpha': 100, 'max_iter': 10000}         0.125473        0.0033
09
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split0_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split1_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split2_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split3_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split4_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('mean_train_
score'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('std_train_s
core'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
```

In [212]:

```
random(Ridge()).random_get(X_scaled,y_log,
                      {'alpha':[10,20,25,30,35,40,45,50,55,57,60,65,70,75,80,10
0],'max_iter':[10000]})
```

```
{'max_iter': 10000, 'alpha': 80} 0.12564921489535272
                            params  mean_test_score  std_test_score
0  {'max_iter': 10000, 'alpha': 20}         0.126761        0.002110
1  {'max_iter': 10000, 'alpha': 45}         0.126066        0.002120
2  {'max_iter': 10000, 'alpha': 55}         0.125899        0.002122
3  {'max_iter': 10000, 'alpha': 57}         0.125871        0.002122
4  {'max_iter': 10000, 'alpha': 75}         0.125684        0.002125
5  {'max_iter': 10000, 'alpha': 35}         0.126288        0.002117
6  {'max_iter': 10000, 'alpha': 25}         0.126581        0.002113
7  {'max_iter': 10000, 'alpha': 80}         0.125649        0.002125
8  {'max_iter': 10000, 'alpha': 60}         0.125832        0.002123
9  {'max_iter': 10000, 'alpha': 50}         0.125977        0.002121

/anaconda3/lib/python3.7/site-packages/sklearn/model_selection/_spli
t.py:2053: FutureWarning: You should specify a value for 'cv' instea
d of relying on the default value. The default value will change fro
m 3 to 5 in version 0.22.
  warnings.warn(CV_WARNING, FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split0_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split1_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split2_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('mean_train_
score'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('std_train_s
core'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
```

In [213]:

```
param_grid = {'C':[0.05,0.1,0.15,0.2],"epsilon":[0.0015,0.002,0.0025,0.025,0.000
4]}
grid(LinearSVR()).grid_get(X_scaled,y_log,param_grid)
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:922: Conv
ergenceWarning: Liblinear failed to converge, increase the number of
iterations.
  "the number of iterations.", ConvergenceWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:922: Conv
ergenceWarning: Liblinear failed to converge, increase the number of
iterations.
  "the number of iterations.", ConvergenceWarning)
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ergenceWarning: Liblinear failed to converge, increase the number of
iterations.
  "the number of iterations.", ConvergenceWarning)
```

```
{'C': 0.15, 'epsilon': 0.002} 0.12588870949551445
```

	params	mean_test_score	std_test_score
0	{'C': 0.05, 'epsilon': 0.0015}	0.127670	0.003651
1	{'C': 0.05, 'epsilon': 0.002}	0.127768	0.003645
2	{'C': 0.05, 'epsilon': 0.0025}	0.127802	0.003675
3	{'C': 0.05, 'epsilon': 0.025}	0.127952	0.003708
4	{'C': 0.05, 'epsilon': 0.0004}	0.127856	0.003632
5	{'C': 0.1, 'epsilon': 0.0015}	0.126160	0.003905
6	{'C': 0.1, 'epsilon': 0.002}	0.126080	0.003903
7	{'C': 0.1, 'epsilon': 0.0025}	0.126175	0.003968
8	{'C': 0.1, 'epsilon': 0.025}	0.126043	0.003983
9	{'C': 0.1, 'epsilon': 0.0004}	0.126119	0.003879
10	{'C': 0.15, 'epsilon': 0.0015}	0.126073	0.004039
11	{'C': 0.15, 'epsilon': 0.002}	0.125889	0.003944
12	{'C': 0.15, 'epsilon': 0.0025}	0.125965	0.003929
13	{'C': 0.15, 'epsilon': 0.025}	0.126161	0.004169
14	{'C': 0.15, 'epsilon': 0.0004}	0.126175	0.003935
15	{'C': 0.2, 'epsilon': 0.0015}	0.126375	0.004057
16	{'C': 0.2, 'epsilon': 0.002}	0.126274	0.004095
17	{'C': 0.2, 'epsilon': 0.0025}	0.126556	0.004186
18	{'C': 0.2, 'epsilon': 0.025}	0.126254	0.003922
19	{'C': 0.2, 'epsilon': 0.0004}	0.126732	0.004116

```
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:922: Conv
ergenceWarning: Liblinear failed to converge, increase the number of
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  "the number of iterations.", ConvergenceWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split0_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split1_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split2_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split3_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split4_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('mean_train_
score'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('std_train_s
core'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
```

In [214]:

```
param_grid = {'C':[0.05,0.1,0.15,0.2],"epsilon":[0.0015,0.002,0.0025,0.025,0.000
4]}
random(LinearSVR()).random_get(X_scaled,y_log,param_grid)
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/model_selection/_spli
t.py:2053: FutureWarning: You should specify a value for 'cv' instea
d of relying on the default value. The default value will change fro
m 3 to 5 in version 0.22.
  warnings.warn(CV_WARNING, FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:922: Conv
ergenceWarning: Liblinear failed to converge, increase the number of
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```

```
{'epsilon': 0.0004, 'C': 0.2} 0.12678993862511065
                            params  mean_test_score  std_test_score
0     {'epsilon': 0.025, 'C': 0.2}         0.127104        0.002853
1    {'epsilon': 0.002, 'C': 0.05}         0.130269        0.002116
2    {'epsilon': 0.0004, 'C': 0.2}         0.126790        0.002844
3     {'epsilon': 0.025, 'C': 0.1}         0.127116        0.002618
4   {'epsilon': 0.0015, 'C': 0.15}         0.127591        0.002796
5    {'epsilon': 0.0025, 'C': 0.2}         0.127116        0.002822
6     {'epsilon': 0.002, 'C': 0.1}         0.127559        0.002652
7    {'epsilon': 0.025, 'C': 0.15}         0.127252        0.002806
8   {'epsilon': 0.0004, 'C': 0.05}         0.130315        0.002087
9   {'epsilon': 0.0025, 'C': 0.05}         0.130144        0.002181
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:922: Conv
ergenceWarning: Liblinear failed to converge, increase the number of
iterations.
  "the number of iterations.", ConvergenceWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split0_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split1_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split2_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('mean_train_
score'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('std_train_s
core'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
```

In [215]:

```
param_grid = {'C':[11,13,15],'kernel':["rbf"],"gamma":[0.0003,0.0004],"epsilon":
[0.008,0.009]}
grid(SVR()).grid_get(X_scaled,y_log,param_grid)
```

```
{'C': 15, 'epsilon': 0.008, 'gamma': 0.0004, 'kernel': 'rbf'} 0.1243
937886301839
                                                params  mean_test_sco
re  \
0   {'C': 11, 'epsilon': 0.008, 'gamma': 0.0003, '...         0.1252
97
1   {'C': 11, 'epsilon': 0.008, 'gamma': 0.0004, '...         0.1245
72
2   {'C': 11, 'epsilon': 0.009, 'gamma': 0.0003, '...         0.1252
71
3   {'C': 11, 'epsilon': 0.009, 'gamma': 0.0004, '...         0.1246
03
4   {'C': 13, 'epsilon': 0.008, 'gamma': 0.0003, '...         0.1252
03
5   {'C': 13, 'epsilon': 0.008, 'gamma': 0.0004, '...         0.1244
76
6   {'C': 13, 'epsilon': 0.009, 'gamma': 0.0003, '...         0.1251
89
7   {'C': 13, 'epsilon': 0.009, 'gamma': 0.0004, '...         0.1245
55
8   {'C': 15, 'epsilon': 0.008, 'gamma': 0.0003, '...         0.1251
28
9   {'C': 15, 'epsilon': 0.008, 'gamma': 0.0004, '...         0.1243
94
10  {'C': 15, 'epsilon': 0.009, 'gamma': 0.0003, '...         0.1251
04
11  {'C': 15, 'epsilon': 0.009, 'gamma': 0.0004, '...         0.1244
51

    std_test_score
0         0.004451
1         0.004298
2         0.004439
3         0.004311
4         0.004440
5         0.004315
6         0.004435
7         0.004330
8         0.004453
9         0.004325
10        0.004449
11        0.004334
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split0_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split1_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split2_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split3_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split4_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('mean_train_
score'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('std_train_s
core'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
```

In [216]:

```
param_grid = {'C':[11,13,15],'kernel':["rbf"],"gamma":[0.0003,0.0004],"epsilon":
[0.008,0.009]}
random(SVR()).random_get(X_scaled,y_log,param_grid)
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/model_selection/_spli
t.py:2053: FutureWarning: You should specify a value for 'cv' instea
d of relying on the default value. The default value will change fro
m 3 to 5 in version 0.22.
  warnings.warn(CV_WARNING, FutureWarning)

{'kernel': 'rbf', 'gamma': 0.0004, 'epsilon': 0.008, 'C': 15} 0.1244
596963550175
                                                params  mean_test_scor
e  \
0  {'kernel': 'rbf', 'gamma': 0.0003, 'epsilon': ...         0.12541
4
1  {'kernel': 'rbf', 'gamma': 0.0004, 'epsilon': ...         0.12448
0
2  {'kernel': 'rbf', 'gamma': 0.0003, 'epsilon': ...         0.12536
6
3  {'kernel': 'rbf', 'gamma': 0.0003, 'epsilon': ...         0.12534
6
4  {'kernel': 'rbf', 'gamma': 0.0003, 'epsilon': ...         0.12538
0
5  {'kernel': 'rbf', 'gamma': 0.0003, 'epsilon': ...         0.12531
5
6  {'kernel': 'rbf', 'gamma': 0.0004, 'epsilon': ...         0.12470
8
7  {'kernel': 'rbf', 'gamma': 0.0004, 'epsilon': ...         0.12455
6
8  {'kernel': 'rbf', 'gamma': 0.0004, 'epsilon': ...         0.12446
0
9  {'kernel': 'rbf', 'gamma': 0.0004, 'epsilon': ...         0.12469
8

   std_test_score
0        0.003041
1        0.003002
2        0.003049
3        0.003053
4        0.003033
5        0.003051
6        0.003007
7        0.002981
8        0.002996
9        0.002994
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split0_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split1_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split2_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('mean_train_
score'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('std_train_s
core'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
```

In [217]:

```
param_grid={'alpha':[0.1,0.15,0.2,0.25], 'kernel':["polynomial"], 'degree':[3],
'coef0':[0.6,0.7,0.75,0.8,0.9]}
grid(KernelRidge()).grid_get(X_scaled,y_log,param_grid)
```

```
{'alpha': 0.25, 'coef0': 0.9, 'degree': 3, 'kernel': 'polynomial'}
0.13498125343336792
                                                params  mean_test_sco
re  \
0   {'alpha': 0.1, 'coef0': 0.6, 'degree': 3, 'ker...         0.1645
14
1   {'alpha': 0.1, 'coef0': 0.7, 'degree': 3, 'ker...         0.1505
85
2   {'alpha': 0.1, 'coef0': 0.75, 'degree': 3, 'ke...         0.1465
20
3   {'alpha': 0.1, 'coef0': 0.8, 'degree': 3, 'ker...         0.1436
30
4   {'alpha': 0.1, 'coef0': 0.9, 'degree': 3, 'ker...         0.1400
97
5   {'alpha': 0.15, 'coef0': 0.6, 'degree': 3, 'ke...         0.1651
89
6   {'alpha': 0.15, 'coef0': 0.7, 'degree': 3, 'ke...         0.1495
47
7   {'alpha': 0.15, 'coef0': 0.75, 'degree': 3, 'k...         0.1449
39
8   {'alpha': 0.15, 'coef0': 0.8, 'degree': 3, 'ke...         0.1416
44
9   {'alpha': 0.15, 'coef0': 0.9, 'degree': 3, 'ke...         0.1375
76
10  {'alpha': 0.2, 'coef0': 0.6, 'degree': 3, 'ker...         0.1665
89
11  {'alpha': 0.2, 'coef0': 0.7, 'degree': 3, 'ker...         0.1493
69
12  {'alpha': 0.2, 'coef0': 0.75, 'degree': 3, 'ke...         0.1442
56
13  {'alpha': 0.2, 'coef0': 0.8, 'degree': 3, 'ker...         0.1405
79
14  {'alpha': 0.2, 'coef0': 0.9, 'degree': 3, 'ker...         0.1360
00
15  {'alpha': 0.25, 'coef0': 0.6, 'degree': 3, 'ke...         0.1683
76
16  {'alpha': 0.25, 'coef0': 0.7, 'degree': 3, 'ke...         0.1496
79
17  {'alpha': 0.25, 'coef0': 0.75, 'degree': 3, 'k...         0.1440
88
18  {'alpha': 0.25, 'coef0': 0.8, 'degree': 3, 'ke...         0.1400
49
19  {'alpha': 0.25, 'coef0': 0.9, 'degree': 3, 'ke...         0.1349
81

    std_test_score
0         0.005877
1         0.005173
2         0.004967
3         0.004819
4         0.004635
5         0.005621
6         0.004905
7         0.004689
8         0.004533
9         0.004335
10        0.005428
11        0.004715
12        0.004496
13        0.004335
14        0.004128
```

```
15        0.005272
16        0.004570
17        0.004352
18        0.004189
19        0.003977

/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split0_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split1_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split2_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split3_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split4_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('mean_train_
score'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('std_train_s
core'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
```

In [218]:

```
param_grid={'alpha':[0.1,0.15,0.2,0.25], 'kernel':["polynomial"], 'degree':[3],
'coef0':[0.6,0.7,0.75,0.8,0.9]}
random(KernelRidge()).random_get(X_scaled,y_log,param_grid)
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/model_selection/_spli
t.py:2053: FutureWarning: You should specify a value for 'cv' instea
d of relying on the default value. The default value will change fro
m 3 to 5 in version 0.22.
  warnings.warn(CV_WARNING, FutureWarning)
```

```
{'kernel': 'polynomial', 'degree': 3, 'coef0': 0.9, 'alpha': 0.25}
0.13788763231762488
```

	params	mean_test_score	std_test_score
0	{'kernel': 'polynomial', 'degree': 3, 'coef0':...	0.144665	0.005907
1	{'kernel': 'polynomial', 'degree': 3, 'coef0':...	0.155317	0.006844
2	{'kernel': 'polynomial', 'degree': 3, 'coef0':...	0.137888	0.005288
3	{'kernel': 'polynomial', 'degree': 3, 'coef0':...	0.144904	0.005875
4	{'kernel': 'polynomial', 'degree': 3, 'coef0':...	0.177947	0.008736
5	{'kernel': 'polynomial', 'degree': 3, 'coef0':...	0.149951	0.006353
6	{'kernel': 'polynomial', 'degree': 3, 'coef0':...	0.155438	0.006886
7	{'kernel': 'polynomial', 'degree': 3, 'coef0':...	0.144594	0.005893
8	{'kernel': 'polynomial', 'degree': 3, 'coef0':...	0.140959	0.005272
9	{'kernel': 'polynomial', 'degree': 3, 'coef0':...	0.149845	0.006279

```
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split0_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split1_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split2_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('mean_train_
score'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('std_train_s
core'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
```

In [219]:

```
grid(ElasticNet()).grid_get(X_scaled,y_log,{'alpha':[0.004,0.005,0.006,0.0065],
                                            'l1_ratio':[0.065,0.06,0.070,0.075],
'max_iter':[10000]})
```

```
{'alpha': 0.0065, 'l1_ratio': 0.075, 'max_iter': 10000} 0.1262414912
449528
                                                params  mean_test_sco
re  \
0   {'alpha': 0.004, 'l1_ratio': 0.065, 'max_iter'...         0.1268
01
1   {'alpha': 0.004, 'l1_ratio': 0.06, 'max_iter':...         0.1268
52
2   {'alpha': 0.004, 'l1_ratio': 0.07, 'max_iter':...         0.1267
51
3   {'alpha': 0.004, 'l1_ratio': 0.075, 'max_iter'...         0.1267
03
4   {'alpha': 0.005, 'l1_ratio': 0.065, 'max_iter'...         0.1266
03
5   {'alpha': 0.005, 'l1_ratio': 0.06, 'max_iter':...         0.1266
59
6   {'alpha': 0.005, 'l1_ratio': 0.07, 'max_iter':...         0.1265
49
7   {'alpha': 0.005, 'l1_ratio': 0.075, 'max_iter'...         0.1264
97
8   {'alpha': 0.006, 'l1_ratio': 0.065, 'max_iter'...         0.1264
28
9   {'alpha': 0.006, 'l1_ratio': 0.06, 'max_iter':...         0.1264
88
10  {'alpha': 0.006, 'l1_ratio': 0.07, 'max_iter':...         0.1263
71
11  {'alpha': 0.006, 'l1_ratio': 0.075, 'max_iter'...         0.1263
19
12  {'alpha': 0.0065, 'l1_ratio': 0.065, 'max_iter...         0.1263
49
13  {'alpha': 0.0065, 'l1_ratio': 0.06, 'max_iter'...         0.1264
09
14  {'alpha': 0.0065, 'l1_ratio': 0.07, 'max_iter'...         0.1262
93
15  {'alpha': 0.0065, 'l1_ratio': 0.075, 'max_iter...         0.1262
41

    std_test_score
0         0.003329
1         0.003328
2         0.003331
3         0.003332
4         0.003334
5         0.003332
6         0.003335
7         0.003336
8         0.003337
9         0.003336
10        0.003338
11        0.003338
12        0.003338
13        0.003337
14        0.003338
15        0.003339
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split0_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split1_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split2_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split3_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split4_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('mean_train_
score'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('std_train_s
core'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
```

In [220]:

```
random(ElasticNet()).random_get(X_scaled,y_log,{'alpha':[0.004,0.005,0.006,0.006
5],
                                                 'l1_ratio':[0.065,0.06,0.070,0.075],
'max_iter':[10000]})
```

```
{'max_iter': 10000, 'l1_ratio': 0.07, 'alpha': 0.0065} 0.12626750848
365328
                                                params  mean_test_scor
e  \
0  {'max_iter': 10000, 'l1_ratio': 0.06, 'alpha':...         0.12680
2
1  {'max_iter': 10000, 'l1_ratio': 0.07, 'alpha':...         0.12650
4
2  {'max_iter': 10000, 'l1_ratio': 0.065, 'alpha'...         0.12639
3
3  {'max_iter': 10000, 'l1_ratio': 0.06, 'alpha':...         0.12644
8
4  {'max_iter': 10000, 'l1_ratio': 0.06, 'alpha':...         0.12637
6
5  {'max_iter': 10000, 'l1_ratio': 0.065, 'alpha'...         0.12655
9
6  {'max_iter': 10000, 'l1_ratio': 0.07, 'alpha':...         0.12670
4
7  {'max_iter': 10000, 'l1_ratio': 0.07, 'alpha':...         0.12626
8
8  {'max_iter': 10000, 'l1_ratio': 0.07, 'alpha':...         0.12634
1
9  {'max_iter': 10000, 'l1_ratio': 0.075, 'alpha'...         0.12645
6

   std_test_score
0        0.002106
1        0.002119
2        0.002124
3        0.002120
4        0.002124
5        0.002116
6        0.002110
7        0.002131
8        0.002127
9        0.002121
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/model_selection/_spli
t.py:2053: FutureWarning: You should specify a value for 'cv' instea
d of relying on the default value. The default value will change fro
m 3 to 5 in version 0.22.
  warnings.warn(CV_WARNING, FutureWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split0_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split1_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('split2_trai
n_score'), which will not be available by default any more in 0.21.
If you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('mean_train_
score'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
125: FutureWarning: You are accessing a training score ('std_train_s
core'), which will not be available by default any more in 0.21. If
you need training scores, please set return_train_score=True
  warnings.warn(*warn_args, **warn_kwargs)
```

In [221]:

```
class AverageWeight(BaseEstimator, RegressorMixin):
    def __init__(self,model,weight):
        self.model = model
        self.weight = weight

    def fit(self,X,y):
        self.models_ = [clone(x) for x in self.model]
        for model in self.models_:
            model.fit(X,y)
        return self

    def predict(self,X):
        w = list()
        pred = np.array([model.predict(X) for model in self.models_])
        # for every data point, single model prediction times weight, then add t
hem together
        for data in range(pred.shape[1]):
            single = [pred[model,data]*weight for model,weight in zip(range(pred
.shape[0]),self.weight)]
            w.append(np.sum(single))
        return w
```

In [222]:

```
lasso = Lasso(alpha= 0.0005, max_iter= 10000)
ridge = Ridge(alpha=64, max_iter= 10000)
svr = SVR(C = 13, epsilon= 0.009, gamma = 0.0004, kernel = 'rbf')
ker = KernelRidge(alpha=0.25 ,kernel='polynomial',degree=3 , coef0=0.9)
ela = ElasticNet(alpha=0.0065,l1_ratio=0.065,max_iter=10000)
bay = BayesianRidge()
```

In [223]:

```
lasso = Lasso(alpha= 0.0005, max_iter= 10000)
ridge = Ridge(alpha=45, max_iter= 10000)
svr = SVR(C = 0.2, epsilon= 0.025, gamma = 0.0004, kernel = 'rbf')
ker = KernelRidge(alpha=0.15 ,kernel='polynomial',degree=3 , coef0=0.9)
ela = ElasticNet(alpha=0.0065,l1_ratio=0.075,max_iter=10000)
bay = BayesianRidge()
```

In [224]:

```
# Lasso            0.111296607965
# Ridge            0.110201749615
# SVR              0.108231959163
# Kernel Ridge CV 0.108256222016
# Elastic CV       0.111127583451
# BayRidge:        0.110577
#0.107705581748
#0.107767677927
# assign weights based on their gridsearch score
w1 = 0.047
w2 = 0.2
w3 = 0.25
w4 = 0.3
w5 = 0.003
w6 = 0.2

weight_avg = AverageWeight(model = [lasso,ridge,svr,ker,ela,bay],weight=[w1,w2,w
3,w4,w5,w6])
score = rmse_cv(weight_avg,X_scaled,y_log)
print(score.mean())
```

```
0.11900337535219294
```

In [225]:

```
weight_avg = AverageWeight(model = [svr,ker],weight=[0.50,0.50])
score = rmse_cv(weight_avg,X_scaled,y_log)
print(score.mean())
```

```
0.12121529805160784
```

In [226]:

```
evc = VotingClassifier( estimators= [('lasso',lasso),('ridge',ridge),('svr',svr
),
                                     ('ker',ker),('ela',ela),('bay',bay)], votin
g = 'hard')
evc.fit(X_scaled,y_log)
```

Out[226]:

```
VotingClassifier(estimators=[('lasso', Lasso(alpha=0.0005, copy_X=Tr
ue, fit_intercept=True, max_iter=10000,
   normalize=False, positive=False, precompute=False, random_state=N
one,
   selection='cyclic', tol=0.0001, warm_start=False)), ('ridge', Rid
ge(alpha=45, copy_X=True, fit_intercept=True, max_iter=10000,
   nor...rue, lambda_1=1e-06, lambda_2=1e-06, n_iter=300,
       normalize=False, tol=0.001, verbose=False))],
         flatten_transform=None, n_jobs=None, voting='hard', weights
=None)
```

In [227]:

```
class stacking(BaseEstimator, RegressorMixin, TransformerMixin):
    def __init__(self,mod,meta_model):
        self.mod = mod
        self.meta_model = meta_model
        self.kf = KFold(n_splits=5, random_state=42, shuffle=True)

    def fit(self,X,y):
        self.saved_model = [list() for i in self.mod]
        oof_train = np.zeros((X.shape[0], len(self.mod)))

        for i,model in enumerate(self.mod):
            for train_index, val_index in self.kf.split(X,y):
                renew_model = clone(model)
                renew_model.fit(X[train_index], y[train_index])
                self.saved_model[i].append(renew_model)
                oof_train[val_index,i] = renew_model.predict(X[val_index])

        self.meta_model.fit(oof_train,y)
        return self

    def predict(self,X):
        whole_test = np.column_stack([np.column_stack(model.predict(X) for model
in single_model).mean(axis=1)
                                      for single_model in self.saved_model])
        return self.meta_model.predict(whole_test)

    def get_oof(self,X,y,test_X):
        oof = np.zeros((X.shape[0],len(self.mod)))
        test_single = np.zeros((test_X.shape[0],5))
        test_mean = np.zeros((test_X.shape[0],len(self.mod)))
        for i,model in enumerate(self.mod):
            for j, (train_index,val_index) in enumerate(self.kf.split(X,y)):
                clone_model = clone(model)
                clone_model.fit(X[train_index],y[train_index])
                oof[val_index,i] = clone_model.predict(X[val_index])
                test_single[:,j] = clone_model.predict(test_X)
            test_mean[:,i] = test_single.mean(axis=1)
        return oof, test_mean
```

In [228]:

```
X_scaled_imputed = Imputer().fit_transform(X_scaled)
y_log_imputed = Imputer().fit_transform(y_log.values.reshape(-1,1)).ravel()
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
58: DeprecationWarning: Class Imputer is deprecated; Imputer was dep
recated in version 0.20 and will be removed in 0.22. Import impute.S
impleImputer from sklearn instead.
  warnings.warn(msg, category=DeprecationWarning)
/anaconda3/lib/python3.7/site-packages/sklearn/utils/deprecation.py:
58: DeprecationWarning: Class Imputer is deprecated; Imputer was dep
recated in version 0.20 and will be removed in 0.22. Import impute.S
impleImputer from sklearn instead.
  warnings.warn(msg, category=DeprecationWarning)
```

In [229]:

```
X_scaled_imputed.shape,y_log_imputed.shape,test_X_scaled.shape
```

Out[229]:

```
((1458, 84), (1458,), (1459, 83))
```

In [230]:

```
stack_model = stacking(mod=[lasso,ridge,svr,ker,ela,bay],meta_model=ker)
```

In [231]:

```
score = rmse_cv(stack_model,X_scaled_imputed,y_log_imputed)
```

In [232]:

```
print(score.mean())
```

```
0.11991883371044768
```

In [233]:

```
X_train_stack,X_test_stack = stack_model.get_oof(X_scaled_imputed,y_log_imputed,
test_X_scaled)
```

```
---------------------------------------------------------------------
-------
ValueError                                Traceback (most recent cal
l last)
<ipython-input-233-de4390529faf> in <module>
----> 1 X_train_stack,X_test_stack = stack_model.get_oof(X_scaled_im
puted,y_log_imputed,test_X_scaled)

<ipython-input-227-2fdd33de90dc> in get_oof(self, X, y, test_X)
     33                 clone_model.fit(X[train_index],y[train_index
])
     34                 oof[val_index,i] = clone_model.predict(X[val
_index])
---> 35                 test_single[:,j] = clone_model.predict(test_
X)
     36             test_mean[:,i] = test_single.mean(axis=1)
     37         return oof, test_mean

/anaconda3/lib/python3.7/site-packages/sklearn/linear_model/base.py
 in predict(self, X)
    211             Returns predicted values.
    212         """
--> 213         return self._decision_function(X)
    214
    215     _preprocess_data = staticmethod(_preprocess_data)

/anaconda3/lib/python3.7/site-packages/sklearn/linear_model/coordina
te_descent.py in _decision_function(self, X)
    803                                  dense_output=True) + sel
f.intercept_
    804         else:
--> 805             return super(ElasticNet, self)._decision_functio
n(X)
    806
    807

/anaconda3/lib/python3.7/site-packages/sklearn/linear_model/base.py
 in _decision_function(self, X)
    196         X = check_array(X, accept_sparse=['csr', 'csc', 'co
o'])
    197         return safe_sparse_dot(X, self.coef_.T,
--> 198                                dense_output=True) + self.int
ercept_
    199
    200     def predict(self, X):

/anaconda3/lib/python3.7/site-packages/sklearn/utils/extmath.py in s
afe_sparse_dot(a, b, dense_output)
    171         return ret
    172     else:
--> 173         return np.dot(a, b)
    174
    175

ValueError: shapes (1459,83) and (84,) not aligned: 83 (dim 1) != 84
(dim 0)
```

In [234]:

```
X_train_stack.shape,X_test_stack.shape,X_scaled_imputed.shape,y_log_imputed.shap
e
```

```
---------------------------------------------------------------------------
-------
NameError                                 Traceback (most recent cal
l last)
<ipython-input-234-8a9493e35d12> in <module>
----> 1 X_train_stack.shape,X_test_stack.shape,X_scaled_imputed.shap
e,y_log_imputed.shape

NameError: name 'X_train_stack' is not defined
```

In [235]:

```
X_train_add = np.hstack((X_scaled_imputed,X_train_stack))
X_test_add = np.hstack((test_X_scaled,X_test_stack))
X_train_add.shape,X_test_add.shape
```

```
---------------------------------------------------------------------------
-------
NameError                                 Traceback (most recent cal
l last)
<ipython-input-235-7fefb47b0469> in <module>
----> 1 X_train_add = np.hstack((X_scaled_imputed,X_train_stack))
      2 X_test_add = np.hstack((test_X_scaled,X_test_stack))
      3 X_train_add.shape,X_test_add.shape

NameError: name 'X_train_stack' is not defined
```

In [236]:

```
score = rmse_cv(stack_model,X_train_add,y_log_imputed)
print(score.mean())
```

```
---------------------------------------------------------------------------
-------
NameError                                 Traceback (most recent cal
l last)
<ipython-input-236-93c8db269170> in <module>
----> 1 score = rmse_cv(stack_model,X_train_add,y_log_imputed)
      2 print(score.mean())

NameError: name 'X_train_add' is not defined
```

In [237]:

```
stack_model = stacking(mod=[lasso,ridge,svr,ker,ela,bay],meta_model=ker)
stack_model.fit(X_scaled_imputed,y_log_imputed)
```

Out[237]:

```
stacking(meta_model=KernelRidge(alpha=0.15, coef0=0.9, degree=3, gam
ma=None, kernel='polynomial',
      kernel_params=None),
     mod=[Lasso(alpha=0.0005, copy_X=True, fit_intercept=True, max_i
ter=10000,
   normalize=False, positive=False, precompute=False, random_state=N
one,
   selection='cyclic', tol=0.0001, warm_start=False), Ridge(alpha=4
5, copy_X=True, fit_intercept=True, max_iter=10000,
   normalize=False, random_state=N...True, lambda_1=1e-06, lambda_2=
1e-06, n_iter=300,
       normalize=False, tol=0.001, verbose=False)])
```

In [238]:

```
print (stack_model.score(X_scaled_imputed,y_log_imputed))
```

```
0.9442012768202671
```

In [239]:

```
p_pred = np.expm1(stack_model.predict(test_X_scaled))
p_pred
```

```
---------------------------------------------------------------------
-------
ValueError                                Traceback (most recent cal
l last)
<ipython-input-239-2d2db05ea870> in <module>
----> 1 p_pred = np.expm1(stack_model.predict(test_X_scaled))
      2 p_pred

<ipython-input-227-2fdd33de90dc> in predict(self, X)
     21     def predict(self,X):
     22         whole_test = np.column_stack([np.column_stack(model.
predict(X) for model in single_model).mean(axis=1)
---> 23                                       for single_model in se
lf.saved_model])
     24         return self.meta_model.predict(whole_test)
     25

<ipython-input-227-2fdd33de90dc> in <listcomp>(.0)
     21     def predict(self,X):
     22         whole_test = np.column_stack([np.column_stack(model.
predict(X) for model in single_model).mean(axis=1)
---> 23                                       for single_model in se
lf.saved_model])
     24         return self.meta_model.predict(whole_test)
     25

/anaconda3/lib/python3.7/site-packages/numpy/lib/shape_base.py in co
lumn_stack(tup)
    587     """
    588     arrays = []
--> 589     for v in tup:
    590         arr = array(v, copy=False, subok=True)
    591         if arr.ndim < 2:

<ipython-input-227-2fdd33de90dc> in <genexpr>(.0)
     20
     21     def predict(self,X):
---> 22         whole_test = np.column_stack([np.column_stack(model.
predict(X) for model in single_model).mean(axis=1)
     23                                       for single_model in se
lf.saved_model])
     24         return self.meta_model.predict(whole_test)

/anaconda3/lib/python3.7/site-packages/sklearn/linear_model/base.py
 in predict(self, X)
    211             Returns predicted values.
    212         """
--> 213         return self._decision_function(X)
    214
    215     _preprocess_data = staticmethod(_preprocess_data)

/anaconda3/lib/python3.7/site-packages/sklearn/linear_model/coordina
te_descent.py in _decision_function(self, X)
    803                                   dense_output=True) + sel
f.intercept_
    804         else:
--> 805             return super(ElasticNet, self)._decision_functio
n(X)
    806
    807
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/linear_model/base.py
 in _decision_function(self, X)
    196         X = check_array(X, accept_sparse=['csr', 'csc', 'co
o'])
    197         return safe_sparse_dot(X, self.coef_.T,
--> 198                                dense_output=True) + self.int
ercept_
    199
    200     def predict(self, X):

/anaconda3/lib/python3.7/site-packages/sklearn/utils/extmath.py in s
afe_sparse_dot(a, b, dense_output)
    171         return ret
    172     else:
--> 173         return np.dot(a, b)
    174
    175

ValueError: shapes (1459,83) and (84,) not aligned: 83 (dim 1) != 84
(dim 0)
```

In [240]:

```
final_result = pd.DataFrame({'Id':test.Id,'SalePrice':p_pred})
final_result.to_csv("final_result_submission.csv",index= False)
```

```
---------------------------------------------------------------------
-------
NameError                                 Traceback (most recent cal
l last)
<ipython-input-240-4673ae51e8e0> in <module>
----> 1 final_result = pd.DataFrame({'Id':test.Id,'SalePrice':p_pred
})
      2 final_result.to_csv("final_result_submission.csv",index= Fal
se)

NameError: name 'p_pred' is not defined
```

In [ ]:

```

```