housing_data_regression

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1 Housing Price Model - Regression Analysis

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The original data set comes from the Ames, Iowa housing data on Kaggle.

```
[1]: import numpy as np
     import pandas as pd
     import matplotlib.pyplot as plt
     import seaborn as sns
     %config Completer.use_jedi = False
```

1.0.1 Load the Processed Data

In the data preprocessing notebook, we took care of the outliers, missing values, and categorical data in order to prepare our data set for these machine learning models.

```
[3]: df = pd.read_csv('./data_processed/Ames_Housing_Data_Clean_Dummies.csv')
     df.head()
```

```
[3]:    Lot Frontage  Lot Area  Overall Qual  Overall Cond  Year Built  \
     0         141.0     31770             6             5        1960
     1          80.0     11622             5             6        1961
     2          81.0     14267             6             6        1958
     3          93.0     11160             7             5        1968
     4          74.0     13830             5             5        1997

        Year Remod/Add  Mas Vnr Area  BsmtFin SF 1  BsmtFin SF 2  Bsmt Unf SF  … \
     0            1960         112.0         639.0           0.0        441.0  …
     1            1961           0.0         468.0         144.0        270.0  …
     2            1958         108.0         923.0           0.0        406.0  …
     3            1968           0.0        1065.0           0.0       1045.0  …
     4            1998           0.0         791.0           0.0        137.0  …

        Sale Type_ConLw  Sale Type_New  Sale Type_Oth  Sale Type_VWD  \
```

```
   0                  0             0             0             0
   1                  0             0             0             0
   2                  0             0             0             0
   3                  0             0             0             0
   4                  0             0             0             0

      Sale Type_WD   Sale Condition_AdjLand  Sale Condition_Alloca  \
   0              1                       0                      0
   1              1                       0                      0
   2              1                       0                      0
   3              1                       0                      0
   4              1                       0                      0

      Sale Condition_Family  Sale Condition_Normal  Sale Condition_Partial
   0                      0                      1                       0
   1                      0                      1                       0
   2                      0                      1                       0
   3                      0                      1                       0
   4                      0                      1                       0

   [5 rows x 274 columns]
```

[4]: ```python
# confirm that there are no missing values
df.isnull().sum().sort_values().max()
```

[4]: 0

[5]: ```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2925 entries, 0 to 2924
Columns: 274 entries, Lot Frontage to Sale Condition_Partial
dtypes: float64(11), int64(263)
memory usage: 6.1 MB
```

[6]: ```python
df.columns
```

[6]: ```
Index(['Lot Frontage', 'Lot Area', 'Overall Qual', 'Overall Cond',
       'Year Built', 'Year Remod/Add', 'Mas Vnr Area', 'BsmtFin SF 1',
       'BsmtFin SF 2', 'Bsmt Unf SF',
       ...
       'Sale Type_ConLw', 'Sale Type_New', 'Sale Type_Oth', 'Sale Type_VWD',
       'Sale Type_WD ', 'Sale Condition_AdjLand', 'Sale Condition_Alloca',
       'Sale Condition_Family', 'Sale Condition_Normal',
       'Sale Condition_Partial'],
      dtype='object', length=274)
```

1.0.2 Split the Data for Training and Testing

```
[7]: # X: features and y: target
     X = df.drop('SalePrice', axis=1)
     y = df['SalePrice']
```

```
[8]: # withhold 10% of the data for testing
     from sklearn.model_selection import train_test_split
     X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.10,␣
      ↪random_state=101)
```

Scale the features using the standard scaler (we do not need to scale the targets):

```
[9]: from sklearn.preprocessing import StandardScaler
```

```
[10]: scaler = StandardScaler()
      X_train_scaled = scaler.fit_transform(X_train)
```

```
[11]: X_test_scaled = scaler.transform(X_test)
```

1.0.3 Model 1: Linear Regression using Elastic Net

Combination of Ridge + Lasso Regression

```
[41]: from sklearn.linear_model import ElasticNet
```

```
[49]: base_model = ElasticNet()
```

We will use a grid search to find the best alpha values and the L1-ratio for the Elastic Net model.

```
[50]: alpha_values = []

      for n in range(-2, 10, 1):
          alpha = 2 ** n
          alpha_values.append(alpha)

      alpha_values
```

```
[50]: [0.25, 0.5, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512]
```

```
[51]: l1_ratio_values = [.1, .5, .9, .95, .99, 1.0]
```

```
[52]: param_grid = {'alpha': alpha_values,
                    'l1_ratio': l1_ratio_values}
```

```
[53]: from sklearn.model_selection import GridSearchCV
```

```
[54]:  # for the grid search, we choose the scoring metric to be the mean squared␣
       ↪error in this case
       grid = GridSearchCV(estimator=base_model,
                           param_grid=param_grid,
                           scoring='neg_mean_squared_error',
                           cv=5)
```

```
[56]:  # fit the model using the training data
       output_warnings = grid.fit(X_train, y_train);
```

```
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 716440645740.9347, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 742561870310.6692, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 818655118539.1367, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 800486621135.0828, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 765971689016.04, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 636723633572.3638, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 655547316065.174, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
```

```
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 725634883092.8562, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 711370292689.2418, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 673165118926.8225, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 397873845768.9937, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 372859127828.69476, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 442840532779.70264, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 432671224857.3934, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 375560605063.34155, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 257096742054.03766, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 204435423096.6745, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
```

```
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 278378527703.93604, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 263853443048.8368, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 202534782262.81482, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 357378117241.09424, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 366091371220.3881, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 414761135787.1528, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 410683082552.69214, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 379894814302.9, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 800399710371.8466, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
```

```
Duality gap: 827316153321.7909, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 913429854109.44, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 890921926867.997, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 853215372200.2468, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 710115963587.6705, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 729892901515.6914, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 809410153535.8291, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 791217983060.0703, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 749853139675.9318, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 435773854846.16504, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
```

```
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 408431898059.625, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 484413900496.0254, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 474216845012.23157, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 411920000319.41736, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 279330454653.7361, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 220186335059.96454, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 299994182587.97284, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 287362618321.2898, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 220642810901.95258, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 359111160011.34515, tolerance: 1355206692.5276787
```

```
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 367890570353.2114, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 416303051175.02545, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 412269595899.2518, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 382300219941.6377, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 887957252217.1732, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 915201796163.8472, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1010505680802.2621, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 984124410685.8416, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 942309392452.272, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
```

```
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 793074022077.6157, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 813537232809.8983, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 902541583829.745, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 880240098169.3368, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 833960603588.7566, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 481219578302.2638, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 451839318549.62964, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 534994572600.1413, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 523848435422.3153, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 447043918970.6502, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
```

```
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 305920090814.9517, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 240839458700.859, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 326911077101.3568, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 315940697015.4159, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 243334185945.66132, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 362312564752.57184, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 371269230909.7869, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 419194082629.78485, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 415273109992.04767, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
```

```
Duality gap: 385691150335.03253, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 967293841432.1654, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 994294916942.696, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1097168723525.351, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1068028700435.5801, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1022001376833.1909, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 877969963291.1707, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 898799573433.8187, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 996125115888.3553, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 970244516530.3763, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
```

```
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 917837396118.6573, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 535356170606.38495, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 504521038259.6239, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 595302975220.7456, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 582291840890.6095, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 494393909779.2727, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 337453009021.857, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 267191895048.04993, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 359921350089.21857, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 349737675324.82935, tolerance: 1438198040.088288
```

```
    model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 266296610071.93408, tolerance: 1345680018.2551236
    model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 362269018968.5795, tolerance: 1355206692.5276787
    model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 376793388125.85895, tolerance: 1307913805.6588454
    model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 423274674612.69916, tolerance: 1415056940.006106
    model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 419932143444.6731, tolerance: 1438198040.088288
    model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 370063006314.4919, tolerance: 1345680018.2551236
    model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1028489586279.8473, tolerance: 1355206692.5276787
    model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1054857701352.4247, tolerance: 1307913805.6588454
    model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1163375250192.4204, tolerance: 1415056940.006106
    model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
```

```
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1132675391919.1016, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1083315219697.8962, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 952816971599.6588, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 973471828058.62, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1077392831253.1412, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1049042238309.2212, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 992130265141.8177, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 598084823607.6685, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 566878177100.0082, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 664203664242.6487, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
```

```
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 648766404573.5117, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 548831201409.5372, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 374927807949.4917, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 300836938253.8325, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 399681206894.6093, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 389208674240.6676, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 291410135505.52405, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 376706993368.88354, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 385515941758.08093, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
```

```
Duality gap: 430113930392.15814, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 422089581488.39264, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 361024322509.2293, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1069819652752.9855, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1095561611606.9418, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1207874213069.6167, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1176412318452.1106, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1124702038859.1355, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1008644778549.3365, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1028678807071.373, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
```

```
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1137351685452.9148, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1107652940265.9077, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1047658535408.4214, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 664786187982.4379, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 634434587488.2823, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 735836732328.164, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 717942371495.6206, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 608136166911.5813, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 418621791410.65564, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 342605489519.76843, tolerance: 1307913805.6588454
```

```
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 445442611924.799, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 433990313331.1874, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 321346097736.02155, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 278218755255.8526, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 337458205769.1549, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1096390481820.9097, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1121731598753.359, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1236455973642.976, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1204599522087.27, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
```

```
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1151369709482.0684, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1044573186417.7306, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1063788135477.055, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1175564736482.7417, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1145262040902.1423, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1082957228597.4376, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 725279053175.1716, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 695913038083.772, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 799133855298.6394, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 779236495832.1782, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
```

```
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 663834662919.3665, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 464914355976.277, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 389407334136.71906, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 492426074808.02637, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 479754607648.5721, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 355935284311.04553, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1115297919515.074, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1140446132446.8542, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1256827828298.4343, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
```

```
Duality gap: 1224681948119.6248, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1170384431759.1182, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1065017942074.7316, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1083137132617.0856, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1196857103743.7615, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1166370351770.0867, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1101864423061.4956, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 768863049012.2845, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 739427666852.7379, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 843083124938.6581, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
```

```
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 822016210067.9722, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 704414235881.3082, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 504785893963.6347, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 430621138104.3981, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 530946074005.8925, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 516983312776.9459, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 388669248588.2582, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1132496909671.5823, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1157399329438.4087, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1275254716242.3552, tolerance: 1415056940.006106
```

```
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1242856142015.003, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1187391331959.0767, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 1073558700459.5005, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
```

```
---------------------------------------------------------------------------
KeyboardInterrupt                         Traceback (most recent call last)
<ipython-input-56-58b5a429ade2> in <module>
      1 # fit the model using the training data
----> 2 output_warnings = grid.fit(X_train, y_train);

~\anaconda3\envs\py3-TF2.0\lib\site-packages\sklearn\utils\validation.py in
 →inner_f(*args, **kwargs)
     61                 extra_args = len(args) - len(all_args)
     62                 if extra_args <= 0:
---> 63                     return f(*args, **kwargs)
     64
     65                 # extra_args > 0

~\anaconda3\envs\py3-TF2.0\lib\site-packages\sklearn\model_selection\_search.py
 →in fit(self, X, y, groups, **fit_params)
    839                 return results
    840
--> 841             self._run_search(evaluate_candidates)
    842
    843             # multimetric is determined here because in the case of a
 →callable

~\anaconda3\envs\py3-TF2.0\lib\site-packages\sklearn\model_selection\_search.py
 →in _run_search(self, evaluate_candidates)
   1286     def _run_search(self, evaluate_candidates):
   1287         """Search all candidates in param_grid"""
-> 1288         evaluate_candidates(ParameterGrid(self.param_grid))
   1289
   1290
```

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```
~\anaconda3\envs\py3-TF2.0\lib\site-packages\sklearn\model_selection\_search.py
 ↪in evaluate_candidates(candidate_params, cv, more_results)
    793                                      n_splits, n_candidates, n_candidates *␣
 ↪n_splits))
    794
--> 795                  out =␣
 ↪parallel(delayed(_fit_and_score)(clone(base_estimator),
    796                                                        X, y,
    797                                                        train=train,␣
 ↪test=test,


~\anaconda3\envs\py3-TF2.0\lib\site-packages\joblib\parallel.py in␣
 ↪__call__(self, iterable)
   1042                self._iterating = self._original_iterator is not None
   1043
-> 1044            while self.dispatch_one_batch(iterator):
   1045                pass
   1046


~\anaconda3\envs\py3-TF2.0\lib\site-packages\joblib\parallel.py in␣
 ↪dispatch_one_batch(self, iterator)
    857                return False
    858            else:
--> 859                self._dispatch(tasks)
    860                return True
    861


~\anaconda3\envs\py3-TF2.0\lib\site-packages\joblib\parallel.py in␣
 ↪_dispatch(self, batch)
    775        with self._lock:
    776            job_idx = len(self._jobs)
--> 777            job = self._backend.apply_async(batch, callback=cb)
    778            # A job can complete so quickly than its callback is
    779            # called before we get here, causing self._jobs to


~\anaconda3\envs\py3-TF2.0\lib\site-packages\joblib\_parallel_backends.py in␣
 ↪apply_async(self, func, callback)
    206    def apply_async(self, func, callback=None):
    207        """Schedule a func to be run"""
--> 208        result = ImmediateResult(func)
    209        if callback:
    210            callback(result)


~\anaconda3\envs\py3-TF2.0\lib\site-packages\joblib\_parallel_backends.py in␣
 ↪__init__(self, batch)
    570            # Don't delay the application, to avoid keeping the input
```

```
    571             # arguments in memory
--> 572             self.results = batch()
    573
    574     def get(self):


~\anaconda3\envs\py3-TF2.0\lib\site-packages\joblib\parallel.py in __call__(self)
    260             # change the default number of processes to -1
    261             with parallel_backend(self._backend, n_jobs=self._n_jobs):
--> 262                 return [func(*args, **kwargs)

    263                         for func, args, kwargs in self.items]
    264


~\anaconda3\envs\py3-TF2.0\lib\site-packages\joblib\parallel.py in <listcomp>(.0)
    260             # change the default number of processes to -1
    261             with parallel_backend(self._backend, n_jobs=self._n_jobs):
--> 262                 return [func(*args, **kwargs)

    263                         for func, args, kwargs in self.items]
    264


~\anaconda3\envs\py3-TF2.0\lib\site-packages\sklearn\utils\fixes.py in
 ↪__call__(self, *args, **kwargs)
    220     def __call__(self, *args, **kwargs):
    221         with config_context(**self.config):
--> 222             return self.function(*args, **kwargs)


~\anaconda3\envs\py3-TF2.0\lib\site-packages\sklearn\model_selection\_validation.
 ↪py in _fit_and_score(estimator, X, y, scorer, train, test, verbose,
 ↪parameters, fit_params, return_train_score, return_parameters,
 ↪return_n_test_samples, return_times, return_estimator, split_progress,
 ↪candidate_progress, error_score)
    583     start_time = time.time()
    584
--> 585     X_train, y_train = _safe_split(estimator, X, y, train)
    586     X_test, y_test = _safe_split(estimator, X, y, test, train)
    587


~\anaconda3\envs\py3-TF2.0\lib\site-packages\sklearn\utils\metaestimators.py in
 ↪_safe_split(estimator, X, y, indices, train_indices)
    209             X_subset = X[np.ix_(indices, train_indices)]
    210     else:
--> 211         X_subset = _safe_indexing(X, indices)
    212
    213     if y is not None:


~\anaconda3\envs\py3-TF2.0\lib\site-packages\sklearn\utils\__init__.py in
 ↪_safe_indexing(X, indices, axis)
    340
```

```
       341        if hasattr(X, "iloc"):
--> 342            return _pandas_indexing(X, indices, indices_dtype, axis=axis)
       343        elif hasattr(X, "shape"):
       344            return _array_indexing(X, indices, indices_dtype, axis=axis)


~\anaconda3\envs\py3-TF2.0\lib\site-packages\sklearn\utils\__init__.py in
↪_pandas_indexing(X, key, key_dtype, axis)
       191        # check whether we should index with loc or iloc
       192        indexer = X.iloc if key_dtype == 'int' else X.loc
--> 193        return indexer[:, key] if axis else indexer[key]
       194
       195


~\anaconda3\envs\py3-TF2.0\lib\site-packages\pandas\core\indexing.py in
↪__getitem__(self, key)
       893
       894                maybe_callable = com.apply_if_callable(key, self.obj)
--> 895                return self._getitem_axis(maybe_callable, axis=axis)
       896
       897        def _is_scalar_access(self, key: Tuple):


~\anaconda3\envs\py3-TF2.0\lib\site-packages\pandas\core\indexing.py in
↪_getitem_axis(self, key, axis)
      1490            # a list of integers
      1491            elif is_list_like_indexer(key):
->    1492                return self._get_list_axis(key, axis=axis)
      1493
      1494            # a single integer


~\anaconda3\envs\py3-TF2.0\lib\site-packages\pandas\core\indexing.py in
↪_get_list_axis(self, key, axis)
      1472            """
      1473            try:
->    1474                return self.obj._take_with_is_copy(key, axis=axis)
      1475            except IndexError as err:
      1476                # re-raise with different error message


~\anaconda3\envs\py3-TF2.0\lib\site-packages\pandas\core\generic.py in
↪_take_with_is_copy(self, indices, axis)
      3598            See the docstring of `take` for full explanation of the
↪parameters.
      3599            """
->    3600            result = self.take(indices=indices, axis=axis)
      3601            # Maybe set copy if we didn't actually change the index.
      3602            if not result._get_axis(axis).equals(self._get_axis(axis)):


~\anaconda3\envs\py3-TF2.0\lib\site-packages\pandas\core\generic.py in
↪take(self, indices, axis, is_copy, **kwargs)
```

```
   3584              self._consolidate_inplace()
   3585
-> 3586              new_data = self._mgr.take(

   3587                  indices, axis=self._get_block_manager_axis(axis), verify=Tr e
   3588              )


~\anaconda3\envs\py3-TF2.0\lib\site-packages\pandas\core\internals\managers.py␣
  →in take(self, indexer, axis, verify, convert)
   1460              np.arange(indexer.start, indexer.stop, indexer.step,␣
  →dtype="int64")
   1461              if isinstance(indexer, slice)
-> 1462              else np.asanyarray(indexer, dtype="int64")
   1463          )
   1464


~\anaconda3\envs\py3-TF2.0\lib\site-packages\numpy\core\_asarray.py in␣
  →asanyarray(a, dtype, order)
   134
   135      """
--> 136      return array(a, dtype, copy=False, order=order, subok=True)
   137
   138


KeyboardInterrupt:
```

[21]: `grid.best_params_`

[21]: {'alpha': 16, 'l1_ratio': 1.0}

The best parameters found during the grid search using the mean squared error as our metric are the following (hyperparameters):

$\alpha = 16$

$L^1_{ratio} = 1.0$

Since we explored alpha values of 8, 16, and 32, we can try to focus on this range of [8, 32] to see if there is a better alpha that we missed:

[22]:
```
new_l1_ratio_values = [.9, .95, .99, 1.0]
new_alpha_values = np.arange(8, 33, 2)
```

[23]:
```
new_param_grid = {'alpha': new_alpha_values,
                  'l1_ratio': new_l1_ratio_values}
```

[28]:
```
new_base_model = ElasticNet()
new_grid = GridSearchCV(estimator=new_base_model,
                        param_grid=new_param_grid,
```

```
                        scoring='neg_mean_squared_error',
                        cv=5,
                        verbose=2)
```

[29]: `new_grid.fit(X_train, y_train)`

```
Fitting 5 folds for each of 52 candidates, totalling 260 fits

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 664786187982.4379, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=8, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 634434587488.2823, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=8, l1_ratio=0.9; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 735836732328.164, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=8, l1_ratio=0.9; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 717942371495.6206, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=8, l1_ratio=0.9; total time=   0.5s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 608136166911.5813, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=8, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 418621791410.65564, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(
```

```
[CV] END …alpha=8, l1_ratio=0.95; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 342605489519.76843, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=8, l1_ratio=0.95; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 445442611924.799, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=8, l1_ratio=0.95; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 433990313331.1874, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=8, l1_ratio=0.95; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 321346097736.02155, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=8, l1_ratio=0.95; total time=   0.3s
[CV] END …alpha=8, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=8, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=8, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=8, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=8, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=8, l1_ratio=1.0; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 278218755255.8526, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=8, l1_ratio=1.0; total time=   0.3s
[CV] END …alpha=8, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=8, l1_ratio=1.0; total time=   0.2s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
```

```
Duality gap: 337458205769.1549, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=8, l1_ratio=1.0; total time=    0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 685508995305.9323, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=10, l1_ratio=0.9; total time=    0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 655521602207.718, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=10, l1_ratio=0.9; total time=    0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 757727991905.2769, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=10, l1_ratio=0.9; total time=    0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 739111770260.2046, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=10, l1_ratio=0.9; total time=    0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 627015149314.0085, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=10, l1_ratio=0.9; total time=    0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 433585299993.0091, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=10, l1_ratio=0.95; total time=    0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
```

```
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 357542849702.2823, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=10, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 460830441087.1433, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=10, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 448999414031.8262, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=10, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 332148272253.08765, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=10, l1_ratio=0.95; total time=   0.4s
[CV] END …alpha=10, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=10, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=10, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=10, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=10, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=10, l1_ratio=1.0; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 221532815556.47043, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=10, l1_ratio=1.0; total time=   0.3s
[CV] END …alpha=10, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=10, l1_ratio=1.0; total time=   0.1s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 175835884304.6772, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=10, l1_ratio=1.0; total time=   0.3s
```

```
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 701681980816.9453, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=12, l1_ratio=0.9; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 671969181362.5261, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=12, l1_ratio=0.9; total time=   0.6s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 774674569782.0378, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=12, l1_ratio=0.9; total time=   0.6s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 755516737697.8171, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=12, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 641904172645.9302, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=12, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 445871893303.3675, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=12, l1_ratio=0.95; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 369949480222.30585, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(
```

```
[CV] END …alpha=12, l1_ratio=0.95; total time=    0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 473298392008.03357, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=12, l1_ratio=0.95; total time=    0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 461173618711.2193, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=12, l1_ratio=0.95; total time=    0.5s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 341266728618.92316, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=12, l1_ratio=0.95; total time=    0.4s
[CV] END …alpha=12, l1_ratio=0.99; total time=    0.0s
[CV] END …alpha=12, l1_ratio=0.99; total time=    0.0s
[CV] END …alpha=12, l1_ratio=0.99; total time=    0.0s
[CV] END …alpha=12, l1_ratio=0.99; total time=    0.0s
[CV] END …alpha=12, l1_ratio=0.99; total time=    0.0s
[CV] END …alpha=12, l1_ratio=1.0; total time=    0.0s
[CV] END …alpha=12, l1_ratio=1.0; total time=    0.1s
[CV] END …alpha=12, l1_ratio=1.0; total time=    0.1s
[CV] END …alpha=12, l1_ratio=1.0; total time=    0.0s
[CV] END …alpha=12, l1_ratio=1.0; total time=    0.2s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 714655442984.484, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=14, l1_ratio=0.9; total time=    0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 685143545979.979, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=14, l1_ratio=0.9; total time=    0.4s
```

```
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 788165642345.505, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=14, l1_ratio=0.9; total time=   0.6s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 768594000107.0034, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=14, l1_ratio=0.9; total time=   0.7s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 653935388317.2412, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=14, l1_ratio=0.9; total time=   0.5s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 456161574490.229, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=14, l1_ratio=0.95; total time=   0.5s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 380434285764.02405, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=14, l1_ratio=0.95; total time=   0.5s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 483671911502.03925, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=14, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 471263981585.3823, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
```

```
[CV] END …alpha=14, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 349115404385.05994, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=14, l1_ratio=0.95; total time=   0.4s
[CV] END …alpha=14, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=14, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=14, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=14, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=14, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=14, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=14, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=14, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=14, l1_ratio=1.0; total time=   0.0s
[CV] END …alpha=14, l1_ratio=1.0; total time=   0.2s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 725279053175.1716, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=16, l1_ratio=0.9; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 695913038083.772, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=16, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 799133855298.6394, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=16, l1_ratio=0.9; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 779236495832.1782, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=16, l1_ratio=0.9; total time=   0.3s
```

```
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 663834662919.3665, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=16, l1_ratio=0.9; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 464914355976.277, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=16, l1_ratio=0.95; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 389407334136.71906, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=16, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 492426074808.02637, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=16, l1_ratio=0.95; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 479754607648.5721, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=16, l1_ratio=0.95; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 355935284311.04553, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=16, l1_ratio=0.95; total time=   0.3s
[CV] END …alpha=16, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=16, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=16, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=16, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=16, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=16, l1_ratio=1.0; total time=   0.2s
```

```
[CV] END …alpha=16, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=16, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=16, l1_ratio=1.0; total time=   0.0s
[CV] END …alpha=16, l1_ratio=1.0; total time=   0.1s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 734112193045.8467, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=18, l1_ratio=0.9; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 704832346445.0581, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=18, l1_ratio=0.9; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 808201804472.9677, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=18, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 788046232364.6165, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=18, l1_ratio=0.9; total time=   0.5s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 672094196229.7571, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=18, l1_ratio=0.9; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 472435221862.7893, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=18, l1_ratio=0.95; total time=   0.3s
```

```
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 397156762272.2815, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=18, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 499891310795.16785, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=18, l1_ratio=0.95; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 486978570232.0341, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=18, l1_ratio=0.95; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 361910048165.4874, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=18, l1_ratio=0.95; total time=   0.4s
[CV] END …alpha=18, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=18, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=18, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=18, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=18, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=18, l1_ratio=1.0; total time=   0.2s
[CV] END …alpha=18, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=18, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=18, l1_ratio=1.0; total time=   0.0s
[CV] END …alpha=18, l1_ratio=1.0; total time=   0.2s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 741552156464.3888, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=20, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
```

```
Duality gap: 712320177775.3374, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=20, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 815800894875.3009, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=20, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 795435187772.602, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=20, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 679061937277.6241, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=20, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 478966591746.9789, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=20, l1_ratio=0.95; total time=    0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 403903240384.8687, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=20, l1_ratio=0.95; total time=    0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 506313994605.3892, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=20, l1_ratio=0.95; total time=    0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
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Objective did not converge. You might want to increase the number of iterations.
Duality gap: 493188468724.5795, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=20, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 367177882021.0077, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=20, l1_ratio=0.95; total time=   0.4s
[CV] END …alpha=20, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=20, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=20, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=20, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=20, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=20, l1_ratio=1.0; total time=   0.2s
[CV] END …alpha=20, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=20, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=20, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=20, l1_ratio=1.0; total time=   0.1s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 747886039665.096, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=22, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 718672184682.4326, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=22, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 822220960124.4805, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=22, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 801683863527.4916, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(
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[CV] END …alpha=22, l1_ratio=0.9; total time=    0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 684991890261.4104, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=22, l1_ratio=0.9; total time=    0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 484678318655.48047, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=22, l1_ratio=0.95; total time=    0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 409814350144.9557, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=22, l1_ratio=0.95; total time=    0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 511880407353.2757, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=22, l1_ratio=0.95; total time=    0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 498564929896.06616, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=22, l1_ratio=0.95; total time=    0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 371845782427.0448, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=22, l1_ratio=0.95; total time=    0.4s
[CV] END …alpha=22, l1_ratio=0.99; total time=    0.0s
[CV] END …alpha=22, l1_ratio=0.99; total time=    0.0s
[CV] END …alpha=22, l1_ratio=0.99; total time=    0.0s
[CV] END …alpha=22, l1_ratio=0.99; total time=    0.0s
[CV] END …alpha=22, l1_ratio=0.99; total time=    0.0s
```

```
[CV] END …alpha=22, l1_ratio=1.0; total time=    0.2s
[CV] END …alpha=22, l1_ratio=1.0; total time=    0.0s
[CV] END …alpha=22, l1_ratio=1.0; total time=    0.2s
[CV] END …alpha=22, l1_ratio=1.0; total time=    0.1s
[CV] END …alpha=22, l1_ratio=1.0; total time=    0.1s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 753324989961.1138, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=24, l1_ratio=0.9; total time=    0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 724112150975.1445, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=24, l1_ratio=0.9; total time=    0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 827697835556.8778, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=24, l1_ratio=0.9; total time=    0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 807019556720.6278, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=24, l1_ratio=0.9; total time=    0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 690074462979.8518, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=24, l1_ratio=0.9; total time=    0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 489702686616.4783, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=24, l1_ratio=0.95; total time=    0.4s
```

```
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 415016239322.28864, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=24, l1_ratio=0.95; total time=   0.5s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 516733633228.07837, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=24, l1_ratio=0.95; total time=   0.5s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 503250332197.701, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=24, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 375998370252.06995, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=24, l1_ratio=0.95; total time=   0.4s
[CV] END …alpha=24, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=24, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=24, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=24, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=24, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=24, l1_ratio=1.0; total time=   0.2s
[CV] END …alpha=24, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=24, l1_ratio=1.0; total time=   0.2s
[CV] END …alpha=24, l1_ratio=1.0; total time=   0.2s
[CV] END …alpha=24, l1_ratio=1.0; total time=   0.1s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 758032845435.9791, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=26, l1_ratio=0.9; total time=   0.6s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
```

```
Duality gap: 728793659557.6989, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=26, l1_ratio=0.9; total time=   0.5s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 832402823229.4955, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=26, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 811613048709.0248, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=26, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 694455696337.6937, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=26, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 494151018154.2243, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=26, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 419614266631.9477, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=26, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 520985711191.05255, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=26, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
```

Objective did not converge. You might want to increase the number of iterations.
Duality gap: 507358179876.87134, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=26, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 379704867650.79443, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=26, l1_ratio=0.95; total time=   0.4s
[CV] END …alpha=26, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=26, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=26, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=26, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=26, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=26, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=26, l1_ratio=1.0; total time=   0.0s
[CV] END …alpha=26, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=26, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=26, l1_ratio=1.0; total time=   0.1s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 762132569717.4592, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=28, l1_ratio=0.9; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 732844557981.0322, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=28, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 836471759485.703, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=28, l1_ratio=0.9; total time=   0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 815577276185.4133, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

```
[CV] END …alpha=28, l1_ratio=0.9; total time=    0.3s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 698249043828.739, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=28, l1_ratio=0.9; total time=    0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 498102409117.4171, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=28, l1_ratio=0.95; total time=    0.5s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 423715287864.7682, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=28, l1_ratio=0.95; total time=    0.5s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 524725865902.90283, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=28, l1_ratio=0.95; total time=    0.6s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 510970662679.35455, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=28, l1_ratio=0.95; total time=    0.5s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 383022089270.1826, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=28, l1_ratio=0.95; total time=    0.6s
[CV] END …alpha=28, l1_ratio=0.99; total time=    0.0s
[CV] END …alpha=28, l1_ratio=0.99; total time=    0.0s
[CV] END …alpha=28, l1_ratio=0.99; total time=    0.0s
[CV] END …alpha=28, l1_ratio=0.99; total time=    0.0s
[CV] END …alpha=28, l1_ratio=0.99; total time=    0.0s
```

```
[CV] END …alpha=28, l1_ratio=1.0; total time=   0.2s
[CV] END …alpha=28, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=28, l1_ratio=1.0; total time=   0.2s
[CV] END …alpha=28, l1_ratio=1.0; total time=   0.2s
[CV] END …alpha=28, l1_ratio=1.0; total time=   0.1s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 765716788287.7736, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=30, l1_ratio=0.9; total time=   0.5s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 736360677539.6583, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=30, l1_ratio=0.9; total time=   0.5s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 840005730401.5388, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=30, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 819018153876.9548, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=30, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 701544475374.3324, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=30, l1_ratio=0.9; total time=   0.6s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 501628893397.226, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=30, l1_ratio=0.95; total time=    0.7s
```

```
C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 427368747181.8229, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=30, l1_ratio=0.95; total time=   0.6s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 528026534387.9383, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=30, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 514161535378.91626, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=30, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 385997007469.5862, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=30, l1_ratio=0.95; total time=   0.4s
[CV] END …alpha=30, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=30, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=30, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=30, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=30, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=30, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=30, l1_ratio=1.0; total time=   0.0s
[CV] END …alpha=30, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=30, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=30, l1_ratio=1.0; total time=   0.1s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 768863049012.2845, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=32, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
```

```
Duality gap: 739427666852.7379, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=32, l1_ratio=0.9; total time=   0.5s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 843083124938.6581, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=32, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 822016210067.9722, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=32, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 704414235881.3082, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=32, l1_ratio=0.9; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 504785893963.6347, tolerance: 1355206692.5276787
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=32, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 430621138104.3981, tolerance: 1307913805.6588454
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=32, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 530946074005.8925, tolerance: 1415056940.006106
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=32, l1_ratio=0.95; total time=   0.4s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
```

```
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 516983312776.9459, tolerance: 1438198040.088288
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=32, l1_ratio=0.95; total time=   0.6s

C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\linear_model\_coordinate_descent.py:530: ConvergenceWarning:
Objective did not converge. You might want to increase the number of iterations.
Duality gap: 388669248588.2582, tolerance: 1345680018.2551236
  model = cd_fast.enet_coordinate_descent(

[CV] END …alpha=32, l1_ratio=0.95; total time=   0.7s
[CV] END …alpha=32, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=32, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=32, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=32, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=32, l1_ratio=0.99; total time=   0.0s
[CV] END …alpha=32, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=32, l1_ratio=1.0; total time=   0.0s
[CV] END …alpha=32, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=32, l1_ratio=1.0; total time=   0.1s
[CV] END …alpha=32, l1_ratio=1.0; total time=   0.1s
```

```
[29]: GridSearchCV(cv=5, estimator=ElasticNet(),
                   param_grid={'alpha': array([ 8, 10, 12, 14, 16, 18, 20, 22, 24, 26,
      28, 30, 32]),
                               'l1_ratio': [0.9, 0.95, 0.99, 1.0]},
                   scoring='neg_mean_squared_error', verbose=2)
```

```
[30]: new_grid.best_params_
```

```
[30]: {'alpha': 14, 'l1_ratio': 1.0}
```

Therefore, we will use an alpha value of either 14 or 16 in the elastic net regression model. The alpha is simply a constant that multiplies the penalty terms. If we use an alpha of 0, this is equal to normal linear regression.

For reference, the scikit-learn documentation says that the l1_ratio is the "the ElasticNet mixing parameter, with 0 <= l1_ratio <= 1. For l1_ratio = 0 the penalty is an L2 penalty. For l1_ratio = 1 it is an L1 penalty. For 0 < l1_ratio < 1, the penalty is a combination of L1 and L2." Therefore, with an l1_ratio of 1.0, we are using the pure L1 penalty method (Lasso).

Elastic Net Model Predictions

```
[62]: from sklearn.metrics import mean_squared_error, mean_absolute_error
```

```
[26]: # alpha = 16
      y_pred = grid.predict(X_test)
      mae = mean_absolute_error(y_test, y_pred)
```

```
rmse = np.sqrt(mean_squared_error(y_test, y_pred))

print(f'MAE:  ${round(mae, 2)}')
print(f'RMSE: ${round(rmse, 2)}')
```

```
MAE:  $14197.05
RMSE: $20172.62
```

[31]:
```
# alpha = 14
new_pred = new_grid.predict(X_test)
new_mae = mean_absolute_error(y_test, new_pred)
new_rmse = np.sqrt(mean_squared_error(y_test, new_pred))

print(f'MAE:  ${round(new_mae, 2)}')
print(f'RMSE: ${round(new_rmse, 2)}')
```

```
MAE:  $14216.35
RMSE: $20225.65
```

[27]:
```
# what was the mean sale price in our dataset?
mean_price = np.mean(df['SalePrice'])
print( "Mean Sale Price: $", round(mean_price, 2) )
```

```
Mean Sale Price: $ 180815.54
```

[32]:
```
# percent error
print("Elastic Net Percent Error: ")
print("MAE:", round( 100 * (mae / mean_price), 2), "%" )
print("RMSE:", round( 100 * (rmse / mean_price), 2), "%" )
```

```
Elastic Net Percent Error:
MAE: 7.85 %
RMSE: 11.16 %
```

Plot the predicted values versus the actual known values for the target prices (y_test):

In order to test various models, I created this function so that we can produce the same plot as the one above and automatically compute the mean absolute error and mean squared error:

[96]:
```
def run_model(model, X_train, y_train, X_test, y_test):

    # FIT MODEL TRAINING
    model.fit(X_train, y_train)

    # GET METRICS
    y_pred = model.predict(X_test)
    rmse = np.sqrt(mean_squared_error(y_test, y_pred))
    mae = mean_absolute_error(y_test, y_pred)
    print(f'MAE:  ${round(mae, 2)}')
```

```python
        print(f'RMSE: ${round(rmse, 2)}')

        # PLOT PREDICTIONS VS TARGET
        plt.figure(figsize=(4,4), dpi=100)
        sns.scatterplot(x=y_test, y=y_pred, alpha=0.5, color='black')
        plt.xticks(rotation=45)
        plt.xlabel('Actual Sale Price (Target)')
        plt.ylabel('Predicted House Value')
#       plt.title('Predicted House Price VS Actual Sale Price', fontsize=12)

        # PLOT THE PERFECT RELATIONSHIP LINE
        x_line = [np.min(y_test), np.max(y_test)]
        y_line = [np.min(y_test), np.max(y_test)]
        plt.plot(x_line, y_line, 'r-', label='Ideal Fit')
        plt.legend()

        # SAVE THE FIGURE
        plt.tight_layout()
        plt.savefig('linear_house_model_results.png', dpi=200)
        plt.show()
```

```python
[99]:  net_model = ElasticNet(alpha=16, l1_ratio=1, max_iter=100000)
       run_model(net_model, X_train, y_train, X_test, y_test)
```

```
MAE:  $14197.05
RMSE: $20172.62
```
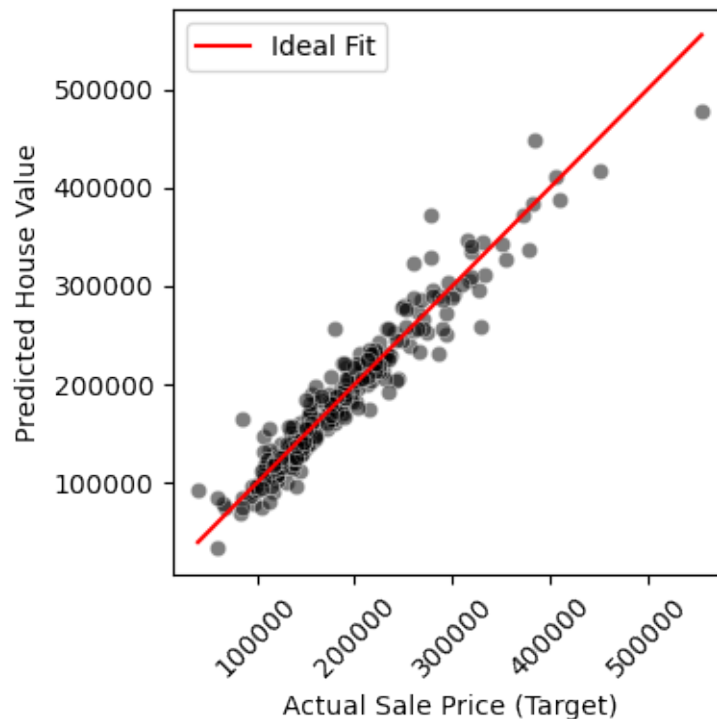
1.0.4 Model 2: Ordinary Linear Regression

```
[82]: from sklearn.linear_model import LinearRegression
```

```
[98]: lin_model = LinearRegression()
      run_model(lin_model, X_train_scaled, y_train, X_test_scaled, y_test)
```

```
MAE:  $14576.7
RMSE: $20849.78
```
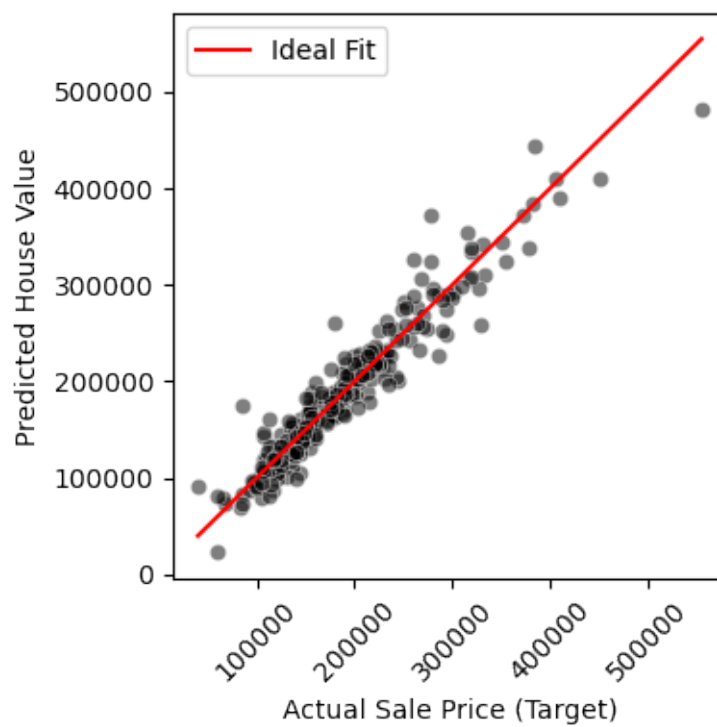

1.0.5 Model 3: Lasso Regression Only

Lasso regularization allows for a sort of "automatic" feature selection as some of the model coefficients could become exactly zero when using Lasso for regression.

```
[41]: from sklearn.linear_model import LassoCV
```

```
[42]:
```

```
# use Lasso cross-validation for regression on 10 folds (testing several alpha␣
 ↪values)
lasso_model = LassoCV(eps=0.0001, n_alphas=256, cv=10, max_iter=1000000)
lasso_model.fit(X_train_scaled, y_train)
```

[42]: LassoCV(cv=10, eps=0.0001, max_iter=1000000, n_alphas=256)

[43]:
```
# the best alpha hyperparameter:
lasso_model.alpha_
```

[43]: 108.25071540394585

[44]:
```
# here we can clearly see how some of the model coefficients were determined to␣
 ↪be zero
lasso_coefs = pd.DataFrame(data=lasso_model.coef_,
                           index=X.columns,
                           columns=['Coefficient'])
lasso_coefs.describe()
```

[44]:
```
          Coefficient
count     273.000000
mean      313.295164
std      2778.847641
min    -10623.600355
25%      -346.885720
50%         0.000000
75%       605.984548
max     28127.643257
```

[45]:
```
# display the coefficients equal to zero only
lasso_coefs[ lasso_coefs['Coefficient'] == 0.0 ]
```

[45]:
```
                        Coefficient
Bsmt Unf SF                    -0.0
1st Flr SF                      0.0
TotRms AbvGrd                   0.0
Garage Yr Blt                  -0.0
3Ssn Porch                     -0.0
…                                 …
Garage Cond_None                0.0
Garage Cond_TA                  0.0
Paved Drive_Y                   0.0
Sale Type_VWD                  -0.0
Sale Condition_Family           0.0

[68 rows x 1 columns]
```

We can see here from the table above that there are 68 coefficients that are equal to zero. This implies that 68 of the 273 features (which includes the dummy variables created during preprocessing) will not be used in the model predictions.

```
[46]: # check the accuracy of predictions on the TRAINING data
      y_pred = lasso_model.predict(X_train_scaled)
      rmse = np.sqrt(mean_squared_error(y_train, y_pred))
      mae = mean_absolute_error(y_train, y_pred)

      print(f'MAE:  ${round(mae, 2)}')
      print(f'RMSE: ${round(rmse, 2)}')
```

```
MAE:  $13443.1
RMSE: $19768.42
```

```
[47]: # check the accuracy of predictions on the TESTING data
      y_pred = lasso_model.predict(X_test_scaled)
      rmse = np.sqrt(mean_squared_error(y_test, y_pred))
      mae = mean_absolute_error(y_test, y_pred)

      print(f'MAE:  ${round(mae, 2)}')
      print(f'RMSE: ${round(rmse, 2)}')
```

```
MAE:  $14191.32
RMSE: $20554.11
```

1.0.6 Model 4: Ridge Regression Only

```
[48]: from sklearn.linear_model import RidgeCV
```

```
[49]: ridge_model = RidgeCV(alphas=[1, 2, 4, 8, 16, 32, 64, 128, 256], cv=10)
      ridge_model.fit(X_train_scaled, y_train)
```

```
[49]: RidgeCV(alphas=array([  1,   2,   4,   8,  16,  32,  64, 128, 256]), cv=10)
```

```
[50]: ridge_model.alpha_
```

```
[50]: 64
```

```
[51]: y_pred = ridge_model.predict(X_test_scaled)
      rmse = np.sqrt(mean_squared_error(y_test, y_pred))
      mae = mean_absolute_error(y_test, y_pred)

      print(f'MAE:  ${round(mae, 2)}')
      print(f'RMSE: ${round(rmse, 2)}')
```

```
MAE:  $14275.03
RMSE: $20866.82
```

1.0.7 Model 5: Random Forest Regressor

```python
[101]: from sklearn.ensemble import RandomForestRegressor
```

```python
[102]: # random forest regressor model with scikit-learn default values:
       rfr_model = RandomForestRegressor()
       rfr_model.fit(X_train_scaled, y_train)
       rfr_pred = rfr_model.predict(X_test_scaled)

       rmse = np.sqrt(mean_squared_error(y_test, rfr_pred))
       mae = mean_absolute_error(y_test, rfr_pred)

       print(f'MAE:  ${round(mae, 2)}')
       print(f'RMSE: ${round(rmse, 2)}')
```

```
MAE:  $15366.47
RMSE: $21807.27
```

```python
[55]: # CREATE A PARAMETER GRID TO SEARCH FOR THE BEST HYPERPARAMETERS
      # Note: this could take a long time depending on your machine's hardware

      n_estimators = [50, 100, 200]
      max_features = ['auto', 'sqrt', 'log2', 16, 32]
      # criterion = ['mse', 'mae']
      max_depth = [2, 4, 6, 8, 10, 'None']

      param_grid = {'n_estimators': n_estimators,
                    'max_features': max_features,
      #               'criterion': criterion,
                    'max_depth': max_depth}
```

```python
[57]: rfr_grid = GridSearchCV(rfr_model, param_grid, verbose=2, cv=5)
```

```python
[58]: rfr_grid.fit(X_train_scaled, y_train)
```

```
Fitting 5 folds for each of 90 candidates, totalling 450 fits
[CV] END …max_depth=2, max_features=auto, n_estimators=50; total time=   0.2s
[CV] END …max_depth=2, max_features=auto, n_estimators=50; total time=   0.2s
[CV] END …max_depth=2, max_features=auto, n_estimators=50; total time=   0.2s
[CV] END …max_depth=2, max_features=auto, n_estimators=50; total time=   0.2s
[CV] END …max_depth=2, max_features=auto, n_estimators=50; total time=   0.2s
[CV] END …max_depth=2, max_features=auto, n_estimators=100; total time=   0.6s
[CV] END …max_depth=2, max_features=auto, n_estimators=100; total time=   0.6s
[CV] END …max_depth=2, max_features=auto, n_estimators=100; total time=   0.6s
```

```
[CV] END …max_depth=2, max_features=auto, n_estimators=100; total time=   0.6s
[CV] END …max_depth=2, max_features=auto, n_estimators=100; total time=   0.6s
[CV] END …max_depth=2, max_features=auto, n_estimators=200; total time=   1.2s
[CV] END …max_depth=2, max_features=auto, n_estimators=200; total time=   1.2s
[CV] END …max_depth=2, max_features=auto, n_estimators=200; total time=   1.2s
[CV] END …max_depth=2, max_features=auto, n_estimators=200; total time=   1.4s
[CV] END …max_depth=2, max_features=auto, n_estimators=200; total time=   1.5s
[CV] END …max_depth=2, max_features=sqrt, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=sqrt, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=sqrt, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=sqrt, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=sqrt, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=sqrt, n_estimators=100; total time=   0.1s
[CV] END …max_depth=2, max_features=sqrt, n_estimators=100; total time=   0.1s
[CV] END …max_depth=2, max_features=sqrt, n_estimators=100; total time=   0.1s
[CV] END …max_depth=2, max_features=sqrt, n_estimators=100; total time=   0.0s
[CV] END …max_depth=2, max_features=sqrt, n_estimators=100; total time=   0.0s
[CV] END …max_depth=2, max_features=sqrt, n_estimators=200; total time=   0.2s
[CV] END …max_depth=2, max_features=sqrt, n_estimators=200; total time=   0.2s
[CV] END …max_depth=2, max_features=sqrt, n_estimators=200; total time=   0.2s
[CV] END …max_depth=2, max_features=sqrt, n_estimators=200; total time=   0.2s
[CV] END …max_depth=2, max_features=sqrt, n_estimators=200; total time=   0.2s
[CV] END …max_depth=2, max_features=log2, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=log2, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=log2, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=log2, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=log2, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=log2, n_estimators=100; total time=   0.0s
[CV] END …max_depth=2, max_features=log2, n_estimators=100; total time=   0.0s
[CV] END …max_depth=2, max_features=log2, n_estimators=100; total time=   0.0s
[CV] END …max_depth=2, max_features=log2, n_estimators=100; total time=   0.0s
[CV] END …max_depth=2, max_features=log2, n_estimators=100; total time=   0.0s
[CV] END …max_depth=2, max_features=log2, n_estimators=200; total time=   0.2s
[CV] END …max_depth=2, max_features=log2, n_estimators=200; total time=   0.2s
[CV] END …max_depth=2, max_features=log2, n_estimators=200; total time=   0.2s
[CV] END …max_depth=2, max_features=log2, n_estimators=200; total time=   0.1s
[CV] END …max_depth=2, max_features=log2, n_estimators=200; total time=   0.1s
[CV] END …max_depth=2, max_features=16, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=16, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=16, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=16, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=16, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=16, n_estimators=100; total time=   0.1s
[CV] END …max_depth=2, max_features=16, n_estimators=100; total time=   0.1s
[CV] END …max_depth=2, max_features=16, n_estimators=100; total time=   0.1s
[CV] END …max_depth=2, max_features=16, n_estimators=100; total time=   0.1s
[CV] END …max_depth=2, max_features=16, n_estimators=100; total time=   0.1s
[CV] END …max_depth=2, max_features=16, n_estimators=200; total time=   0.2s
```

58

```
[CV] END …max_depth=2, max_features=16, n_estimators=200; total time=   0.3s
[CV] END …max_depth=2, max_features=16, n_estimators=200; total time=   0.2s
[CV] END …max_depth=2, max_features=16, n_estimators=200; total time=   0.2s
[CV] END …max_depth=2, max_features=16, n_estimators=200; total time=   0.2s
[CV] END …max_depth=2, max_features=32, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=32, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=32, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=32, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=32, n_estimators=50; total time=   0.0s
[CV] END …max_depth=2, max_features=32, n_estimators=100; total time=   0.1s
[CV] END …max_depth=2, max_features=32, n_estimators=100; total time=   0.1s
[CV] END …max_depth=2, max_features=32, n_estimators=100; total time=   0.1s
[CV] END …max_depth=2, max_features=32, n_estimators=100; total time=   0.1s
[CV] END …max_depth=2, max_features=32, n_estimators=100; total time=   0.1s
[CV] END …max_depth=2, max_features=32, n_estimators=200; total time=   0.2s
[CV] END …max_depth=2, max_features=32, n_estimators=200; total time=   0.2s
[CV] END …max_depth=2, max_features=32, n_estimators=200; total time=   0.2s
[CV] END …max_depth=2, max_features=32, n_estimators=200; total time=   0.3s
[CV] END …max_depth=2, max_features=32, n_estimators=200; total time=   0.4s
[CV] END …max_depth=4, max_features=auto, n_estimators=50; total time=   0.6s
[CV] END …max_depth=4, max_features=auto, n_estimators=50; total time=   0.6s
[CV] END …max_depth=4, max_features=auto, n_estimators=50; total time=   0.5s
[CV] END …max_depth=4, max_features=auto, n_estimators=50; total time=   0.5s
[CV] END …max_depth=4, max_features=auto, n_estimators=50; total time=   0.6s
[CV] END …max_depth=4, max_features=auto, n_estimators=100; total time=   1.4s
[CV] END …max_depth=4, max_features=auto, n_estimators=100; total time=   1.3s
[CV] END …max_depth=4, max_features=auto, n_estimators=100; total time=   1.5s
[CV] END …max_depth=4, max_features=auto, n_estimators=100; total time=   1.4s
[CV] END …max_depth=4, max_features=auto, n_estimators=100; total time=   1.5s
[CV] END …max_depth=4, max_features=auto, n_estimators=200; total time=   2.5s
[CV] END …max_depth=4, max_features=auto, n_estimators=200; total time=   2.4s
[CV] END …max_depth=4, max_features=auto, n_estimators=200; total time=   2.5s
[CV] END …max_depth=4, max_features=auto, n_estimators=200; total time=   2.6s
[CV] END …max_depth=4, max_features=auto, n_estimators=200; total time=   2.5s
[CV] END …max_depth=4, max_features=sqrt, n_estimators=50; total time=   0.0s
[CV] END …max_depth=4, max_features=sqrt, n_estimators=50; total time=   0.0s
[CV] END …max_depth=4, max_features=sqrt, n_estimators=50; total time=   0.0s
[CV] END …max_depth=4, max_features=sqrt, n_estimators=50; total time=   0.0s
[CV] END …max_depth=4, max_features=sqrt, n_estimators=50; total time=   0.0s
[CV] END …max_depth=4, max_features=sqrt, n_estimators=100; total time=   0.1s
[CV] END …max_depth=4, max_features=sqrt, n_estimators=100; total time=   0.1s
[CV] END …max_depth=4, max_features=sqrt, n_estimators=100; total time=   0.1s
[CV] END …max_depth=4, max_features=sqrt, n_estimators=100; total time=   0.1s
[CV] END …max_depth=4, max_features=sqrt, n_estimators=100; total time=   0.1s
[CV] END …max_depth=4, max_features=sqrt, n_estimators=200; total time=   0.2s
[CV] END …max_depth=4, max_features=sqrt, n_estimators=200; total time=   0.3s
[CV] END …max_depth=4, max_features=sqrt, n_estimators=200; total time=   0.3s
[CV] END …max_depth=4, max_features=sqrt, n_estimators=200; total time=   0.3s
```

```
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[CV] END …max_depth=10, max_features=log2, n_estimators=50; total time=    0.0s
[CV] END …max_depth=10, max_features=log2, n_estimators=50; total time=    0.0s
[CV] END ..max_depth=10, max_features=log2, n_estimators=100; total time=    0.2s
[CV] END ..max_depth=10, max_features=log2, n_estimators=100; total time=    0.2s
[CV] END ..max_depth=10, max_features=log2, n_estimators=100; total time=    0.2s
[CV] END ..max_depth=10, max_features=log2, n_estimators=100; total time=    0.2s
[CV] END ..max_depth=10, max_features=log2, n_estimators=100; total time=    0.2s
[CV] END ..max_depth=10, max_features=log2, n_estimators=200; total time=    0.4s
[CV] END ..max_depth=10, max_features=log2, n_estimators=200; total time=    0.4s
[CV] END ..max_depth=10, max_features=log2, n_estimators=200; total time=    0.6s
[CV] END ..max_depth=10, max_features=log2, n_estimators=200; total time=    0.5s
```

```
[CV] END ..max_depth=10, max_features=log2, n_estimators=200; total time=    0.4s
[CV] END …max_depth=10, max_features=16, n_estimators=50; total time=    0.1s
[CV] END …max_depth=10, max_features=16, n_estimators=50; total time=    0.4s
[CV] END …max_depth=10, max_features=16, n_estimators=50; total time=    0.2s
[CV] END …max_depth=10, max_features=16, n_estimators=50; total time=    0.1s
[CV] END …max_depth=10, max_features=16, n_estimators=50; total time=    0.1s
[CV] END …max_depth=10, max_features=16, n_estimators=100; total time=    0.3s
[CV] END …max_depth=10, max_features=16, n_estimators=100; total time=    0.3s
[CV] END …max_depth=10, max_features=16, n_estimators=100; total time=    0.2s
[CV] END …max_depth=10, max_features=16, n_estimators=100; total time=    0.2s
[CV] END …max_depth=10, max_features=16, n_estimators=100; total time=    0.3s
[CV] END …max_depth=10, max_features=16, n_estimators=200; total time=    0.6s
[CV] END …max_depth=10, max_features=16, n_estimators=200; total time=    0.6s
[CV] END …max_depth=10, max_features=16, n_estimators=200; total time=    0.6s
[CV] END …max_depth=10, max_features=16, n_estimators=200; total time=    0.9s
[CV] END …max_depth=10, max_features=16, n_estimators=200; total time=    0.8s
[CV] END …max_depth=10, max_features=32, n_estimators=50; total time=    0.2s
[CV] END …max_depth=10, max_features=32, n_estimators=50; total time=    0.2s
[CV] END …max_depth=10, max_features=32, n_estimators=50; total time=    0.2s
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[CV] END …max_depth=10, max_features=32, n_estimators=100; total time=    0.5s
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[CV] END …max_depth=10, max_features=32, n_estimators=200; total time=    1.0s
[CV] END …max_depth=10, max_features=32, n_estimators=200; total time=    1.1s
[CV] END …max_depth=10, max_features=32, n_estimators=200; total time=    1.3s
[CV] END …max_depth=10, max_features=32, n_estimators=200; total time=    1.3s
[CV] END …max_depth=10, max_features=32, n_estimators=200; total time=    1.0s
[CV] END .max_depth=None, max_features=auto, n_estimators=50; total time=    0.0s
[CV] END .max_depth=None, max_features=auto, n_estimators=50; total time=    0.0s
[CV] END .max_depth=None, max_features=auto, n_estimators=50; total time=    0.0s
[CV] END .max_depth=None, max_features=auto, n_estimators=50; total time=    0.0s
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  File "C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
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    trees = Parallel(n_jobs=self.n_jobs, verbose=self.verbose,
  File "C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
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  File "C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
```

```
packages\joblib\parallel.py", line 859, in dispatch_one_batch
    self._dispatch(tasks)
  File "C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\joblib\parallel.py", line 777, in _dispatch
    job = self._backend.apply_async(batch, callback=cb)
  File "C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\joblib\_parallel_backends.py", line 208, in apply_async
    result = ImmediateResult(func)
  File "C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
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  File "C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
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    trees = Parallel(n_jobs=self.n_jobs, verbose=self.verbose,
  File "C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\joblib\parallel.py", line 1041, in __call__
    if self.dispatch_one_batch(iterator):
  File "C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\joblib\parallel.py", line 859, in dispatch_one_batch
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    self._dispatch(tasks)
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[CV] END max_depth=None, max_features=auto, n_estimators=100; total time=   0.0s
[CV] END max_depth=None, max_features=auto, n_estimators=100; total time=   0.0s
[CV] END max_depth=None, max_features=auto, n_estimators=100; total time=   0.0s
[CV] END max_depth=None, max_features=auto, n_estimators=200; total time=   0.0s
[CV] END max_depth=None, max_features=auto, n_estimators=200; total time=   0.0s

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packages\joblib\parallel.py", line 859, in dispatch_one_batch
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[CV] END max_depth=None, max_features=auto, n_estimators=200; total time=   0.0s
[CV] END max_depth=None, max_features=auto, n_estimators=200; total time=   0.0s
[CV] END max_depth=None, max_features=auto, n_estimators=200; total time=   0.0s
[CV] END .max_depth=None, max_features=sqrt, n_estimators=50; total time=   0.0s
[CV] END .max_depth=None, max_features=sqrt, n_estimators=50; total time=   0.0s
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    if self.dispatch_one_batch(iterator):
  File "C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\joblib\parallel.py", line 859, in dispatch_one_batch
    self._dispatch(tasks)
  File "C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
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[CV] END .max_depth=None, max_features=sqrt, n_estimators=50; total time=   0.0s
[CV] END .max_depth=None, max_features=sqrt, n_estimators=50; total time=   0.0s
[CV] END max_depth=None, max_features=sqrt, n_estimators=100; total time=   0.0s
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  warnings.warn("Estimator fit failed. The score on this train-test"

[CV] END max_depth=None, max_features=sqrt, n_estimators=200; total time=   0.0s
[CV] END .max_depth=None, max_features=log2, n_estimators=50; total time=   0.0s
[CV] END .max_depth=None, max_features=log2, n_estimators=50; total time=   0.0s
[CV] END .max_depth=None, max_features=log2, n_estimators=50; total time=   0.0s
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[CV] END max_depth=None, max_features=log2, n_estimators=100; total time=   0.0s
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[CV] END max_depth=None, max_features=log2, n_estimators=200; total time=   0.0s
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    if self.dispatch_one_batch(iterator):
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[CV] END max_depth=None, max_features=log2, n_estimators=200; total time=   0.0s
[CV] END max_depth=None, max_features=log2, n_estimators=200; total time=   0.0s
[CV] END max_depth=None, max_features=log2, n_estimators=200; total time=   0.0s
[CV] END …max_depth=None, max_features=16, n_estimators=50; total time=   0.0s
[CV] END …max_depth=None, max_features=16, n_estimators=50; total time=   0.0s
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    if self.dispatch_one_batch(iterator):
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packages\joblib\parallel.py", line 859, in dispatch_one_batch
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[CV] END …max_depth=None, max_features=16, n_estimators=50; total time=   0.0s
[CV] END ..max_depth=None, max_features=16, n_estimators=100; total time=   0.0s
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[CV] END ..max_depth=None, max_features=16, n_estimators=200; total time=   0.0s
[CV] END ...max_depth=None, max_features=32, n_estimators=50; total time=   0.0s
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[CV] END ..max_depth=None, max_features=32, n_estimators=100; total time=   0.0s
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[CV] END ..max_depth=None, max_features=32, n_estimators=100; total time=   0.0s
[CV] END ..max_depth=None, max_features=32, n_estimators=100; total time=   0.0s
[CV] END ..max_depth=None, max_features=32, n_estimators=200; total time=   0.0s
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C:\Users\pbeata\anaconda3\envs\py3-TF2.0\lib\site-
packages\sklearn\model_selection\_search.py:918: UserWarning: One or more of the
test scores are non-finite: [0.6994022  0.69927963 0.69784822 0.62364063
0.63153066 0.62330554
 0.53557582 0.53160879 0.51556392 0.61669915 0.62361633 0.62543769
 0.69680363 0.69249435 0.69395109 0.83775098 0.8402021  0.84169755
 0.78741227 0.79005179 0.79321167 0.71520427 0.71743782 0.71798354
```

```
    0.79019007 0.78701918 0.79041871 0.82821862 0.83071089 0.83145012
    0.87881046 0.88099568 0.88209776 0.85147394 0.85556494 0.85219665
    0.79733499 0.80291997 0.803209   0.84866774 0.85416758 0.85092174
    0.8752552  0.8780613  0.88112726 0.89283443 0.89510365 0.89494443
    0.87975921 0.87808662 0.87773997 0.83975725 0.84240376 0.84255786
    0.87922819 0.87967431 0.88061544 0.89569962 0.8978056  0.89944645
    0.8980329  0.89883351 0.89966195 0.89363185 0.89229613 0.8926233
    0.86027174 0.86439327 0.86523161 0.88895594 0.8931033  0.89293131
    0.90363354 0.90499495 0.90623134        nan        nan        nan
           nan        nan        nan        nan        nan        nan
           nan        nan        nan        nan        nan        nan]
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[CV] END ..max_depth=None, max_features=32, n_estimators=200; total time=   0.0s
[CV] END ..max_depth=None, max_features=32, n_estimators=200; total time=   0.0s
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[58]:
```
GridSearchCV(cv=5, estimator=RandomForestRegressor(),
             param_grid={'max_depth': [2, 4, 6, 8, 10, 'None'],
                         'max_features': ['auto', 'sqrt', 'log2', 16, 32],
                         'n_estimators': [50, 100, 200]},
             verbose=2)
```

[59]:
```
# the best hyperparameters found during the grid search:
rfr_grid.best_estimator_
```

[59]:
```
RandomForestRegressor(max_depth=10, max_features=32, n_estimators=200)
```

[60]:
```
rfr_pred = rfr_grid.predict(X_test_scaled)
mae = mean_absolute_error(y_test, rfr_pred)
rmse = np.sqrt(mean_squared_error(y_test, rfr_pred))

print(f'MAE:  ${round(mae, 2)}')
print(f'RMSE: ${round(rmse, 2)}')
```

```
MAE:  $15614.91
RMSE: $21997.33
```

1.0.8 Summary of Model Performance

Model	MAE	RMSE	Notes
1. Elastic Net	\$14,197	\$20,172	Lowest RMSE
2. Linear	\$14,577	\$20,849	
3. Lasso	\$14,191	\$20,554	Lowest MAE
4. Ridge	\$14,275	\$20,867	
5. Random Forest	\$15,366	\$21,807	

The best regression model in terms of the mean absolute error (using the 10% withheld training split of data) was the Lasso model. The lowest root mean square error was the Elastic Net with an L1 ration of 1, which is essentially the same thing as pure Lasso regression. We can confirm this by comparing the mean absolute error for the Elastic Net and Lasso above as they are quite similar.

For a mean house sale price of \$180,815 across the full data set, this means that the mean average absolute error of the Lasso model relative to the average price as a percentage is only 7.8%.

The Random Forest Regressor performed the worst out of this group of regression models (relatively speaking). While Random Forests are commonly used for classification problems, scikit-learn provides a regressor based on Random Forests as well. However, if we take a closer look at the grid search results for the Random Forest Regressor, we see that using a max depth of 10 and max features of 32, the mean absolute error was \$15,615: meaning that our error only increased from \$14,191 (Lasso) to \$15,615 (Random Forest), but we only needed to use 32 features compared to the 205 needed for Lasso. *Note that when using Lasso, 68 of the coefficients dropped to zero, therefore only 273 - 68 = 205 features were included in the actual predictions.*

For a mean house sale price of \$180,815 across the full data set, this means that the mean average absolute error of the Random Forest model relative to the average price as a percentage is only 8.5%.