car prediction

October 3, 2021

[9]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import scipy.stats as stat
import warnings
warnings.filterwarnings('ignore')
```

[10]:
```
df=pd.read_csv('car data.csv')
```

[11]:
```
df.head()
```

[11]:

	Car_Name	Year	Selling_Price	Present_Price	Kms_Driven	Fuel_Type	Seller_Type	Transmission	Owner
0	ritz	2014	3.35	5.59	27000	Petrol	Dealer	Manual	0
1	sx4	2013	4.75	9.54	43000	Diesel	Dealer	Manual	0
2	ciaz	2017	7.25	9.85	6900	Petrol	Dealer	Manual	0
3	wagon r	2011	2.85	4.15	5200	Petrol	Dealer	Manual	0
4	swift	2014	4.60	6.87	42450	Diesel	Dealer	Manual	0

[12]:
```
df.shape
```

[12]:
```
(301, 9)
```

[6]:
```
print(df['Seller_Type'].unique())
```

```
['Dealer' 'Individual']
```

[7]:
```
print(df['Transmission'].unique())
```

```
['Manual' 'Automatic']
```

[8]:
```
print(df['Owner'].unique())
```

```
[0 1 3]
```

[9]:
```
df.isnull().sum()
```

[9]:
```
Car_Name         0
Year             0
Selling_Price    0
Present_Price    0
Kms_Driven       0
Fuel_Type        0
Seller_Type      0
Transmission     0
Owner            0
dtype: int64
```

[10]:
```
df.describe()
```

[10]:
```
              Year  Selling_Price  Present_Price     Kms_Driven       Owner
count   301.000000     301.000000     301.000000     301.000000  301.000000
mean   2013.627907       4.661296       7.628472   36947.205980    0.043189
std       2.891554       5.082812       8.644115   38886.883882    0.247915
min    2003.000000       0.100000       0.320000     500.000000    0.000000
25%    2012.000000       0.900000       1.200000   15000.000000    0.000000
50%    2014.000000       3.600000       6.400000   32000.000000    0.000000
75%    2016.000000       6.000000       9.900000   48767.000000    0.000000
max    2018.000000      35.000000      92.600000  500000.000000    3.000000
```

[12]:
```
df.columns
```

[12]:
```
Index(['Car_Name', 'Year', 'Selling_Price', 'Present_Price', 'Kms_Driven',
       'Fuel_Type', 'Seller_Type', 'Transmission', 'Owner'],
      dtype='object')
```

[13]:
```
df['current_year']=2021
```

[14]:
```
df.head()
```

[14]:
```
  Car_Name  Year  Selling_Price  Present_Price  Kms_Driven Fuel_Type  \
0     ritz  2014           3.35           5.59       27000    Petrol
1      sx4  2013           4.75           9.54       43000    Diesel
2     ciaz  2017           7.25           9.85        6900    Petrol
3  wagon r  2011           2.85           4.15        5200    Petrol
4    swift  2014           4.60           6.87       42450    Diesel

  Seller_Type Transmission  Owner  current_year
0      Dealer       Manual      0          2021
1      Dealer       Manual      0          2021
2      Dealer       Manual      0          2021
3      Dealer       Manual      0          2021
4      Dealer       Manual      0          2021
```

[15]:
```
df.columns
```

[15]:
```
Index(['Car_Name', 'Year', 'Selling_Price', 'Present_Price', 'Kms_Driven',
       'Fuel_Type', 'Seller_Type', 'Transmission', 'Owner', 'current_year'],
      dtype='object')
```

[16]:
```
no_year=df['current_year']-df['Year']
```

[17]:
```
df['n_years']=no_year
```

[18]:
```
df.head()
```

[18]:

	Car_Name	Year	Selling_Price	Present_Price	Kms_Driven	Fuel_Type	Seller_Type	Transmission	Owner	current_year	n_years
0	ritz	2014	3.35	5.59	27000	Petrol	Dealer	Manual	0	2021	7
1	sx4	2013	4.75	9.54	43000	Diesel	Dealer	Manual	0	2021	8
2	ciaz	2017	7.25	9.85	6900	Petrol	Dealer	Manual	0	2021	4
3	wagon r	2011	2.85	4.15	5200	Petrol	Dealer	Manual	0	2021	10
4	swift	2014	4.60	6.87	42450	Diesel	Dealer	Manual	0	2021	7

[19]:
```
df.drop('current_year',axis=1,inplace=True)
```

[20]:
```
df.head()
```

[20]:

	Car_Name	Year	Selling_Price	Present_Price	Kms_Driven	Fuel_Type	Seller_Type	Transmission	Owner	n_years
0	ritz	2014	3.35	5.59	27000	Petrol	Dealer	Manual	0	7
1	sx4	2013	4.75	9.54	43000	Diesel	Dealer	Manual	0	8
2	ciaz	2017	7.25	9.85	6900	Petrol	Dealer	Manual	0	4
3	wagon r	2011	2.85	4.15	5200	Petrol	Dealer	Manual	0	10
4	swift	2014	4.60	6.87	42450	Diesel	Dealer	Manual	0	7

[30]:
```
df.columns
```

[30]:
```
Index(['Year', 'Selling_Price', 'Present_Price', 'Kms_Driven', 'Fuel_Type',
       'Seller_Type', 'Transmission', 'Owner', 'n_years'],
      dtype='object')
```

[ ]:

[31]:
```
df1=pd.get_dummies(df,columns=['Fuel_Type','Seller_Type','Transmission'])
```

[32]:
```
df1.head()
```

[32]:
```
   Year  Selling_Price  Present_Price  Kms_Driven  Owner  n_years  \
0  2014           3.35           5.59       27000      0        7
1  2013           4.75           9.54       43000      0        8
2  2017           7.25           9.85        6900      0        4
3  2011           2.85           4.15        5200      0       10
4  2014           4.60           6.87       42450      0        7

   Fuel_Type_CNG  Fuel_Type_Diesel  Fuel_Type_Petrol  Seller_Type_Dealer  \
0              0                 0                 1                   1
1              0                 1                 0                   1
2              0                 0                 1                   1
3              0                 0                 1                   1
4              0                 1                 0                   1

   Seller_Type_Individual  Transmission_Automatic  Transmission_Manual
0                       0                       0                    1
1                       0                       0                    1
2                       0                       0                    1
3                       0                       0                    1
4                       0                       0                    1
```

[33]:
```
df1.describe()
```

[33]:
```
              Year  Selling_Price  Present_Price     Kms_Driven       Owner  \
count   301.000000     301.000000     301.000000     301.000000  301.000000
mean   2013.627907       4.661296       7.628472   36947.205980    0.043189
std       2.891554       5.082812       8.644115   38886.883882    0.247915
min    2003.000000       0.100000       0.320000     500.000000    0.000000
25%    2012.000000       0.900000       1.200000   15000.000000    0.000000
50%    2014.000000       3.600000       6.400000   32000.000000    0.000000
75%    2016.000000       6.000000       9.900000   48767.000000    0.000000
max    2018.000000      35.000000      92.600000  500000.000000    3.000000

          n_years  Fuel_Type_CNG  Fuel_Type_Diesel  Fuel_Type_Petrol  \
count  301.000000     301.000000        301.000000        301.000000
mean     7.372093       0.006645          0.199336          0.794020
std      2.891554       0.081378          0.400166          0.405089
min      3.000000       0.000000          0.000000          0.000000
25%      5.000000       0.000000          0.000000          1.000000
50%      7.000000       0.000000          0.000000          1.000000
75%      9.000000       0.000000          0.000000          1.000000
max     18.000000       1.000000          1.000000          1.000000

       Seller_Type_Dealer  Seller_Type_Individual  Transmission_Automatic  \
count          301.000000              301.000000              301.000000
mean             0.647841                0.352159                0.132890
std              0.478439                0.478439                0.340021
min              0.000000                0.000000                0.000000
```

```
25%              0.000000                0.000000                0.000000
50%              1.000000                0.000000                0.000000
75%              1.000000                1.000000                0.000000
max              1.000000                1.000000                1.000000

       Transmission_Manual
count           301.000000
mean              0.867110
std               0.340021
min               0.000000
25%               1.000000
50%               1.000000
75%               1.000000
max               1.000000
```

[34]:
```
df1.corr()
```

[34]:
```
                          Year  Selling_Price  Present_Price  Kms_Driven  \
Year                  1.000000       0.236141      -0.047584   -0.524342
Selling_Price         0.236141       1.000000       0.878983    0.029187
Present_Price        -0.047584       0.878983       1.000000    0.203647
Kms_Driven           -0.524342       0.029187       0.203647    1.000000
Owner                -0.182104      -0.088344       0.008057    0.089216
n_years              -1.000000      -0.236141       0.047584    0.524342
Fuel_Type_CNG        -0.017790      -0.025164      -0.011500    0.012223
Fuel_Type_Diesel      0.064315       0.552339       0.473306    0.172515
Fuel_Type_Petrol     -0.059959      -0.540571      -0.465244   -0.172874
Seller_Type_Dealer    0.039896       0.550724       0.512030    0.101419
Seller_Type_Individual -0.039896     -0.550724      -0.512030   -0.101419
Transmission_Automatic -0.000394      0.367128       0.348715    0.162510
Transmission_Manual    0.000394      -0.367128      -0.348715   -0.162510

                          Owner   n_years  Fuel_Type_CNG  Fuel_Type_Diesel  \
Year                  -0.182104 -1.000000      -0.017790          0.064315
Selling_Price         -0.088344 -0.236141      -0.025164          0.552339
Present_Price          0.008057  0.047584      -0.011500          0.473306
Kms_Driven             0.089216  0.524342       0.012223          0.172515
Owner                  1.000000  0.182104      -0.014272         -0.053469
n_years                0.182104  1.000000       0.017790         -0.064315
Fuel_Type_CNG         -0.014272  0.017790       1.000000         -0.040808
Fuel_Type_Diesel      -0.053469 -0.064315      -0.040808          1.000000
Fuel_Type_Petrol       0.055687  0.059959      -0.160577         -0.979648
Seller_Type_Dealer    -0.124269 -0.039896       0.060300          0.350467
Seller_Type_Individual  0.124269  0.039896      -0.060300         -0.350467
Transmission_Automatic  0.050316  0.000394      -0.032018          0.098643
Transmission_Manual    -0.050316 -0.000394       0.032018         -0.098643

                       Fuel_Type_Petrol  Seller_Type_Dealer  \
```

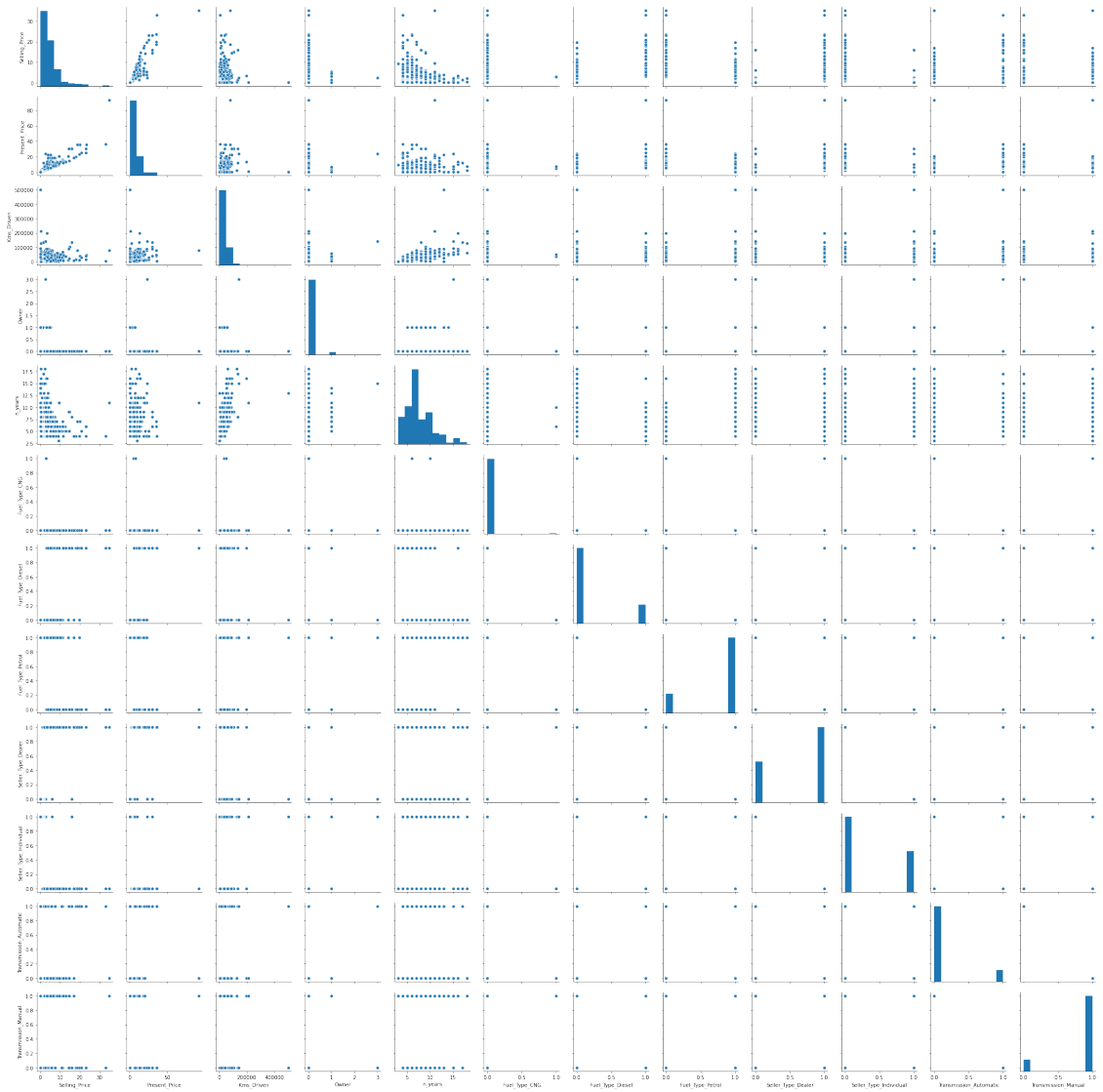
```
Year                          -0.059959            0.039896
Selling_Price                 -0.540571            0.550724
Present_Price                 -0.465244            0.512030
Kms_Driven                    -0.172874            0.101419
Owner                          0.055687           -0.124269
n_years                        0.059959           -0.039896
Fuel_Type_CNG                 -0.160577            0.060300
Fuel_Type_Diesel              -0.979648            0.350467
Fuel_Type_Petrol               1.000000           -0.358321
Seller_Type_Dealer            -0.358321            1.000000
Seller_Type_Individual         0.358321           -1.000000
Transmission_Automatic        -0.091013            0.063240
Transmission_Manual            0.091013           -0.063240

                      Seller_Type_Individual  Transmission_Automatic  \
Year                               -0.039896               -0.000394
Selling_Price                      -0.550724                0.367128
Present_Price                      -0.512030                0.348715
Kms_Driven                         -0.101419                0.162510
Owner                               0.124269                0.050316
n_years                             0.039896                0.000394
Fuel_Type_CNG                      -0.060300               -0.032018
Fuel_Type_Diesel                   -0.350467                0.098643
Fuel_Type_Petrol                    0.358321               -0.091013
Seller_Type_Dealer                 -1.000000                0.063240
Seller_Type_Individual              1.000000               -0.063240
Transmission_Automatic             -0.063240                1.000000
Transmission_Manual                 0.063240               -1.000000

                      Transmission_Manual
Year                             0.000394
Selling_Price                   -0.367128
Present_Price                   -0.348715
Kms_Driven                      -0.162510
Owner                           -0.050316
n_years                         -0.000394
Fuel_Type_CNG                    0.032018
Fuel_Type_Diesel                -0.098643
Fuel_Type_Petrol                 0.091013
Seller_Type_Dealer              -0.063240
Seller_Type_Individual           0.063240
Transmission_Automatic          -1.000000
Transmission_Manual              1.000000
```

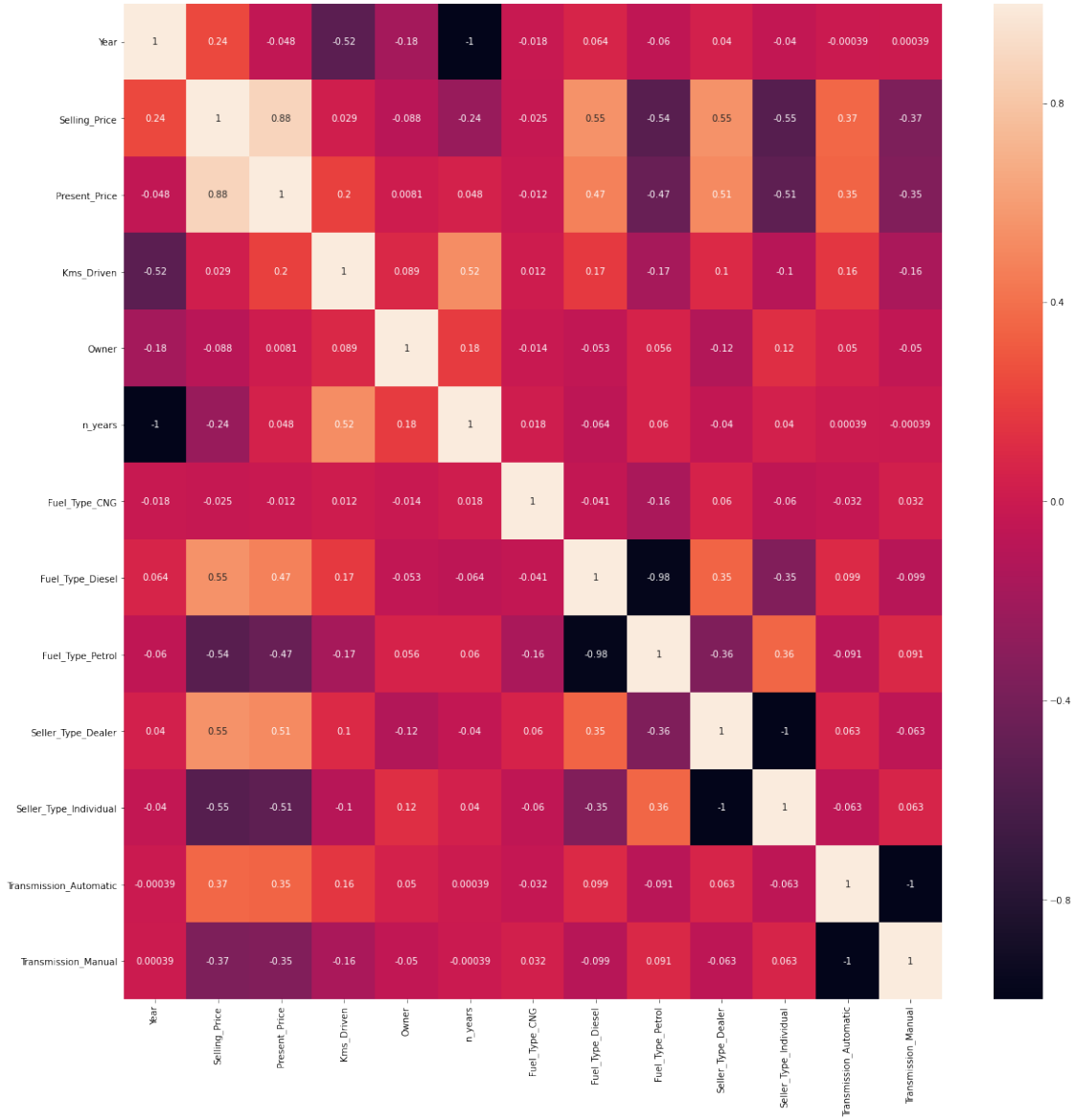
[52]:
```
sns.pairplot(df1)
```

[52]:
```
<seaborn.axisgrid.PairGrid at 0x1d5d620d9b0>
```



[35]:
```
corr=df1.corr()
plt.figure(figsize=(20,20))
sns.heatmap(corr,annot=True)
```

[35]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1d8f1c5b400>
```



[36]:
```
df1.columns
```

[36]:
```
Index(['Year', 'Selling_Price', 'Present_Price', 'Kms_Driven', 'Owner',
       'n_years', 'Fuel_Type_CNG', 'Fuel_Type_Diesel', 'Fuel_Type_Petrol',
       'Seller_Type_Dealer', 'Seller_Type_Individual',
       'Transmission_Automatic', 'Transmission_Manual'],
      dtype='object')
```

[ ]:

[37]:
```
df1.head()
```

[37]:

	Year	Selling_Price	Present_Price	Kms_Driven	Owner	n_years	\
0	2014	3.35	5.59	27000	0	7	

```
1  2013           4.75           9.54       43000      0        8
2  2017           7.25           9.85        6900      0        4
3  2011           2.85           4.15        5200      0       10
4  2014           4.60           6.87       42450      0        7

   Fuel_Type_CNG  Fuel_Type_Diesel  Fuel_Type_Petrol  Seller_Type_Dealer  \
0              0                 0                 1                   1
1              0                 1                 0                   1
2              0                 0                 1                   1
3              0                 0                 1                   1
4              0                 1                 0                   1

   Seller_Type_Individual  Transmission_Automatic  Transmission_Manual
0                       0                       0                    1
1                       0                       0                    1
2                       0                       0                    1
3                       0                       0                    1
4                       0                       0                    1
```

[61]:
```
x=df1.drop('Selling_Price',axis=1)
```

[62]:
```
y=df1['Selling_Price']
```

[ ]:
```

```

[ ]:
```
#when we deal with many number of features at correlation by using the some␣
 ↪conditional formate and apply the threshold value
    threshold=0.8

    def correlation(df,threshold):
        set_col=set() #all columns in dataset
        corr=df.corr() #appling the correlation
        for i in range(len(corr.columns)):
            for j in range(i):
                if abs(corr.iloc[i,j]) > threshold:
                    colname=corr.columns[i]
                    set_col.add(colname)
                    return set_col

                print(correlation)
```

[ ]:
```
#outliers detection
def outliers(df,features)
outliers_indicate=[]
for i in features:
    Q1=np.percentaile(df[i].25)
    Q3=np.percentaile(df[i].75)

    IQR=Q3-Q1
```

```
    outlier_setup=IQR*1.5

    outlier_list_column=df(df[i]<Q1-outlier_step | df(df[i]> + outlier_step).
↪index)

    outlierindecates.extended(outlie_list_column)
    outlier_indicates=counter(outlier_indicates)
    multiple_outlier_list=list(i for i  v in outlier_indicate.items() if v>2)
    return mulitple_outliers
```

[72]:
```
n_estimators=[int(x) for x in  np.linspace(start=100,stop=2000,num=20)]
max_features=['auto','sqrt','log2']
max_depth=[int(x) for x in np.linspace(10,1000,10)]
min_samples_split=[2,5,10,15,100]
min_samples_leaf=[1,2,5,10]
random_grid={
    'n_estimators':n_estimators,
    'max_features':max_features,
    'max_depth':max_depth,
    'min_samples_split':min_samples_split,
    'min_samples_leaf':min_samples_leaf,
    'criterion':['MSE']
}
```

[ ]:
```
random_grid
```

[64]:
```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.3,random_state=0)
```

[65]:
```
from sklearn.ensemble import RandomForestRegressor
```

[66]:
```
rf=RandomForestRegressor()
```

[67]:
```
rf.fit(x_train,y_train)
```

[67]:
```
RandomForestRegressor()
```

[68]:
```
from sklearn.model_selection import RandomizedSearchCV
```

[79]:
```
from sklearn.metrics import mean_squared_error
```

[92]:
```
rcv=RandomizedSearchCV(estimator=rf,param_distributions=random_grid,scoring='neg_mean_squared_
```

[93]:
```
rcv
```

[93]:
```
RandomizedSearchCV(cv=3, estimator=RandomForestRegressor(), n_iter=100,
                   n_jobs=1,
                   param_distributions={'criterion': ['MSE'],
                                        'max_depth': [10, 120, 230, 340, 450,
                                                      560, 670, 780, 890,
                                                      1000],
                                        'max_features': ['auto', 'sqrt',
                                                         'log2'],
```

```
                                        'min_samples_leaf': [1, 2, 5, 10],
                                        'min_samples_split': [2, 5, 10, 15,
                                                              100],
                                        'n_estimators': [100, 200, 300, 400,
                                                         500, 600, 700, 800,
                                                         900, 1000, 1100, 1200,
                                                         1300, 1400, 1500, 1600,
                                                         1700, 1800, 1900,
                                                         2000]},
                           random_state=100, scoring='neg_mean_squared_error',
                           verbose=2)
```

[94]:
```
rcv.fit(x_train,y_train)
```

```
Fitting 3 folds for each of 100 candidates, totalling 300 fits
[CV] n_estimators=100, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=450, criterion=MSE
[CV]  n_estimators=100, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=450, criterion=MSE, total=   0.1s
[CV] n_estimators=100, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=450, criterion=MSE
[CV]  n_estimators=100, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=450, criterion=MSE, total=   0.0s
[CV] n_estimators=100, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=450, criterion=MSE
[CV]  n_estimators=100, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=450, criterion=MSE, total=   0.0s
[CV] n_estimators=1700, min_samples_split=5, min_samples_leaf=2,
max_features=log2, max_depth=560, criterion=MSE

[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.
[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    0.0s remaining:    0.0s

[CV]  n_estimators=1700, min_samples_split=5, min_samples_leaf=2,
max_features=log2, max_depth=560, criterion=MSE, total=   0.7s
[CV] n_estimators=1700, min_samples_split=5, min_samples_leaf=2,
max_features=log2, max_depth=560, criterion=MSE
[CV]  n_estimators=1700, min_samples_split=5, min_samples_leaf=2,
max_features=log2, max_depth=560, criterion=MSE, total=   0.7s
[CV] n_estimators=1700, min_samples_split=5, min_samples_leaf=2,
max_features=log2, max_depth=560, criterion=MSE
[CV]  n_estimators=1700, min_samples_split=5, min_samples_leaf=2,
max_features=log2, max_depth=560, criterion=MSE, total=   0.8s
[CV] n_estimators=2000, min_samples_split=5, min_samples_leaf=1,
max_features=log2, max_depth=670, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=5, min_samples_leaf=1,
max_features=log2, max_depth=670, criterion=MSE, total=   0.9s
[CV] n_estimators=2000, min_samples_split=5, min_samples_leaf=1,
```

```
max_features=log2, max_depth=670, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=5, min_samples_leaf=1,
max_features=log2, max_depth=670, criterion=MSE, total=   0.9s
[CV] n_estimators=2000, min_samples_split=5, min_samples_leaf=1,
max_features=log2, max_depth=670, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=5, min_samples_leaf=1,
max_features=log2, max_depth=670, criterion=MSE, total=   0.7s
[CV] n_estimators=2000, min_samples_split=15, min_samples_leaf=1,
max_features=auto, max_depth=10, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=15, min_samples_leaf=1,
max_features=auto, max_depth=10, criterion=MSE, total=   0.8s
[CV] n_estimators=2000, min_samples_split=15, min_samples_leaf=1,
max_features=auto, max_depth=10, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=15, min_samples_leaf=1,
max_features=auto, max_depth=10, criterion=MSE, total=   0.8s
[CV] n_estimators=2000, min_samples_split=15, min_samples_leaf=1,
max_features=auto, max_depth=10, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=15, min_samples_leaf=1,
max_features=auto, max_depth=10, criterion=MSE, total=   0.8s
[CV] n_estimators=1100, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=10, criterion=MSE
[CV]  n_estimators=1100, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=10, criterion=MSE, total=   0.4s
[CV] n_estimators=1100, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=10, criterion=MSE
[CV]  n_estimators=1100, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=10, criterion=MSE, total=   0.5s
[CV] n_estimators=1100, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=10, criterion=MSE
[CV]  n_estimators=1100, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=10, criterion=MSE, total=   0.4s
[CV] n_estimators=300, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=890, criterion=MSE
[CV]  n_estimators=300, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=890, criterion=MSE, total=   0.1s
[CV] n_estimators=300, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=890, criterion=MSE
[CV]  n_estimators=300, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=890, criterion=MSE, total=   0.1s
[CV] n_estimators=300, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=890, criterion=MSE
[CV]  n_estimators=300, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=890, criterion=MSE, total=   0.1s
[CV] n_estimators=1000, min_samples_split=10, min_samples_leaf=2,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=10, min_samples_leaf=2,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.4s
[CV] n_estimators=1000, min_samples_split=10, min_samples_leaf=2,
```

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max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=10, min_samples_leaf=2,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.4s
[CV] n_estimators=1000, min_samples_split=10, min_samples_leaf=2,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=10, min_samples_leaf=2,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.4s
[CV] n_estimators=700, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=670, criterion=MSE
[CV]  n_estimators=700, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=670, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=670, criterion=MSE
[CV]  n_estimators=700, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=670, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=670, criterion=MSE
[CV]  n_estimators=700, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=670, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=450, criterion=MSE
[CV]  n_estimators=700, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=450, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=450, criterion=MSE
[CV]  n_estimators=700, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=450, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=450, criterion=MSE
[CV]  n_estimators=700, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=450, criterion=MSE, total=   0.3s
[CV] n_estimators=300, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE
[CV]  n_estimators=300, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE, total=   0.1s
[CV] n_estimators=300, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE
[CV]  n_estimators=300, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE, total=   0.1s
[CV] n_estimators=300, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE
[CV]  n_estimators=300, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE, total=   0.2s
[CV] n_estimators=1300, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=1000, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=1000, criterion=MSE, total=   0.5s
[CV] n_estimators=1300, min_samples_split=100, min_samples_leaf=2,
```

```
max_features=auto, max_depth=1000, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=1000, criterion=MSE, total=   0.6s
[CV] n_estimators=1300, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=1000, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=1000, criterion=MSE, total=   0.6s
[CV] n_estimators=1700, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=1700, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.6s
[CV] n_estimators=1700, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=1700, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.7s
[CV] n_estimators=1700, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=1700, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.7s
[CV] n_estimators=1200, min_samples_split=15, min_samples_leaf=5,
max_features=auto, max_depth=890, criterion=MSE
[CV]  n_estimators=1200, min_samples_split=15, min_samples_leaf=5,
max_features=auto, max_depth=890, criterion=MSE, total=   0.5s
[CV] n_estimators=1200, min_samples_split=15, min_samples_leaf=5,
max_features=auto, max_depth=890, criterion=MSE
[CV]  n_estimators=1200, min_samples_split=15, min_samples_leaf=5,
max_features=auto, max_depth=890, criterion=MSE, total=   0.5s
[CV] n_estimators=1200, min_samples_split=15, min_samples_leaf=5,
max_features=auto, max_depth=890, criterion=MSE
[CV]  n_estimators=1200, min_samples_split=15, min_samples_leaf=5,
max_features=auto, max_depth=890, criterion=MSE, total=   0.5s
[CV] n_estimators=1300, min_samples_split=100, min_samples_leaf=5,
max_features=sqrt, max_depth=1000, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=100, min_samples_leaf=5,
max_features=sqrt, max_depth=1000, criterion=MSE, total=   0.5s
[CV] n_estimators=1300, min_samples_split=100, min_samples_leaf=5,
max_features=sqrt, max_depth=1000, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=100, min_samples_leaf=5,
max_features=sqrt, max_depth=1000, criterion=MSE, total=   0.5s
[CV] n_estimators=1300, min_samples_split=100, min_samples_leaf=5,
max_features=sqrt, max_depth=1000, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=100, min_samples_leaf=5,
max_features=sqrt, max_depth=1000, criterion=MSE, total=   0.5s
[CV] n_estimators=1200, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=890, criterion=MSE
[CV]  n_estimators=1200, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=890, criterion=MSE, total=   0.5s
[CV] n_estimators=1200, min_samples_split=100, min_samples_leaf=1,
```

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max_features=sqrt, max_depth=890, criterion=MSE
[CV]  n_estimators=1200, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=890, criterion=MSE, total=   0.5s
[CV] n_estimators=1200, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=890, criterion=MSE
[CV]  n_estimators=1200, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=890, criterion=MSE, total=   0.5s
[CV] n_estimators=100, min_samples_split=10, min_samples_leaf=2,
max_features=auto, max_depth=120, criterion=MSE
[CV]  n_estimators=100, min_samples_split=10, min_samples_leaf=2,
max_features=auto, max_depth=120, criterion=MSE, total=   0.0s
[CV] n_estimators=100, min_samples_split=10, min_samples_leaf=2,
max_features=auto, max_depth=120, criterion=MSE
[CV]  n_estimators=100, min_samples_split=10, min_samples_leaf=2,
max_features=auto, max_depth=120, criterion=MSE, total=   0.1s
[CV] n_estimators=100, min_samples_split=10, min_samples_leaf=2,
max_features=auto, max_depth=120, criterion=MSE
[CV]  n_estimators=100, min_samples_split=10, min_samples_leaf=2,
max_features=auto, max_depth=120, criterion=MSE, total=   0.0s
[CV] n_estimators=1900, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=670, criterion=MSE
[CV]  n_estimators=1900, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=670, criterion=MSE, total=   0.8s
[CV] n_estimators=1900, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=670, criterion=MSE
[CV]  n_estimators=1900, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=670, criterion=MSE, total=   0.7s
[CV] n_estimators=1900, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=670, criterion=MSE
[CV]  n_estimators=1900, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=670, criterion=MSE, total=   0.7s
[CV] n_estimators=1300, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=1000, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=1000, criterion=MSE, total=   0.5s
[CV] n_estimators=1300, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=1000, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=1000, criterion=MSE, total=   0.6s
[CV] n_estimators=1300, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=1000, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=1000, criterion=MSE, total=   0.6s
[CV] n_estimators=400, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=890, criterion=MSE
[CV]  n_estimators=400, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=890, criterion=MSE, total=   0.2s
[CV] n_estimators=400, min_samples_split=5, min_samples_leaf=2,
```

```
max_features=auto, max_depth=890, criterion=MSE
[CV]  n_estimators=400, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=890, criterion=MSE, total=   0.2s
[CV] n_estimators=400, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=890, criterion=MSE
[CV]  n_estimators=400, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=890, criterion=MSE, total=   0.2s
[CV] n_estimators=1000, min_samples_split=15, min_samples_leaf=2,
max_features=log2, max_depth=450, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=15, min_samples_leaf=2,
max_features=log2, max_depth=450, criterion=MSE, total=   0.5s
[CV] n_estimators=1000, min_samples_split=15, min_samples_leaf=2,
max_features=log2, max_depth=450, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=15, min_samples_leaf=2,
max_features=log2, max_depth=450, criterion=MSE, total=   0.4s
[CV] n_estimators=1000, min_samples_split=15, min_samples_leaf=2,
max_features=log2, max_depth=450, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=15, min_samples_leaf=2,
max_features=log2, max_depth=450, criterion=MSE, total=   0.4s
[CV] n_estimators=1100, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=560, criterion=MSE
[CV]  n_estimators=1100, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=560, criterion=MSE, total=   0.4s
[CV] n_estimators=1100, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=560, criterion=MSE
[CV]  n_estimators=1100, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=560, criterion=MSE, total=   0.4s
[CV] n_estimators=1100, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=560, criterion=MSE
[CV]  n_estimators=1100, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=560, criterion=MSE, total=   0.5s
[CV] n_estimators=1500, min_samples_split=5, min_samples_leaf=1,
max_features=auto, max_depth=230, criterion=MSE
[CV]  n_estimators=1500, min_samples_split=5, min_samples_leaf=1,
max_features=auto, max_depth=230, criterion=MSE, total=   0.6s
[CV] n_estimators=1500, min_samples_split=5, min_samples_leaf=1,
max_features=auto, max_depth=230, criterion=MSE
[CV]  n_estimators=1500, min_samples_split=5, min_samples_leaf=1,
max_features=auto, max_depth=230, criterion=MSE, total=   0.6s
[CV] n_estimators=1500, min_samples_split=5, min_samples_leaf=1,
max_features=auto, max_depth=230, criterion=MSE
[CV]  n_estimators=1500, min_samples_split=5, min_samples_leaf=1,
max_features=auto, max_depth=230, criterion=MSE, total=   0.6s
[CV] n_estimators=800, min_samples_split=100, min_samples_leaf=2,
max_features=log2, max_depth=450, criterion=MSE
[CV]  n_estimators=800, min_samples_split=100, min_samples_leaf=2,
max_features=log2, max_depth=450, criterion=MSE, total=   0.3s
[CV] n_estimators=800, min_samples_split=100, min_samples_leaf=2,
```

```
max_features=log2, max_depth=450, criterion=MSE
[CV]  n_estimators=800, min_samples_split=100, min_samples_leaf=2,
max_features=log2, max_depth=450, criterion=MSE, total=   0.3s
[CV] n_estimators=800, min_samples_split=100, min_samples_leaf=2,
max_features=log2, max_depth=450, criterion=MSE
[CV]  n_estimators=800, min_samples_split=100, min_samples_leaf=2,
max_features=log2, max_depth=450, criterion=MSE, total=   0.4s
[CV] n_estimators=100, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=120, criterion=MSE
[CV]  n_estimators=100, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=120, criterion=MSE, total=   0.0s
[CV] n_estimators=100, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=120, criterion=MSE
[CV]  n_estimators=100, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=120, criterion=MSE, total=   0.0s
[CV] n_estimators=100, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=120, criterion=MSE
[CV]  n_estimators=100, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=120, criterion=MSE, total=   0.0s
[CV] n_estimators=1600, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=890, criterion=MSE
[CV]  n_estimators=1600, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=890, criterion=MSE, total=   0.7s
[CV] n_estimators=1600, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=890, criterion=MSE
[CV]  n_estimators=1600, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=890, criterion=MSE, total=   0.6s
[CV] n_estimators=1600, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=890, criterion=MSE
[CV]  n_estimators=1600, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=890, criterion=MSE, total=   0.7s
[CV] n_estimators=1400, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=450, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=450, criterion=MSE, total=   0.6s
[CV] n_estimators=1400, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=450, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=450, criterion=MSE, total=   0.6s
[CV] n_estimators=1400, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=450, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=450, criterion=MSE, total=   0.6s
[CV] n_estimators=1400, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=230, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=230, criterion=MSE, total=   0.5s
[CV] n_estimators=1400, min_samples_split=2, min_samples_leaf=1,
```

```
max_features=log2, max_depth=230, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=230, criterion=MSE, total=   0.5s
[CV] n_estimators=1400, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=230, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=230, criterion=MSE, total=   0.6s
[CV] n_estimators=200, min_samples_split=2, min_samples_leaf=2,
max_features=log2, max_depth=560, criterion=MSE
[CV]  n_estimators=200, min_samples_split=2, min_samples_leaf=2,
max_features=log2, max_depth=560, criterion=MSE, total=   0.1s
[CV] n_estimators=200, min_samples_split=2, min_samples_leaf=2,
max_features=log2, max_depth=560, criterion=MSE
[CV]  n_estimators=200, min_samples_split=2, min_samples_leaf=2,
max_features=log2, max_depth=560, criterion=MSE, total=   0.1s
[CV] n_estimators=200, min_samples_split=2, min_samples_leaf=2,
max_features=log2, max_depth=560, criterion=MSE
[CV]  n_estimators=200, min_samples_split=2, min_samples_leaf=2,
max_features=log2, max_depth=560, criterion=MSE, total=   0.1s
[CV] n_estimators=400, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=450, criterion=MSE
[CV]  n_estimators=400, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=450, criterion=MSE, total=   0.1s
[CV] n_estimators=400, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=450, criterion=MSE
[CV]  n_estimators=400, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=450, criterion=MSE, total=   0.2s
[CV] n_estimators=400, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=450, criterion=MSE
[CV]  n_estimators=400, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=450, criterion=MSE, total=   0.2s
[CV] n_estimators=100, min_samples_split=5, min_samples_leaf=1,
max_features=log2, max_depth=780, criterion=MSE
[CV]  n_estimators=100, min_samples_split=5, min_samples_leaf=1,
max_features=log2, max_depth=780, criterion=MSE, total=   0.0s
[CV] n_estimators=100, min_samples_split=5, min_samples_leaf=1,
max_features=log2, max_depth=780, criterion=MSE
[CV]  n_estimators=100, min_samples_split=5, min_samples_leaf=1,
max_features=log2, max_depth=780, criterion=MSE, total=   0.0s
[CV] n_estimators=100, min_samples_split=5, min_samples_leaf=1,
max_features=log2, max_depth=780, criterion=MSE
[CV]  n_estimators=100, min_samples_split=5, min_samples_leaf=1,
max_features=log2, max_depth=780, criterion=MSE, total=   0.0s
[CV] n_estimators=400, min_samples_split=10, min_samples_leaf=1,
max_features=auto, max_depth=1000, criterion=MSE
[CV]  n_estimators=400, min_samples_split=10, min_samples_leaf=1,
max_features=auto, max_depth=1000, criterion=MSE, total=   0.2s
[CV] n_estimators=400, min_samples_split=10, min_samples_leaf=1,
```

```
max_features=auto, max_depth=1000, criterion=MSE
[CV]  n_estimators=400, min_samples_split=10, min_samples_leaf=1,
max_features=auto, max_depth=1000, criterion=MSE, total=   0.2s
[CV] n_estimators=400, min_samples_split=10, min_samples_leaf=1,
max_features=auto, max_depth=1000, criterion=MSE
[CV]  n_estimators=400, min_samples_split=10, min_samples_leaf=1,
max_features=auto, max_depth=1000, criterion=MSE, total=   0.1s
[CV] n_estimators=400, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=230, criterion=MSE
[CV]  n_estimators=400, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=230, criterion=MSE, total=   0.2s
[CV] n_estimators=400, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=230, criterion=MSE
[CV]  n_estimators=400, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=230, criterion=MSE, total=   0.2s
[CV] n_estimators=400, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=230, criterion=MSE
[CV]  n_estimators=400, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=230, criterion=MSE, total=   0.2s
[CV] n_estimators=1200, min_samples_split=5, min_samples_leaf=5,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=1200, min_samples_split=5, min_samples_leaf=5,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.5s
[CV] n_estimators=1200, min_samples_split=5, min_samples_leaf=5,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=1200, min_samples_split=5, min_samples_leaf=5,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.5s
[CV] n_estimators=1200, min_samples_split=5, min_samples_leaf=5,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=1200, min_samples_split=5, min_samples_leaf=5,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.4s
[CV] n_estimators=1600, min_samples_split=100, min_samples_leaf=1,
max_features=log2, max_depth=1000, criterion=MSE
[CV]  n_estimators=1600, min_samples_split=100, min_samples_leaf=1,
max_features=log2, max_depth=1000, criterion=MSE, total=   0.6s
[CV] n_estimators=1600, min_samples_split=100, min_samples_leaf=1,
max_features=log2, max_depth=1000, criterion=MSE
[CV]  n_estimators=1600, min_samples_split=100, min_samples_leaf=1,
max_features=log2, max_depth=1000, criterion=MSE, total=   0.6s
[CV] n_estimators=1600, min_samples_split=100, min_samples_leaf=1,
max_features=log2, max_depth=1000, criterion=MSE
[CV]  n_estimators=1600, min_samples_split=100, min_samples_leaf=1,
max_features=log2, max_depth=1000, criterion=MSE, total=   0.6s
[CV] n_estimators=1000, min_samples_split=15, min_samples_leaf=10,
max_features=log2, max_depth=1000, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=15, min_samples_leaf=10,
max_features=log2, max_depth=1000, criterion=MSE, total=   0.4s
[CV] n_estimators=1000, min_samples_split=15, min_samples_leaf=10,
```

```
max_features=log2, max_depth=1000, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=15, min_samples_leaf=10,
max_features=log2, max_depth=1000, criterion=MSE, total=   0.4s
[CV] n_estimators=1000, min_samples_split=15, min_samples_leaf=10,
max_features=log2, max_depth=1000, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=15, min_samples_leaf=10,
max_features=log2, max_depth=1000, criterion=MSE, total=   0.4s
[CV] n_estimators=1800, min_samples_split=10, min_samples_leaf=2,
max_features=log2, max_depth=890, criterion=MSE
[CV]  n_estimators=1800, min_samples_split=10, min_samples_leaf=2,
max_features=log2, max_depth=890, criterion=MSE, total=   0.7s
[CV] n_estimators=1800, min_samples_split=10, min_samples_leaf=2,
max_features=log2, max_depth=890, criterion=MSE
[CV]  n_estimators=1800, min_samples_split=10, min_samples_leaf=2,
max_features=log2, max_depth=890, criterion=MSE, total=   0.7s
[CV] n_estimators=1800, min_samples_split=10, min_samples_leaf=2,
max_features=log2, max_depth=890, criterion=MSE
[CV]  n_estimators=1800, min_samples_split=10, min_samples_leaf=2,
max_features=log2, max_depth=890, criterion=MSE, total=   0.7s
[CV] n_estimators=800, min_samples_split=15, min_samples_leaf=2,
max_features=auto, max_depth=340, criterion=MSE
[CV]  n_estimators=800, min_samples_split=15, min_samples_leaf=2,
max_features=auto, max_depth=340, criterion=MSE, total=   0.3s
[CV] n_estimators=800, min_samples_split=15, min_samples_leaf=2,
max_features=auto, max_depth=340, criterion=MSE
[CV]  n_estimators=800, min_samples_split=15, min_samples_leaf=2,
max_features=auto, max_depth=340, criterion=MSE, total=   0.3s
[CV] n_estimators=800, min_samples_split=15, min_samples_leaf=2,
max_features=auto, max_depth=340, criterion=MSE
[CV]  n_estimators=800, min_samples_split=15, min_samples_leaf=2,
max_features=auto, max_depth=340, criterion=MSE, total=   0.3s
[CV] n_estimators=800, min_samples_split=2, min_samples_leaf=1,
max_features=sqrt, max_depth=1000, criterion=MSE
[CV]  n_estimators=800, min_samples_split=2, min_samples_leaf=1,
max_features=sqrt, max_depth=1000, criterion=MSE, total=   0.3s
[CV] n_estimators=800, min_samples_split=2, min_samples_leaf=1,
max_features=sqrt, max_depth=1000, criterion=MSE
[CV]  n_estimators=800, min_samples_split=2, min_samples_leaf=1,
max_features=sqrt, max_depth=1000, criterion=MSE, total=   0.3s
[CV] n_estimators=800, min_samples_split=2, min_samples_leaf=1,
max_features=sqrt, max_depth=1000, criterion=MSE
[CV]  n_estimators=800, min_samples_split=2, min_samples_leaf=1,
max_features=sqrt, max_depth=1000, criterion=MSE, total=   0.3s
[CV] n_estimators=2000, min_samples_split=10, min_samples_leaf=1,
max_features=auto, max_depth=450, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=10, min_samples_leaf=1,
max_features=auto, max_depth=450, criterion=MSE, total=   0.8s
[CV] n_estimators=2000, min_samples_split=10, min_samples_leaf=1,
```

```
max_features=auto, max_depth=450, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=10, min_samples_leaf=1,
max_features=auto, max_depth=450, criterion=MSE, total=   0.8s
[CV] n_estimators=2000, min_samples_split=10, min_samples_leaf=1,
max_features=auto, max_depth=450, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=10, min_samples_leaf=1,
max_features=auto, max_depth=450, criterion=MSE, total=   0.7s
[CV] n_estimators=900, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=230, criterion=MSE
[CV]  n_estimators=900, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=230, criterion=MSE, total=   0.4s
[CV] n_estimators=900, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=230, criterion=MSE
[CV]  n_estimators=900, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=230, criterion=MSE, total=   0.3s
[CV] n_estimators=900, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=230, criterion=MSE
[CV]  n_estimators=900, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=230, criterion=MSE, total=   0.3s
[CV] n_estimators=300, min_samples_split=2, min_samples_leaf=1,
max_features=auto, max_depth=10, criterion=MSE
[CV]  n_estimators=300, min_samples_split=2, min_samples_leaf=1,
max_features=auto, max_depth=10, criterion=MSE, total=   0.1s
[CV] n_estimators=300, min_samples_split=2, min_samples_leaf=1,
max_features=auto, max_depth=10, criterion=MSE
[CV]  n_estimators=300, min_samples_split=2, min_samples_leaf=1,
max_features=auto, max_depth=10, criterion=MSE, total=   0.1s
[CV] n_estimators=300, min_samples_split=2, min_samples_leaf=1,
max_features=auto, max_depth=10, criterion=MSE
[CV]  n_estimators=300, min_samples_split=2, min_samples_leaf=1,
max_features=auto, max_depth=10, criterion=MSE, total=   0.1s
[CV] n_estimators=1000, min_samples_split=100, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=100, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE, total=   0.4s
[CV] n_estimators=1000, min_samples_split=100, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=100, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE, total=   0.4s
[CV] n_estimators=1000, min_samples_split=100, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=100, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE, total=   0.4s
[CV] n_estimators=1400, min_samples_split=2, min_samples_leaf=10,
max_features=log2, max_depth=340, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=2, min_samples_leaf=10,
max_features=log2, max_depth=340, criterion=MSE, total=   0.5s
[CV] n_estimators=1400, min_samples_split=2, min_samples_leaf=10,
```

```
max_features=log2, max_depth=340, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=2, min_samples_leaf=10,
max_features=log2, max_depth=340, criterion=MSE, total=   0.5s
[CV] n_estimators=1400, min_samples_split=2, min_samples_leaf=10,
max_features=log2, max_depth=340, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=2, min_samples_leaf=10,
max_features=log2, max_depth=340, criterion=MSE, total=   0.5s
[CV] n_estimators=700, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=230, criterion=MSE
[CV]  n_estimators=700, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=230, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=230, criterion=MSE
[CV]  n_estimators=700, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=230, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=230, criterion=MSE
[CV]  n_estimators=700, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=230, criterion=MSE, total=   0.3s
[CV] n_estimators=2000, min_samples_split=2, min_samples_leaf=1,
max_features=auto, max_depth=890, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=2, min_samples_leaf=1,
max_features=auto, max_depth=890, criterion=MSE, total=   0.8s
[CV] n_estimators=2000, min_samples_split=2, min_samples_leaf=1,
max_features=auto, max_depth=890, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=2, min_samples_leaf=1,
max_features=auto, max_depth=890, criterion=MSE, total=   0.8s
[CV] n_estimators=2000, min_samples_split=2, min_samples_leaf=1,
max_features=auto, max_depth=890, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=2, min_samples_leaf=1,
max_features=auto, max_depth=890, criterion=MSE, total=   0.8s
[CV] n_estimators=400, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=890, criterion=MSE
[CV]  n_estimators=400, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=890, criterion=MSE, total=   0.2s
[CV] n_estimators=400, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=890, criterion=MSE
[CV]  n_estimators=400, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=890, criterion=MSE, total=   0.2s
[CV] n_estimators=400, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=890, criterion=MSE
[CV]  n_estimators=400, min_samples_split=2, min_samples_leaf=10,
max_features=sqrt, max_depth=890, criterion=MSE, total=   0.2s
[CV] n_estimators=1400, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=230, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=230, criterion=MSE, total=   0.5s
[CV] n_estimators=1400, min_samples_split=10, min_samples_leaf=1,
```

```
max_features=log2, max_depth=230, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=230, criterion=MSE, total=   0.5s
[CV] n_estimators=1400, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=230, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=10, min_samples_leaf=1,
max_features=log2, max_depth=230, criterion=MSE, total=   0.5s
[CV] n_estimators=700, min_samples_split=2, min_samples_leaf=5,
max_features=auto, max_depth=670, criterion=MSE
[CV]  n_estimators=700, min_samples_split=2, min_samples_leaf=5,
max_features=auto, max_depth=670, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=2, min_samples_leaf=5,
max_features=auto, max_depth=670, criterion=MSE
[CV]  n_estimators=700, min_samples_split=2, min_samples_leaf=5,
max_features=auto, max_depth=670, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=2, min_samples_leaf=5,
max_features=auto, max_depth=670, criterion=MSE
[CV]  n_estimators=700, min_samples_split=2, min_samples_leaf=5,
max_features=auto, max_depth=670, criterion=MSE, total=   0.3s
[CV] n_estimators=1900, min_samples_split=100, min_samples_leaf=10,
max_features=auto, max_depth=340, criterion=MSE
[CV]  n_estimators=1900, min_samples_split=100, min_samples_leaf=10,
max_features=auto, max_depth=340, criterion=MSE, total=   0.7s
[CV] n_estimators=1900, min_samples_split=100, min_samples_leaf=10,
max_features=auto, max_depth=340, criterion=MSE
[CV]  n_estimators=1900, min_samples_split=100, min_samples_leaf=10,
max_features=auto, max_depth=340, criterion=MSE, total=   0.8s
[CV] n_estimators=1900, min_samples_split=100, min_samples_leaf=10,
max_features=auto, max_depth=340, criterion=MSE
[CV]  n_estimators=1900, min_samples_split=100, min_samples_leaf=10,
max_features=auto, max_depth=340, criterion=MSE, total=   0.7s
[CV] n_estimators=1300, min_samples_split=100, min_samples_leaf=2,
max_features=sqrt, max_depth=230, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=100, min_samples_leaf=2,
max_features=sqrt, max_depth=230, criterion=MSE, total=   0.5s
[CV] n_estimators=1300, min_samples_split=100, min_samples_leaf=2,
max_features=sqrt, max_depth=230, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=100, min_samples_leaf=2,
max_features=sqrt, max_depth=230, criterion=MSE, total=   0.5s
[CV] n_estimators=1300, min_samples_split=100, min_samples_leaf=2,
max_features=sqrt, max_depth=230, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=100, min_samples_leaf=2,
max_features=sqrt, max_depth=230, criterion=MSE, total=   0.5s
[CV] n_estimators=800, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=1000, criterion=MSE
[CV]  n_estimators=800, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=1000, criterion=MSE, total=   0.3s
[CV] n_estimators=800, min_samples_split=15, min_samples_leaf=10,
```

```
max_features=sqrt, max_depth=1000, criterion=MSE
[CV]  n_estimators=800, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=1000, criterion=MSE, total=   0.3s
[CV] n_estimators=800, min_samples_split=15, min_samples_leaf=10,
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[CV]  n_estimators=800, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=1000, criterion=MSE, total=   0.4s
[CV] n_estimators=1000, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=340, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=340, criterion=MSE, total=   0.4s
[CV] n_estimators=1000, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=340, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=340, criterion=MSE, total=   0.4s
[CV] n_estimators=1000, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=340, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=10, min_samples_leaf=10,
max_features=auto, max_depth=340, criterion=MSE, total=   0.4s
[CV] n_estimators=700, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE
[CV]  n_estimators=700, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE
[CV]  n_estimators=700, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE
[CV]  n_estimators=700, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=10, criterion=MSE, total=   0.3s
[CV] n_estimators=1300, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=890, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=890, criterion=MSE, total=   0.5s
[CV] n_estimators=1300, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=890, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=890, criterion=MSE, total=   0.5s
[CV] n_estimators=1300, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=890, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=2, min_samples_leaf=1,
max_features=log2, max_depth=890, criterion=MSE, total=   0.5s
[CV] n_estimators=700, min_samples_split=15, min_samples_leaf=1,
max_features=auto, max_depth=780, criterion=MSE
[CV]  n_estimators=700, min_samples_split=15, min_samples_leaf=1,
max_features=auto, max_depth=780, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=15, min_samples_leaf=1,
```

```
max_features=auto, max_depth=780, criterion=MSE
[CV]  n_estimators=700, min_samples_split=15, min_samples_leaf=1,
max_features=auto, max_depth=780, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=15, min_samples_leaf=1,
max_features=auto, max_depth=780, criterion=MSE
[CV]  n_estimators=700, min_samples_split=15, min_samples_leaf=1,
max_features=auto, max_depth=780, criterion=MSE, total=   0.3s
[CV] n_estimators=100, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=120, criterion=MSE
[CV]  n_estimators=100, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=120, criterion=MSE, total=   0.0s
[CV] n_estimators=100, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=120, criterion=MSE
[CV]  n_estimators=100, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=120, criterion=MSE, total=   0.1s
[CV] n_estimators=100, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=120, criterion=MSE
[CV]  n_estimators=100, min_samples_split=10, min_samples_leaf=5,
max_features=log2, max_depth=120, criterion=MSE, total=   0.0s
[CV] n_estimators=1700, min_samples_split=100, min_samples_leaf=5,
max_features=log2, max_depth=560, criterion=MSE
[CV]  n_estimators=1700, min_samples_split=100, min_samples_leaf=5,
max_features=log2, max_depth=560, criterion=MSE, total=   0.7s
[CV] n_estimators=1700, min_samples_split=100, min_samples_leaf=5,
max_features=log2, max_depth=560, criterion=MSE
[CV]  n_estimators=1700, min_samples_split=100, min_samples_leaf=5,
max_features=log2, max_depth=560, criterion=MSE, total=   0.8s
[CV] n_estimators=1700, min_samples_split=100, min_samples_leaf=5,
max_features=log2, max_depth=560, criterion=MSE
[CV]  n_estimators=1700, min_samples_split=100, min_samples_leaf=5,
max_features=log2, max_depth=560, criterion=MSE, total=   0.7s
[CV] n_estimators=1500, min_samples_split=15, min_samples_leaf=5,
max_features=log2, max_depth=560, criterion=MSE
[CV]  n_estimators=1500, min_samples_split=15, min_samples_leaf=5,
max_features=log2, max_depth=560, criterion=MSE, total=   0.6s
[CV] n_estimators=1500, min_samples_split=15, min_samples_leaf=5,
max_features=log2, max_depth=560, criterion=MSE
[CV]  n_estimators=1500, min_samples_split=15, min_samples_leaf=5,
max_features=log2, max_depth=560, criterion=MSE, total=   0.6s
[CV] n_estimators=1500, min_samples_split=15, min_samples_leaf=5,
max_features=log2, max_depth=560, criterion=MSE
[CV]  n_estimators=1500, min_samples_split=15, min_samples_leaf=5,
max_features=log2, max_depth=560, criterion=MSE, total=   0.6s
[CV] n_estimators=1400, min_samples_split=5, min_samples_leaf=2,
max_features=log2, max_depth=340, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=5, min_samples_leaf=2,
max_features=log2, max_depth=340, criterion=MSE, total=   0.6s
[CV] n_estimators=1400, min_samples_split=5, min_samples_leaf=2,
```

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max_features=log2, max_depth=340, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=5, min_samples_leaf=2,
max_features=log2, max_depth=340, criterion=MSE, total=   0.6s
[CV] n_estimators=1400, min_samples_split=5, min_samples_leaf=2,
max_features=log2, max_depth=340, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=5, min_samples_leaf=2,
max_features=log2, max_depth=340, criterion=MSE, total=   0.7s
[CV] n_estimators=1900, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=120, criterion=MSE
[CV]  n_estimators=1900, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=120, criterion=MSE, total=   0.8s
[CV] n_estimators=1900, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=120, criterion=MSE
[CV]  n_estimators=1900, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=120, criterion=MSE, total=   0.8s
[CV] n_estimators=1900, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=120, criterion=MSE
[CV]  n_estimators=1900, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=120, criterion=MSE, total=   1.0s
[CV] n_estimators=1000, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.5s
[CV] n_estimators=1000, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.5s
[CV] n_estimators=1000, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.6s
[CV] n_estimators=200, min_samples_split=10, min_samples_leaf=2,
max_features=auto, max_depth=890, criterion=MSE
[CV]  n_estimators=200, min_samples_split=10, min_samples_leaf=2,
max_features=auto, max_depth=890, criterion=MSE, total=   0.1s
[CV] n_estimators=200, min_samples_split=10, min_samples_leaf=2,
max_features=auto, max_depth=890, criterion=MSE
[CV]  n_estimators=200, min_samples_split=10, min_samples_leaf=2,
max_features=auto, max_depth=890, criterion=MSE, total=   0.1s
[CV] n_estimators=200, min_samples_split=10, min_samples_leaf=2,
max_features=auto, max_depth=890, criterion=MSE
[CV]  n_estimators=200, min_samples_split=10, min_samples_leaf=2,
max_features=auto, max_depth=890, criterion=MSE, total=   0.1s
[CV] n_estimators=1100, min_samples_split=2, min_samples_leaf=1,
max_features=sqrt, max_depth=780, criterion=MSE
[CV]  n_estimators=1100, min_samples_split=2, min_samples_leaf=1,
max_features=sqrt, max_depth=780, criterion=MSE, total=   0.6s
[CV] n_estimators=1100, min_samples_split=2, min_samples_leaf=1,
```

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max_features=sqrt, max_depth=780, criterion=MSE
[CV]  n_estimators=1100, min_samples_split=2, min_samples_leaf=1,
max_features=sqrt, max_depth=780, criterion=MSE, total=   0.5s
[CV] n_estimators=1100, min_samples_split=2, min_samples_leaf=1,
max_features=sqrt, max_depth=780, criterion=MSE
[CV]  n_estimators=1100, min_samples_split=2, min_samples_leaf=1,
max_features=sqrt, max_depth=780, criterion=MSE, total=   0.5s
[CV] n_estimators=1000, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=670, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=670, criterion=MSE, total=   0.5s
[CV] n_estimators=1000, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=670, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=670, criterion=MSE, total=   0.5s
[CV] n_estimators=1000, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=670, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=670, criterion=MSE, total=   0.5s
[CV] n_estimators=200, min_samples_split=5, min_samples_leaf=1,
max_features=auto, max_depth=670, criterion=MSE
[CV]  n_estimators=200, min_samples_split=5, min_samples_leaf=1,
max_features=auto, max_depth=670, criterion=MSE, total=   0.1s
[CV] n_estimators=200, min_samples_split=5, min_samples_leaf=1,
max_features=auto, max_depth=670, criterion=MSE
[CV]  n_estimators=200, min_samples_split=5, min_samples_leaf=1,
max_features=auto, max_depth=670, criterion=MSE, total=   0.1s
[CV] n_estimators=200, min_samples_split=5, min_samples_leaf=1,
max_features=auto, max_depth=670, criterion=MSE
[CV]  n_estimators=200, min_samples_split=5, min_samples_leaf=1,
max_features=auto, max_depth=670, criterion=MSE, total=   0.1s
[CV] n_estimators=1300, min_samples_split=2, min_samples_leaf=5,
max_features=auto, max_depth=560, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=2, min_samples_leaf=5,
max_features=auto, max_depth=560, criterion=MSE, total=   0.6s
[CV] n_estimators=1300, min_samples_split=2, min_samples_leaf=5,
max_features=auto, max_depth=560, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=2, min_samples_leaf=5,
max_features=auto, max_depth=560, criterion=MSE, total=   0.6s
[CV] n_estimators=1300, min_samples_split=2, min_samples_leaf=5,
max_features=auto, max_depth=560, criterion=MSE
[CV]  n_estimators=1300, min_samples_split=2, min_samples_leaf=5,
max_features=auto, max_depth=560, criterion=MSE, total=   0.6s
[CV] n_estimators=900, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=10, criterion=MSE
[CV]  n_estimators=900, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=10, criterion=MSE, total=   0.4s
[CV] n_estimators=900, min_samples_split=100, min_samples_leaf=1,
```

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max_features=sqrt, max_depth=10, criterion=MSE
[CV]  n_estimators=900, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=10, criterion=MSE, total=   0.4s
[CV] n_estimators=900, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=10, criterion=MSE
[CV]  n_estimators=900, min_samples_split=100, min_samples_leaf=1,
max_features=sqrt, max_depth=10, criterion=MSE, total=   0.4s
[CV] n_estimators=2000, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=230, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=230, criterion=MSE, total=   0.9s
[CV] n_estimators=2000, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=230, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=230, criterion=MSE, total=   0.9s
[CV] n_estimators=2000, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=230, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=230, criterion=MSE, total=   0.9s
[CV] n_estimators=1400, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=1000, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=1000, criterion=MSE, total=   0.7s
[CV] n_estimators=1400, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=1000, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=1000, criterion=MSE, total=   0.6s
[CV] n_estimators=1400, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=1000, criterion=MSE
[CV]  n_estimators=1400, min_samples_split=5, min_samples_leaf=2,
max_features=auto, max_depth=1000, criterion=MSE, total=   0.6s
[CV] n_estimators=1000, min_samples_split=2, min_samples_leaf=2,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=2, min_samples_leaf=2,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.5s
[CV] n_estimators=1000, min_samples_split=2, min_samples_leaf=2,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=2, min_samples_leaf=2,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.5s
[CV] n_estimators=1000, min_samples_split=2, min_samples_leaf=2,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=1000, min_samples_split=2, min_samples_leaf=2,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.5s
[CV] n_estimators=600, min_samples_split=2, min_samples_leaf=2,
max_features=sqrt, max_depth=450, criterion=MSE
[CV]  n_estimators=600, min_samples_split=2, min_samples_leaf=2,
max_features=sqrt, max_depth=450, criterion=MSE, total=   0.3s
[CV] n_estimators=600, min_samples_split=2, min_samples_leaf=2,
```

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max_features=sqrt, max_depth=450, criterion=MSE
[CV]  n_estimators=600, min_samples_split=2, min_samples_leaf=2,
max_features=sqrt, max_depth=450, criterion=MSE, total=   0.3s
[CV] n_estimators=600, min_samples_split=2, min_samples_leaf=2,
max_features=sqrt, max_depth=450, criterion=MSE
[CV]  n_estimators=600, min_samples_split=2, min_samples_leaf=2,
max_features=sqrt, max_depth=450, criterion=MSE, total=   0.3s
[CV] n_estimators=300, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=890, criterion=MSE
[CV]  n_estimators=300, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=890, criterion=MSE, total=   0.2s
[CV] n_estimators=300, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=890, criterion=MSE
[CV]  n_estimators=300, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=890, criterion=MSE, total=   0.1s
[CV] n_estimators=300, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=890, criterion=MSE
[CV]  n_estimators=300, min_samples_split=2, min_samples_leaf=5,
max_features=log2, max_depth=890, criterion=MSE, total=   0.1s
[CV] n_estimators=800, min_samples_split=5, min_samples_leaf=5,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=800, min_samples_split=5, min_samples_leaf=5,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.4s
[CV] n_estimators=800, min_samples_split=5, min_samples_leaf=5,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=800, min_samples_split=5, min_samples_leaf=5,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.4s
[CV] n_estimators=800, min_samples_split=5, min_samples_leaf=5,
max_features=sqrt, max_depth=340, criterion=MSE
[CV]  n_estimators=800, min_samples_split=5, min_samples_leaf=5,
max_features=sqrt, max_depth=340, criterion=MSE, total=   0.4s
[CV] n_estimators=1100, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=230, criterion=MSE
[CV]  n_estimators=1100, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=230, criterion=MSE, total=   0.5s
[CV] n_estimators=1100, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=230, criterion=MSE
[CV]  n_estimators=1100, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=230, criterion=MSE, total=   0.5s
[CV] n_estimators=1100, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=230, criterion=MSE
[CV]  n_estimators=1100, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=230, criterion=MSE, total=   0.5s
[CV] n_estimators=800, min_samples_split=15, min_samples_leaf=1,
max_features=sqrt, max_depth=120, criterion=MSE
[CV]  n_estimators=800, min_samples_split=15, min_samples_leaf=1,
max_features=sqrt, max_depth=120, criterion=MSE, total=   0.4s
[CV] n_estimators=800, min_samples_split=15, min_samples_leaf=1,
```

```
max_features=sqrt, max_depth=120, criterion=MSE
[CV]  n_estimators=800, min_samples_split=15, min_samples_leaf=1,
max_features=sqrt, max_depth=120, criterion=MSE, total=   0.4s
[CV] n_estimators=800, min_samples_split=15, min_samples_leaf=1,
max_features=sqrt, max_depth=120, criterion=MSE
[CV]  n_estimators=800, min_samples_split=15, min_samples_leaf=1,
max_features=sqrt, max_depth=120, criterion=MSE, total=   0.4s
[CV] n_estimators=900, min_samples_split=5, min_samples_leaf=5,
max_features=log2, max_depth=780, criterion=MSE
[CV]  n_estimators=900, min_samples_split=5, min_samples_leaf=5,
max_features=log2, max_depth=780, criterion=MSE, total=   0.4s
[CV] n_estimators=900, min_samples_split=5, min_samples_leaf=5,
max_features=log2, max_depth=780, criterion=MSE
[CV]  n_estimators=900, min_samples_split=5, min_samples_leaf=5,
max_features=log2, max_depth=780, criterion=MSE, total=   0.4s
[CV] n_estimators=900, min_samples_split=5, min_samples_leaf=5,
max_features=log2, max_depth=780, criterion=MSE
[CV]  n_estimators=900, min_samples_split=5, min_samples_leaf=5,
max_features=log2, max_depth=780, criterion=MSE, total=   0.4s
[CV] n_estimators=700, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=780, criterion=MSE
[CV]  n_estimators=700, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=780, criterion=MSE, total=   0.4s
[CV] n_estimators=700, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=780, criterion=MSE
[CV]  n_estimators=700, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=780, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=780, criterion=MSE
[CV]  n_estimators=700, min_samples_split=100, min_samples_leaf=2,
max_features=auto, max_depth=780, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=15, min_samples_leaf=2,
max_features=log2, max_depth=1000, criterion=MSE
[CV]  n_estimators=700, min_samples_split=15, min_samples_leaf=2,
max_features=log2, max_depth=1000, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=15, min_samples_leaf=2,
max_features=log2, max_depth=1000, criterion=MSE
[CV]  n_estimators=700, min_samples_split=15, min_samples_leaf=2,
max_features=log2, max_depth=1000, criterion=MSE, total=   0.3s
[CV] n_estimators=700, min_samples_split=15, min_samples_leaf=2,
max_features=log2, max_depth=1000, criterion=MSE
[CV]  n_estimators=700, min_samples_split=15, min_samples_leaf=2,
max_features=log2, max_depth=1000, criterion=MSE, total=   0.3s
[CV] n_estimators=1200, min_samples_split=100, min_samples_leaf=2,
max_features=log2, max_depth=340, criterion=MSE
[CV]  n_estimators=1200, min_samples_split=100, min_samples_leaf=2,
max_features=log2, max_depth=340, criterion=MSE, total=   0.5s
[CV] n_estimators=1200, min_samples_split=100, min_samples_leaf=2,
```

```
max_features=log2, max_depth=340, criterion=MSE
[CV]  n_estimators=1200, min_samples_split=100, min_samples_leaf=2,
max_features=log2, max_depth=340, criterion=MSE, total=   0.5s
[CV] n_estimators=1200, min_samples_split=100, min_samples_leaf=2,
max_features=log2, max_depth=340, criterion=MSE
[CV]  n_estimators=1200, min_samples_split=100, min_samples_leaf=2,
max_features=log2, max_depth=340, criterion=MSE, total=   0.6s
[CV] n_estimators=1600, min_samples_split=5, min_samples_leaf=1,
max_features=sqrt, max_depth=780, criterion=MSE
[CV]  n_estimators=1600, min_samples_split=5, min_samples_leaf=1,
max_features=sqrt, max_depth=780, criterion=MSE, total=   0.7s
[CV] n_estimators=1600, min_samples_split=5, min_samples_leaf=1,
max_features=sqrt, max_depth=780, criterion=MSE
[CV]  n_estimators=1600, min_samples_split=5, min_samples_leaf=1,
max_features=sqrt, max_depth=780, criterion=MSE, total=   0.8s
[CV] n_estimators=1600, min_samples_split=5, min_samples_leaf=1,
max_features=sqrt, max_depth=780, criterion=MSE
[CV]  n_estimators=1600, min_samples_split=5, min_samples_leaf=1,
max_features=sqrt, max_depth=780, criterion=MSE, total=   0.7s
[CV] n_estimators=200, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=230, criterion=MSE
[CV]  n_estimators=200, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=230, criterion=MSE, total=   0.1s
[CV] n_estimators=200, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=230, criterion=MSE
[CV]  n_estimators=200, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=230, criterion=MSE, total=   0.1s
[CV] n_estimators=200, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=230, criterion=MSE
[CV]  n_estimators=200, min_samples_split=5, min_samples_leaf=2,
max_features=sqrt, max_depth=230, criterion=MSE, total=   0.1s
[CV] n_estimators=500, min_samples_split=10, min_samples_leaf=5,
max_features=sqrt, max_depth=1000, criterion=MSE
[CV]  n_estimators=500, min_samples_split=10, min_samples_leaf=5,
max_features=sqrt, max_depth=1000, criterion=MSE, total=   0.2s
[CV] n_estimators=500, min_samples_split=10, min_samples_leaf=5,
max_features=sqrt, max_depth=1000, criterion=MSE
[CV]  n_estimators=500, min_samples_split=10, min_samples_leaf=5,
max_features=sqrt, max_depth=1000, criterion=MSE, total=   0.2s
[CV] n_estimators=500, min_samples_split=10, min_samples_leaf=5,
max_features=sqrt, max_depth=1000, criterion=MSE
[CV]  n_estimators=500, min_samples_split=10, min_samples_leaf=5,
max_features=sqrt, max_depth=1000, criterion=MSE, total=   0.2s
[CV] n_estimators=1700, min_samples_split=15, min_samples_leaf=5,
max_features=sqrt, max_depth=890, criterion=MSE
[CV]  n_estimators=1700, min_samples_split=15, min_samples_leaf=5,
max_features=sqrt, max_depth=890, criterion=MSE, total=   0.8s
[CV] n_estimators=1700, min_samples_split=15, min_samples_leaf=5,
```

```
max_features=sqrt, max_depth=890, criterion=MSE
[CV]  n_estimators=1700, min_samples_split=15, min_samples_leaf=5,
max_features=sqrt, max_depth=890, criterion=MSE, total=   0.8s
[CV] n_estimators=1700, min_samples_split=15, min_samples_leaf=5,
max_features=sqrt, max_depth=890, criterion=MSE
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max_features=log2, max_depth=10, criterion=MSE, total=   1.0s
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max_features=log2, max_depth=10, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=5, min_samples_leaf=1,
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max_features=auto, max_depth=560, criterion=MSE
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```

```
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[CV]  n_estimators=2000, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=560, criterion=MSE, total=   0.9s
[CV] n_estimators=2000, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=560, criterion=MSE
[CV]  n_estimators=2000, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=560, criterion=MSE, total=   0.9s
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max_features=sqrt, max_depth=670, criterion=MSE
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```

```
max_features=sqrt, max_depth=670, criterion=MSE
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[CV] n_estimators=1800, min_samples_split=2, min_samples_leaf=10,
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[CV]  n_estimators=1000, min_samples_split=15, min_samples_leaf=10,
max_features=sqrt, max_depth=670, criterion=MSE, total=   0.5s
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[CV]  n_estimators=500, min_samples_split=5, min_samples_leaf=5,
max_features=auto, max_depth=670, criterion=MSE, total=   0.2s
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```

```
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max_features=auto, max_depth=1000, criterion=MSE, total=   0.2s
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[CV]  n_estimators=1200, min_samples_split=2, min_samples_leaf=10,
max_features=auto, max_depth=890, criterion=MSE, total=   0.6s
[CV] n_estimators=1200, min_samples_split=2, min_samples_leaf=10,
max_features=auto, max_depth=890, criterion=MSE
[CV]  n_estimators=1200, min_samples_split=2, min_samples_leaf=10,
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max_features=sqrt, max_depth=780, criterion=MSE
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max_features=sqrt, max_depth=780, criterion=MSE, total=   0.4s
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max_features=sqrt, max_depth=780, criterion=MSE
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max_features=sqrt, max_depth=780, criterion=MSE, total=   0.4s
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max_features=sqrt, max_depth=890, criterion=MSE
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max_features=sqrt, max_depth=890, criterion=MSE, total=   0.9s
[CV] n_estimators=1800, min_samples_split=5, min_samples_leaf=1,
```

```
max_features=sqrt, max_depth=890, criterion=MSE
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max_features=auto, max_depth=450, criterion=MSE, total=   0.7s

[Parallel(n_jobs=1)]: Done 300 out of 300 | elapsed:  2.3min finished


      ␣
↪---------------------------------------------------------------------------

       KeyError                                  Traceback (most recent call␣
↪last)

       <ipython-input-94-b757a035f514> in <module>
   ----> 1 rcv.fit(x_train,y_train)


       ~\Anaconda3\lib\site-packages\sklearn\utils\validation.py in␣
↪inner_f(*args, **kwargs)
        70                           FutureWarning)
        71         kwargs.update({k: arg for k, arg in zip(sig.parameters,␣
↪args)})
   ---> 72         return f(**kwargs)
        73     return inner_f
        74


       ~\Anaconda3\lib\site-packages\sklearn\model_selection\_search.py in␣
↪fit(self, X, y, groups, **fit_params)
       763             refit_start_time = time.time()
       764             if y is not None:
   --> 765                 self.best_estimator_.fit(X, y, **fit_params)
```

```
      766             else:
      767                 self.best_estimator_.fit(X, **fit_params)


      ~\Anaconda3\lib\site-packages\sklearn\ensemble\_forest.py in fit(self,␣
↪X, y, sample_weight)
      390                     verbose=self.verbose, class_weight=self.
↪class_weight,
      391                     n_samples_bootstrap=n_samples_bootstrap)
  --> 392                 for i, t in enumerate(trees))
      393
      394             # Collect newly grown trees


      ~\Anaconda3\lib\site-packages\joblib\parallel.py in __call__(self,␣
↪iterable)
      919             # remaining jobs.
      920             self._iterating = False
  --> 921             if self.dispatch_one_batch(iterator):
      922                 self._iterating = self._original_iterator is not None
      923


      ~\Anaconda3\lib\site-packages\joblib\parallel.py in␣
↪dispatch_one_batch(self, iterator)
      757                 return False
      758             else:
  --> 759                 self._dispatch(tasks)
      760                 return True
      761


      ~\Anaconda3\lib\site-packages\joblib\parallel.py in _dispatch(self,␣
↪batch)
      714         with self._lock:
      715             job_idx = len(self._jobs)
  --> 716             job = self._backend.apply_async(batch, callback=cb)
      717             # A job can complete so quickly than its callback is
      718             # called before we get here, causing self._jobs to


      ~\Anaconda3\lib\site-packages\joblib\_parallel_backends.py in␣
↪apply_async(self, func, callback)
      180     def apply_async(self, func, callback=None):
      181         """Schedule a func to be run"""
  --> 182         result = ImmediateResult(func)
      183         if callback:
```

```
      184             callback(result)


      ~\Anaconda3\lib\site-packages\joblib\_parallel_backends.py in␣
↪__init__(self, batch)
      547         # Don't delay the application, to avoid keeping the input
      548         # arguments in memory
  --> 549         self.results = batch()
      550
      551     def get(self):


      ~\Anaconda3\lib\site-packages\joblib\parallel.py in __call__(self)
      223         with parallel_backend(self._backend, n_jobs=self._n_jobs):
      224             return [func(*args, **kwargs)
  --> 225                     for func, args, kwargs in self.items]
      226
      227     def __len__(self):


      ~\Anaconda3\lib\site-packages\joblib\parallel.py in <listcomp>(.0)
      223         with parallel_backend(self._backend, n_jobs=self._n_jobs):
      224             return [func(*args, **kwargs)
  --> 225                     for func, args, kwargs in self.items]
      226
      227     def __len__(self):


      ~\Anaconda3\lib\site-packages\sklearn\ensemble\_forest.py in␣
↪_parallel_build_trees(tree, forest, X, y, sample_weight, tree_idx, n_trees,␣
↪verbose, class_weight, n_samples_bootstrap)
      166                                                              ␣
↪indices=indices)
      167
  --> 168         tree.fit(X, y, sample_weight=curr_sample_weight,␣
↪check_input=False)
      169     else:
      170         tree.fit(X, y, sample_weight=sample_weight,␣
↪check_input=False)


      ~\Anaconda3\lib\site-packages\sklearn\tree\_classes.py in fit(self, X,␣
↪y, sample_weight, check_input, X_idx_sorted)
     1244             sample_weight=sample_weight,
     1245             check_input=check_input,
  -> 1246             X_idx_sorted=X_idx_sorted)
     1247         return self
```

```
      1248

      ~\Anaconda3\lib\site-packages\sklearn\tree\_classes.py in fit(self, X,␣
↪y, sample_weight, check_input, X_idx_sorted)
      334                                                     self.
↪n_classes_)
      335             else:
   --> 336                 criterion = CRITERIA_REG[self.criterion](self.
↪n_outputs_,
      337                                                      n_samples)
      338

      KeyError: 'MSE'
```

[ ]:
```
predict=rcv.predict(x_test)
```

[ ]:
```
sns.distplot(y_test-predict)
```

[ ]:
```
plt.scotter(y_test,predict)
```

[100]:
```
import pickle
#open the file were you want to store the data
file=open('car_price_prediction.pkl','wb')
#dump informatin to that file
pickle.dump(rcv,file)
```

[ ]:

[ ]:

[ ]: