

A2 - Predicting Car Prices

Importing the libraries

```
In [3]: #Import necessary libraries
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import warnings
from sklearn import preprocessing
warnings.filterwarnings('ignore')
```

Loading data

```
In [4]: # Load the dataset using pandas and storing them in a dataframe variable
df = pd.read_csv('Cars.csv')
```

```
In [5]: # Displaying the first few rows of the dataframe
df.head()
```

```
Out[5]:
```

	name	year	selling_price	km_driven	fuel	seller_type	transmission	owner_type
0	Maruti Swift Dzire VDI	2014	450000	145500	Diesel	Individual	Manual	First Owner
1	Skoda Rapid 1.5 TDI Ambition	2014	370000	120000	Diesel	Individual	Manual	Second Owner
2	Honda City 2017-2020 EXi	2006	158000	140000	Petrol	Individual	Manual	Third Owner
3	Hyundai i20 Sportz Diesel	2010	225000	127000	Diesel	Individual	Manual	First Owner
4	Maruti Swift VXi BSIII	2007	130000	120000	Petrol	Individual	Manual	First Owner

```
In [6]: #Checking the statistical summary of the dataframe
df.describe()
```

Out [6]:

	year	selling_price	km_driven	seats
count	8128.000000	8.128000e+03	8.128000e+03	7907.000000
mean	2013.804011	6.382718e+05	6.981951e+04	5.416719
std	4.044249	8.062534e+05	5.655055e+04	0.959588
min	1983.000000	2.999900e+04	1.000000e+00	2.000000
25%	2011.000000	2.549990e+05	3.500000e+04	5.000000
50%	2015.000000	4.500000e+05	6.000000e+04	5.000000
75%	2017.000000	6.750000e+05	9.800000e+04	5.000000
max	2020.000000	1.000000e+07	2.360457e+06	14.000000

In [7]: *#Checking the data types and non-null values in the dataframe*
`df.info()`

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8128 entries, 0 to 8127
Data columns (total 13 columns):
#   Column                Non-Null Count  Dtype
---  -
0   name                   8128 non-null   object
1   year                   8128 non-null   int64
2   selling_price          8128 non-null   int64
3   km_driven              8128 non-null   int64
4   fuel                   8128 non-null   object
5   seller_type            8128 non-null   object
6   transmission           8128 non-null   object
7   owner                  8128 non-null   object
8   mileage                7907 non-null   object
9   engine                 7907 non-null   object
10  max_power              7913 non-null   object
11  torque                 7906 non-null   object
12  seats                  7907 non-null   float64
dtypes: float64(1), int64(3), object(9)
memory usage: 825.6+ KB
```

In [8]: *#Checking the number of rows and columns in the dataframe*
`df.shape`

Out[8]: (8128, 13)

In [9]: *#Checking the column names in the dataframe*
`df.columns`

Out[9]: Index(['name', 'year', 'selling_price', 'km_driven', 'fuel', 'seller_type',
'transmission', 'owner', 'mileage', 'engine', 'max_power', 'torque',
'seats'],
dtype='object')

In [10]: *#Checking for unique values in "owner" column*
`df['owner'].unique()`

```
Out[10]: array(['First Owner', 'Second Owner', 'Third Owner',  
              'Fourth & Above Owner', 'Test Drive Car'], dtype=object)
```

Task 1: Preparing the datasets

Create a mapping dictionary for the 'Owner' column

```
In [11]: #Mapping the owner column to numerical values.  
ownermap = {  
    "First Owner":1,  
    "Second Owner":2,  
    "Third Owner":3,  
    "Fourth & Above Owner":4,  
    "Test Drive Car":5  
}
```

```
In [12]: #Checking if the owner column exists in the dataframe and then mapping it  
if 'owner' in df.columns:  
    df['owner'] = df['owner'].map(ownermap)
```

```
In [13]: #Checking if mapping is done correctly  
df.owner.unique()
```

```
Out[13]: array([1, 2, 3, 4, 5])
```

Removing the rows of 'Fuel' column with values of LPG and CNG

```
In [14]: #Getting the count of unique values in the 'Fuel' column  
df['fuel'].unique()
```

```
Out[14]: array(['Diesel', 'Petrol', 'LPG', 'CNG'], dtype=object)
```

```
In [15]: #Storing the unique values to remove in an array  
fuel_to_remove = ['CNG', 'LPG']
```

```
In [16]: #Removing the unwanted fuel types from the dataframe  
df = df[~df['fuel'].isin(fuel_to_remove)]
```

```
In [17]: #checking if the unwanted fuel types are removed  
df['fuel'].unique()
```

```
Out[17]: array(['Diesel', 'Petrol'], dtype=object)
```

Removing "kmpl" and converting the column to numerical type for feature mileage

```
In [18]: #Getting the values of mileage column  
df['mileage'].head()
```

```
Out[18]: 0      23.4 kmpl  
        1      21.14 kmpl  
        2      17.7 kmpl  
        3      23.0 kmpl  
        4      16.1 kmpl  
        Name: mileage, dtype: object
```

```
In [19]: #Removing the "kmpl" from the mileage column  
df['mileage'] = df['mileage'].str.split( ).str[0]
```

```
In [20]: #Converting the mileage column to float type  
df['mileage'] = df['mileage'].astype(float)
```

```
In [21]: #Checking if the conversation is done correctly  
df['mileage'].dtype
```

```
Out[21]: dtype('float64')
```

Removing "CC" and converting the column to numerical type for feature engine

```
In [22]: #Getting the values of 'engine' feature column  
df['engine'].head()
```

```
Out[22]: 0      1248 CC  
        1      1498 CC  
        2      1497 CC  
        3      1396 CC  
        4      1298 CC  
        Name: engine, dtype: object
```

```
In [23]: #Removing the 'CC' from the engine column using str.split() method  
df['engine'] = df['engine'].str.split( ).str[0]
```

```
In [24]: #Verifying the changes in the engine column  
df['engine'].head()
```

```
Out[24]: 0      1248  
        1      1498  
        2      1497  
        3      1396  
        4      1298  
        Name: engine, dtype: object
```

```
In [25]: #converting the data type of engine column to float  
df['engine'] = df['engine'].astype(float)
```

```
In [26]: #verifying the data type of engine column  
df['engine'].dtype
```

```
Out[26]: dtype('float64')
```

Removing "bhp" and converting the column to numerical type for feature max_power

```
In [27]: #Getting the values of the column 'max_power'  
df['max_power'].head()
```

```
Out[27]: 0      74 bhp
         1    103.52 bhp
         2      78 bhp
         3      90 bhp
         4     88.2 bhp
         Name: max_power, dtype: object
```

```
In [28]: #Removing the 'bhp' from the max_power column using str.split() method
df['max_power'] = df['max_power'].str.split(' ').str[0]
```

```
In [29]: #Converting the data type of max_power column to float
df['max_power'] = df['max_power'].astype(float)
```

```
In [30]: #Verifying the changes
df['engine'].head()
```

```
Out[30]: 0     1248.0
         1     1498.0
         2     1497.0
         3     1396.0
         4     1298.0
         Name: engine, dtype: float64
```

```
In [31]: #Converting the mileage column to float type
df['mileage'] = df['mileage'].astype(float)
```

```
In [32]: #Verifying the changes
df['engine'].dtypes
```

```
Out[32]: dtype('float64')
```

Taking only the first word for the feature brand

```
In [33]: df.columns
```

```
Out[33]: Index(['name', 'year', 'selling_price', 'km_driven', 'fuel', 'seller_type',
               'transmission', 'owner', 'mileage', 'engine', 'max_power', 'torque',
               'seats'],
              dtype='object')
```

```
In [34]: #Renaming the column 'name' to 'brand'
df.rename(columns={'name': 'brand'}, inplace=True)
#checking the changes
df.columns
```

```
Out[34]: Index(['brand', 'year', 'selling_price', 'km_driven', 'fuel', 'seller_type',
               'transmission', 'owner', 'mileage', 'engine', 'max_power', 'torque',
               'seats'],
              dtype='object')
```

```
In [35]: #Getting information about the column 'brand'
df['brand'].head()
```

```
Out[35]: 0      Maruti Swift Dzire VDI
1      Skoda Rapid 1.5 TDI Ambition
2      Honda City 2017-2020 EXi
3      Hyundai i20 Sportz Diesel
4      Maruti Swift VXI BSIII
Name: brand, dtype: object
```

```
In [36]: #Only taking the first word from the brand column by using the str.split()
df['brand'] = df['brand'].str.split( ).str[0]
```

```
In [37]: #Verifying the changes
df['brand'].head()
```

```
Out[37]: 0      Maruti
1      Skoda
2      Honda
3      Hyundai
4      Maruti
Name: brand, dtype: object
```

Dropping the feature torque

```
In [38]: #Removing the feature 'torque' from the dataframe using the drop() method
df = df.drop(['torque'], axis=1)
```

Removing the 'Test Drive Cars' i.e. owner = 5 from the data set.

```
In [39]: #Removing the 'Owner=5' from the dataframe using the query() method
df = df.query("owner != '5'")
```

```
In [40]: #Verifying the changes on the owner column
df['owner'].unique()
```

```
Out[40]: array([1, 2, 3, 4, 5])
```

```
In [41]: #Checking the cleaned dataframe
df.head()
```

```
Out[41]:
```

	brand	year	selling_price	km_driven	fuel	seller_type	transmission	owner
0	Maruti	2014	450000	145500	Diesel	Individual	Manual	
1	Skoda	2014	370000	120000	Diesel	Individual	Manual	
2	Honda	2006	158000	140000	Petrol	Individual	Manual	
3	Hyundai	2010	225000	127000	Diesel	Individual	Manual	
4	Maruti	2007	130000	120000	Petrol	Individual	Manual	

Changing the columns 'brand', 'fuel', 'seller_type' and 'trasmission' to numerical format.

```
In [42]: #Importing the LabelEncoder from sklearn library
from sklearn.preprocessing import LabelEncoder

#Initializing the LabelEncoder
label_encoder_brand = LabelEncoder()
```

```

label_encoder_fuel = LabelEncoder()
label_encoder_seller_type = LabelEncoder()
label_encoder_transmission = LabelEncoder()

#Transforming the categorical columns using the fit_transform() method
df['brand'] = label_encoder_brand.fit_transform(df['brand'])
original_brands = label_encoder_brand.classes_.tolist()
df['fuel'] = label_encoder_fuel.fit_transform(df['fuel'])
df['seller_type'] = label_encoder_seller_type.fit_transform(df['seller_ty
df['transmission'] = label_encoder_transmission.fit_transform(df['transmi

```

In [43]: *#Checking for the changes made*
df.head()

Out [43]:

	brand	year	selling_price	km_driven	fuel	seller_type	transmission	owner
0	20	2014	450000	145500	0	1	1	1
1	27	2014	370000	120000	0	1	1	2
2	10	2006	158000	140000	1	1	1	3
3	11	2010	225000	127000	0	1	1	1
4	20	2007	130000	120000	1	1	1	1

In [44]: *#Creating a csv of the encoded data set.*
df.to_csv('le_cars_data.csv', sep = ',', index=False, encoding='utf-8 ')

Exploratory Data Analysis

In [45]: *#Seperating the numerical and categorical columns from the dataframe*
#Excluding the column 'selling_price' from the numerical columns using df

```

df_copy = df.loc[:, df.columns != 'selling_price']

#Seperating the numerical and categorical columns from the dataframe

num_cols = df_copy.select_dtypes(include=['int64', 'float64'])
cat_cols = df_copy.select_dtypes(exclude=['int64', 'float64'])

```

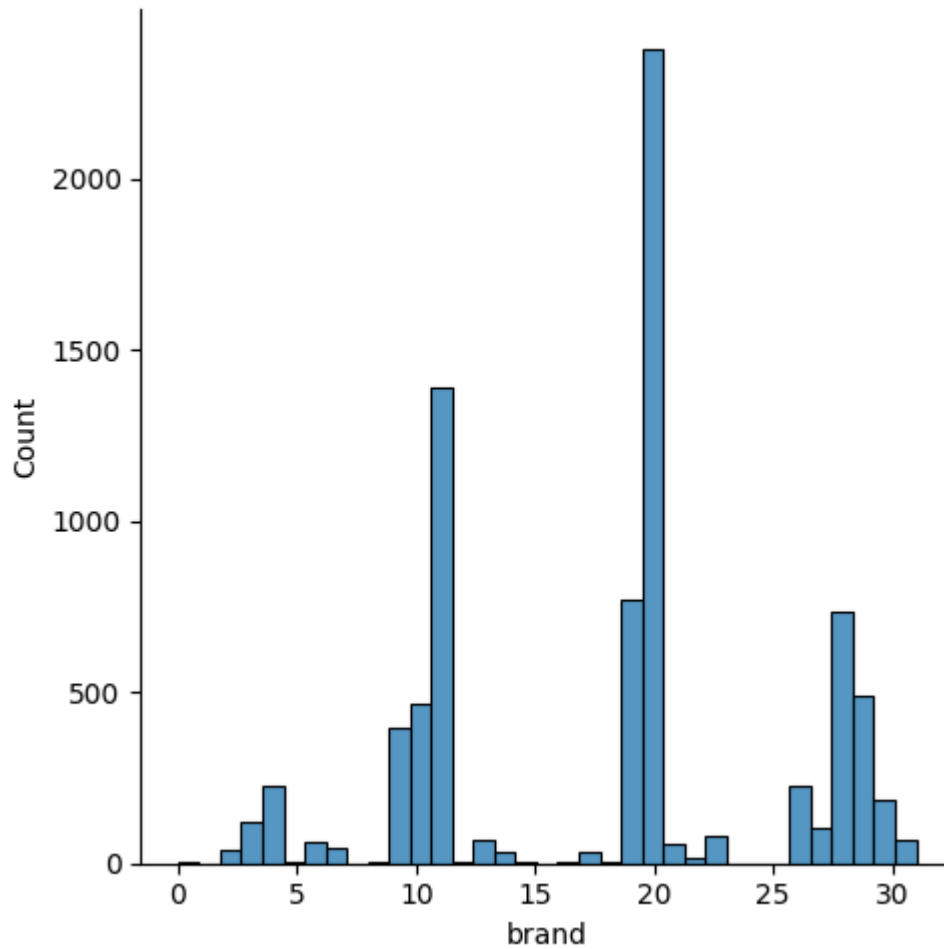
In [46]: *#Verifying the changes made to the dataset*
num_cols.columns, cat_cols.columns

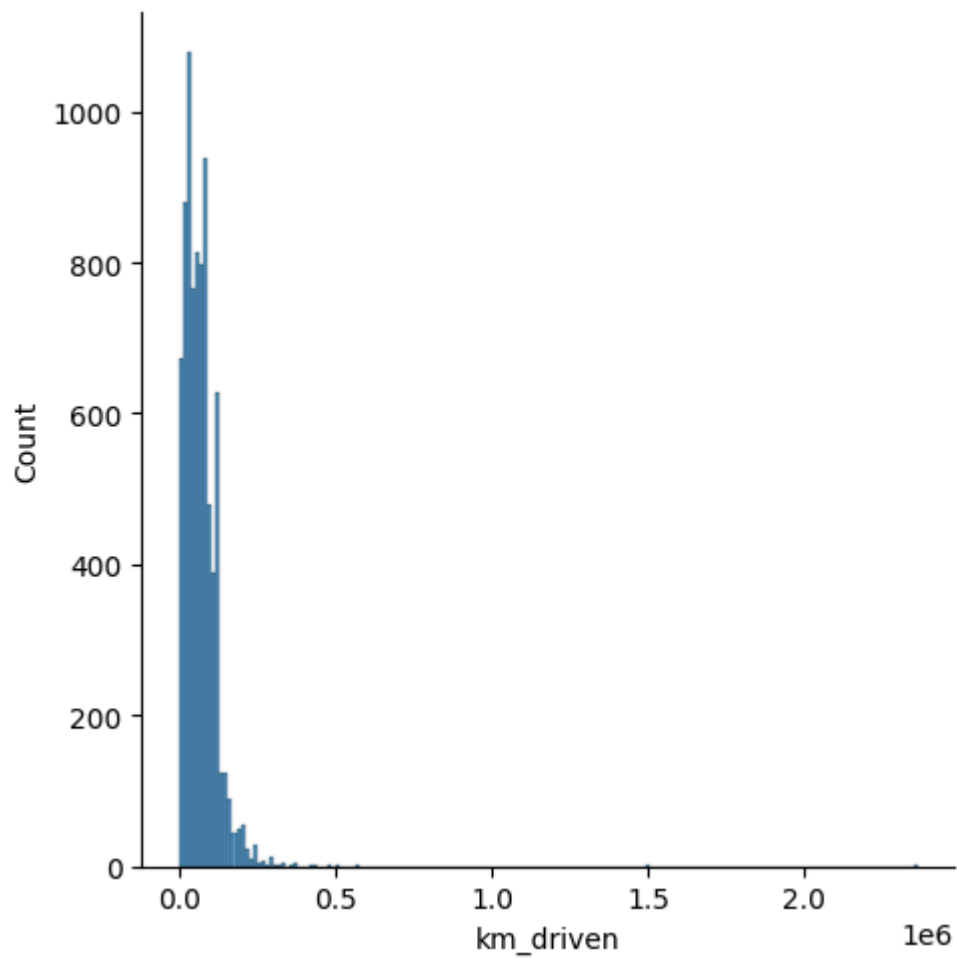
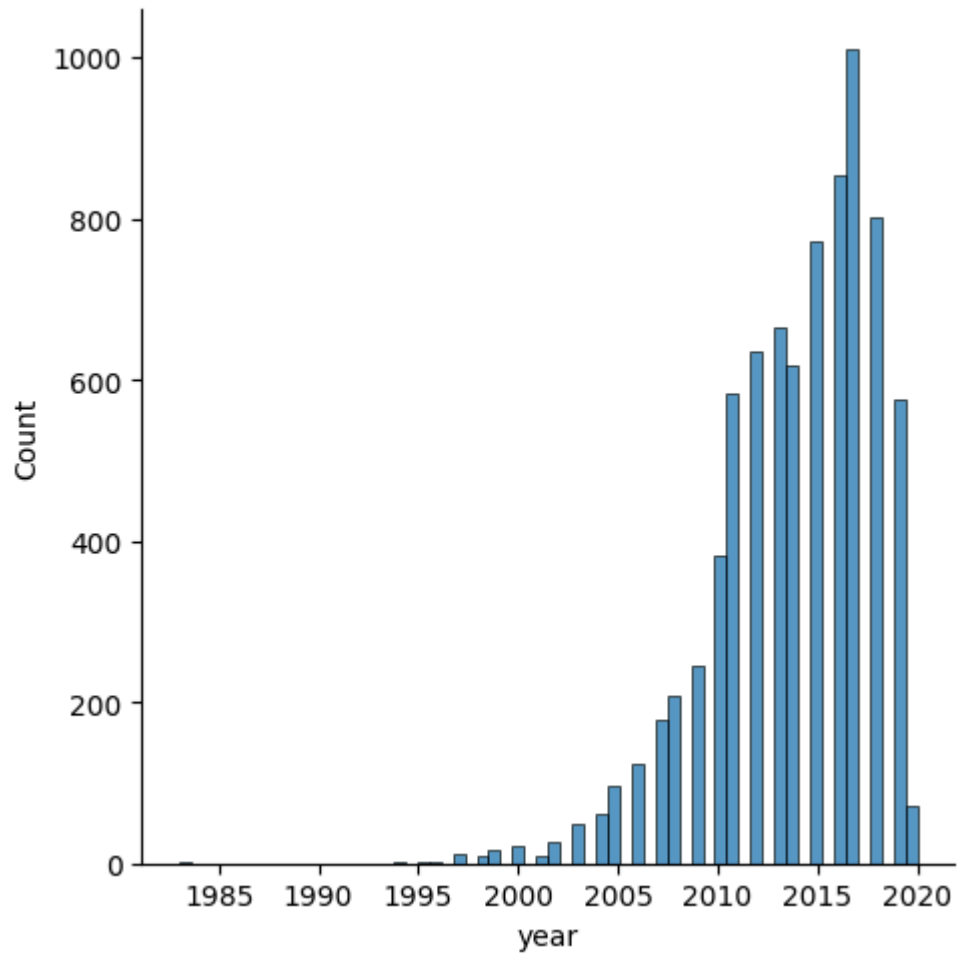
Out [46]: (Index(['brand', 'year', 'km_driven', 'fuel', 'seller_type', 'transmission',
 'owner', 'mileage', 'engine', 'max_power', 'seats'],
 dtype='object'),
 Index([], dtype='object'))

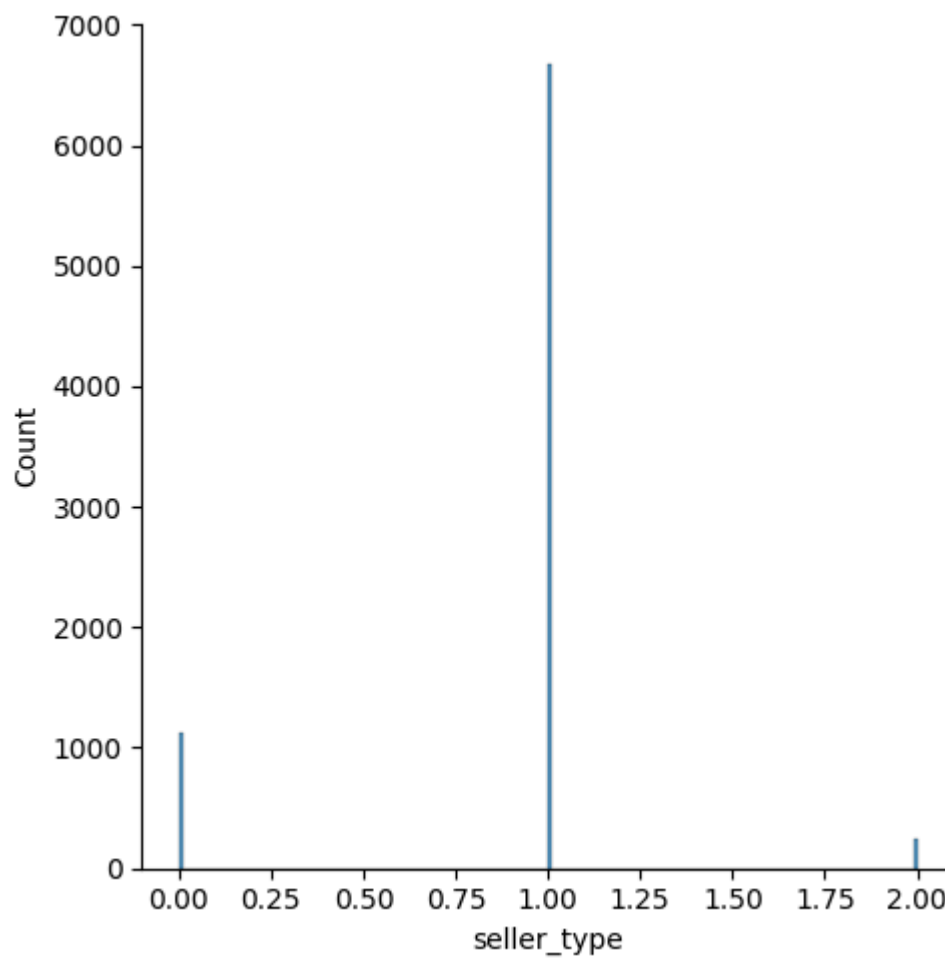
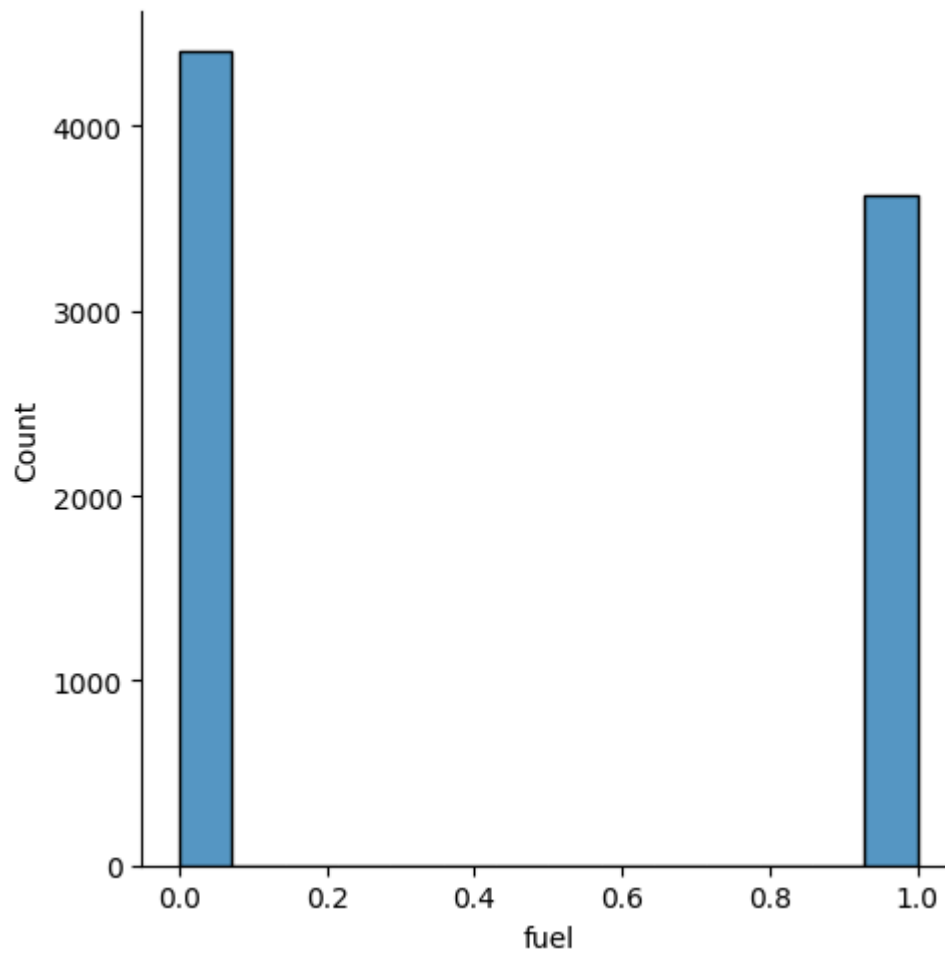
Univariate Analysis

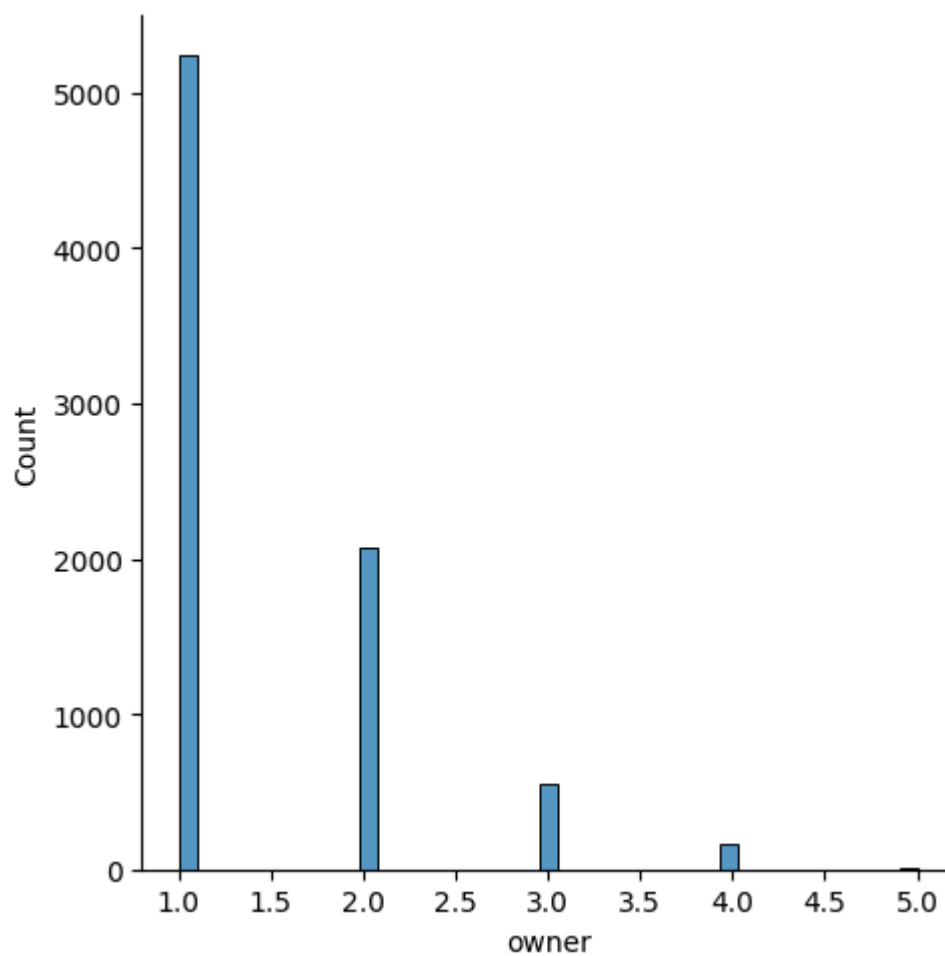
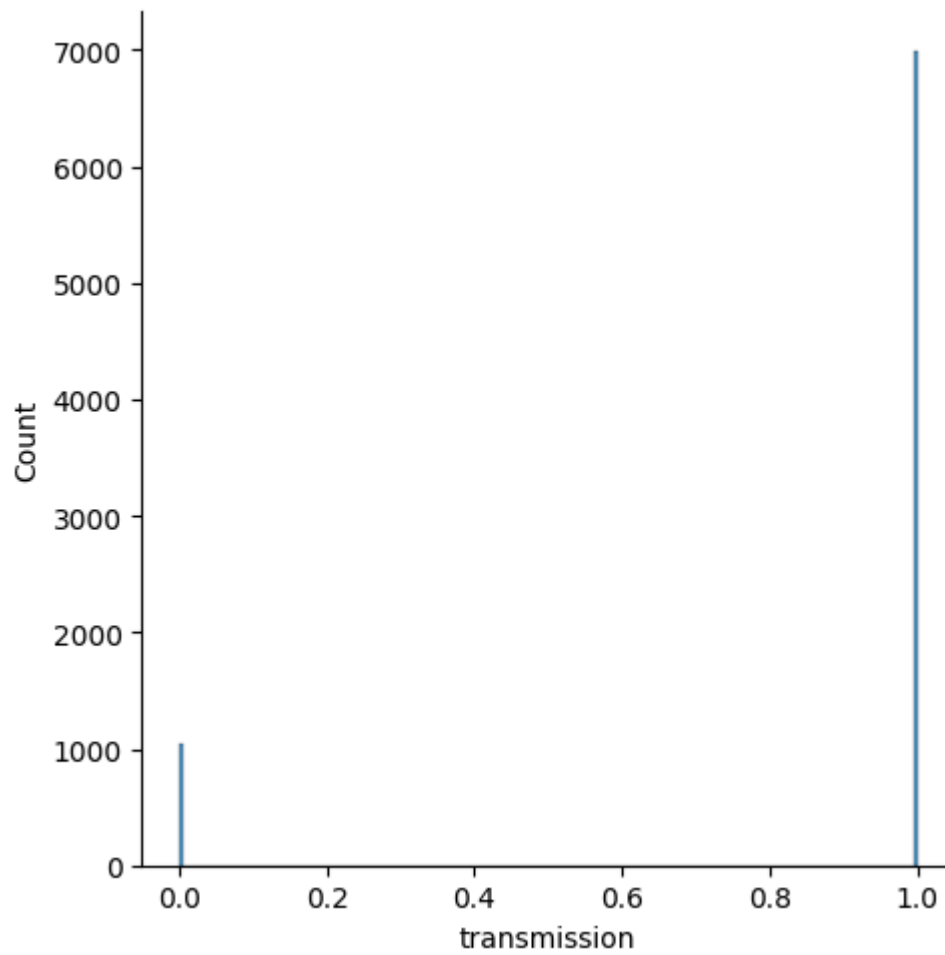
Distribution plot

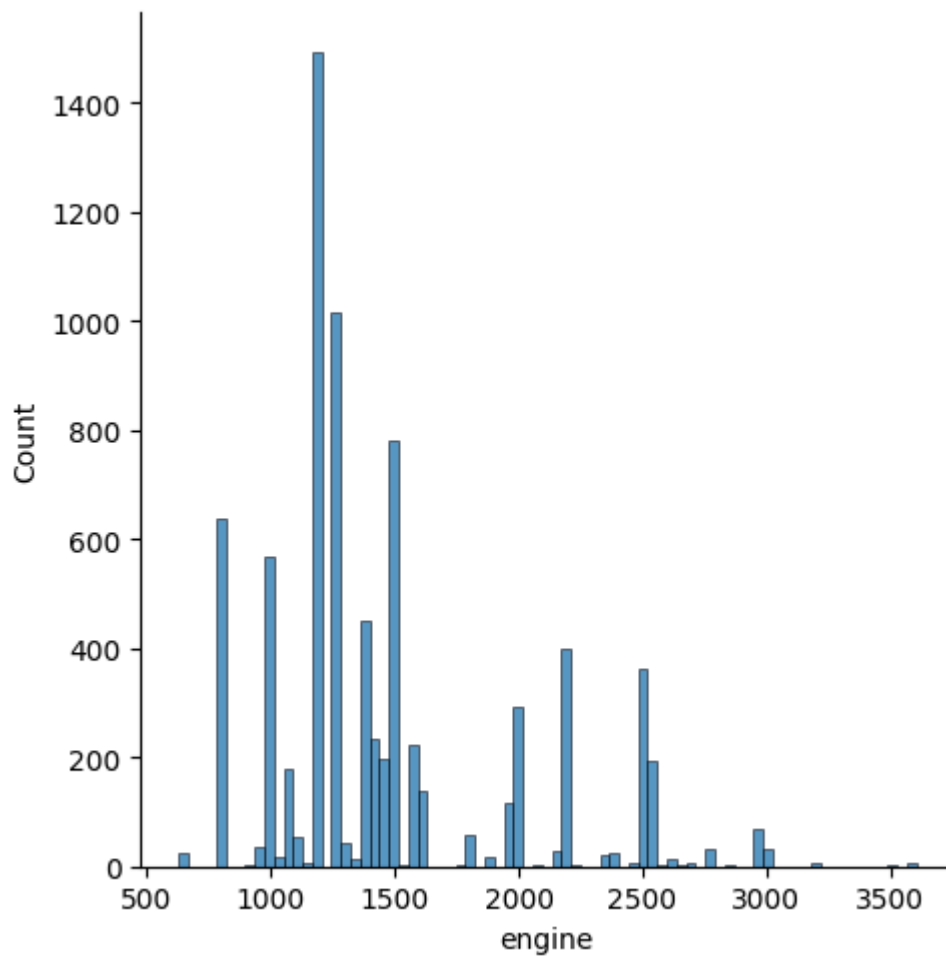
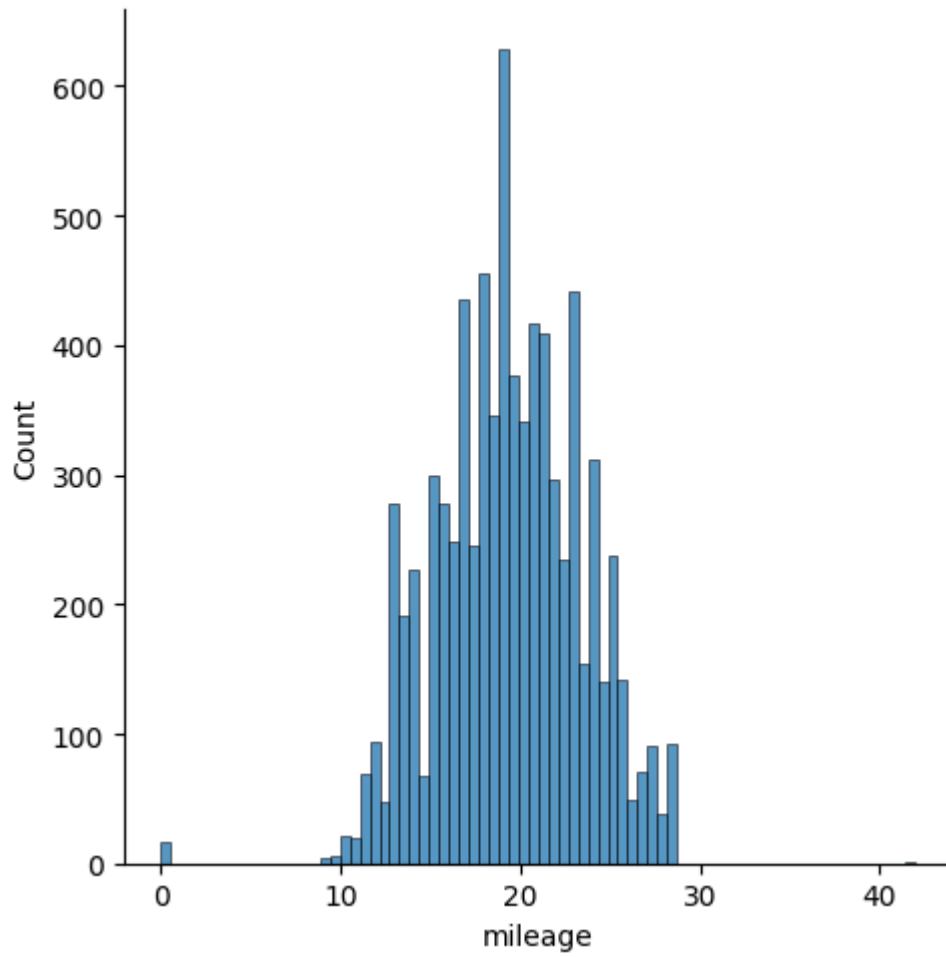
```
In [47]: #Analysing the count of all numerical colums using the distribution plot  
for col in num_cols.columns:  
    sns.displot(df, x=df[col])
```

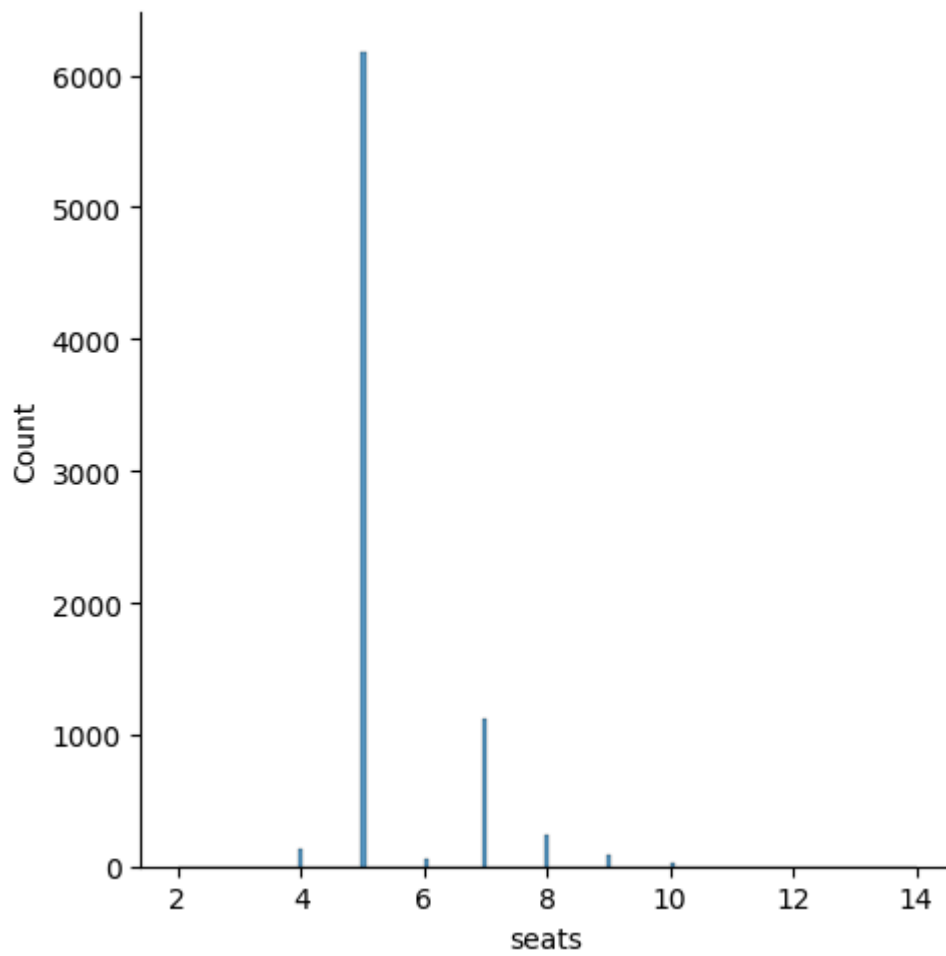
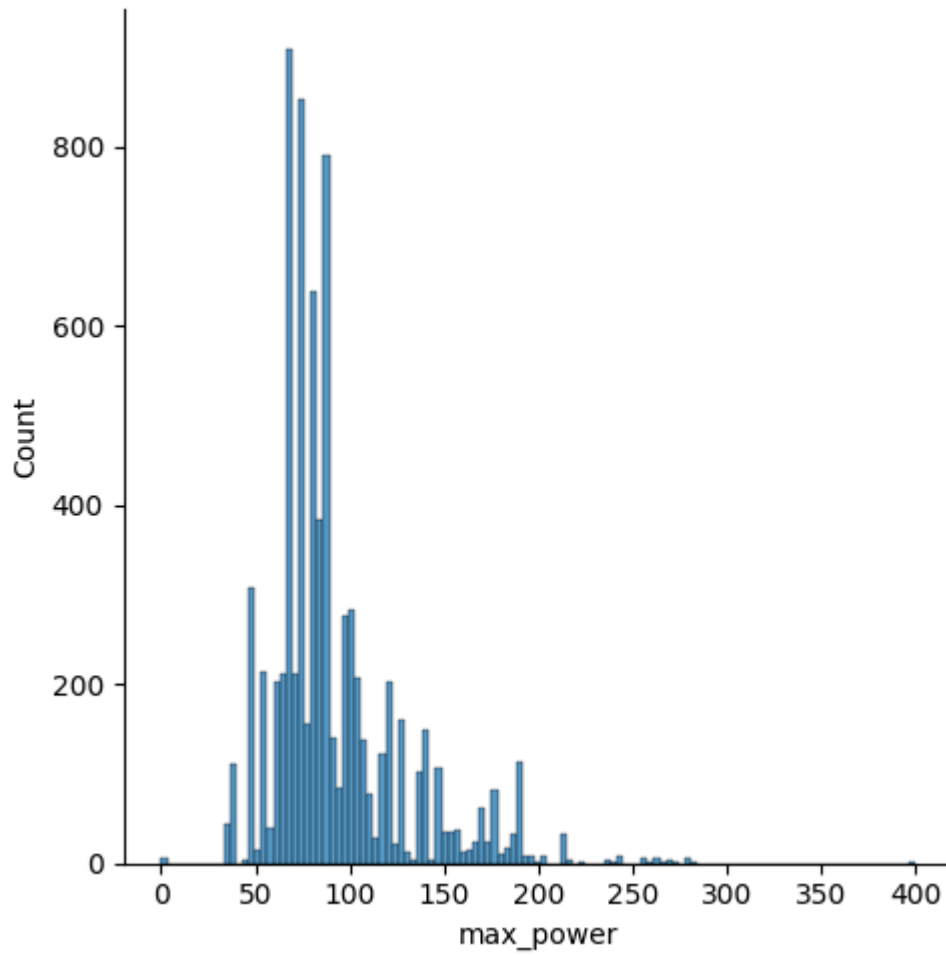










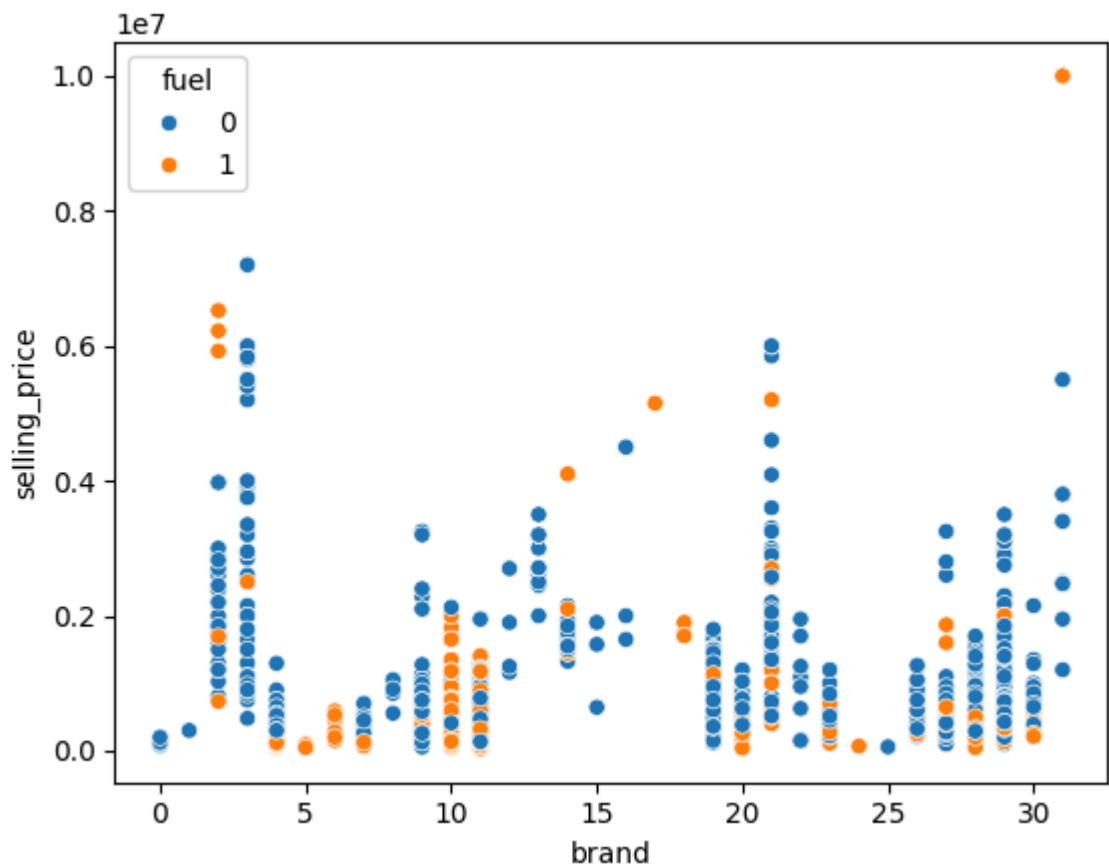


Multivariate Analysis

Scatterplot

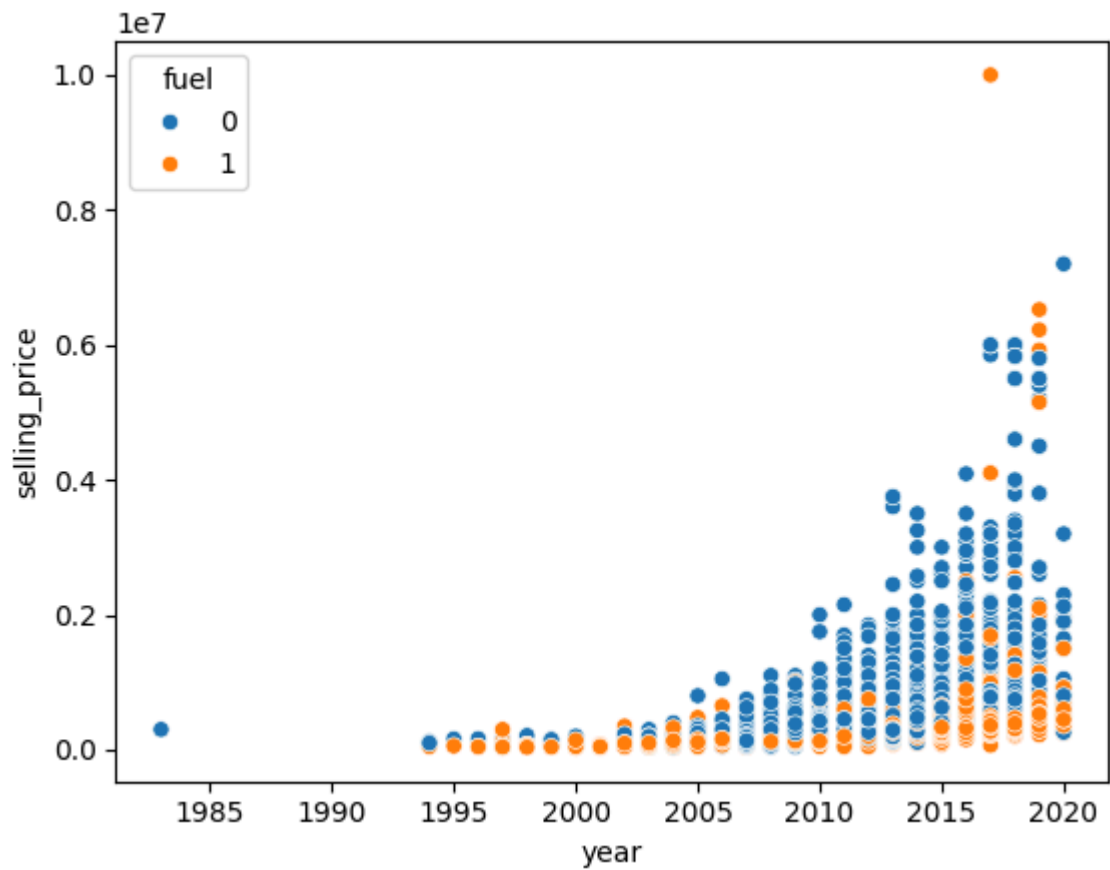
```
In [48]: #Plotting the features in the scatter plot to see the relationship between  
sns.scatterplot(x=df['brand'], y=df['selling_price'], hue=df['fuel'])
```

```
Out[48]: <Axes: xlabel='brand', ylabel='selling_price'>
```



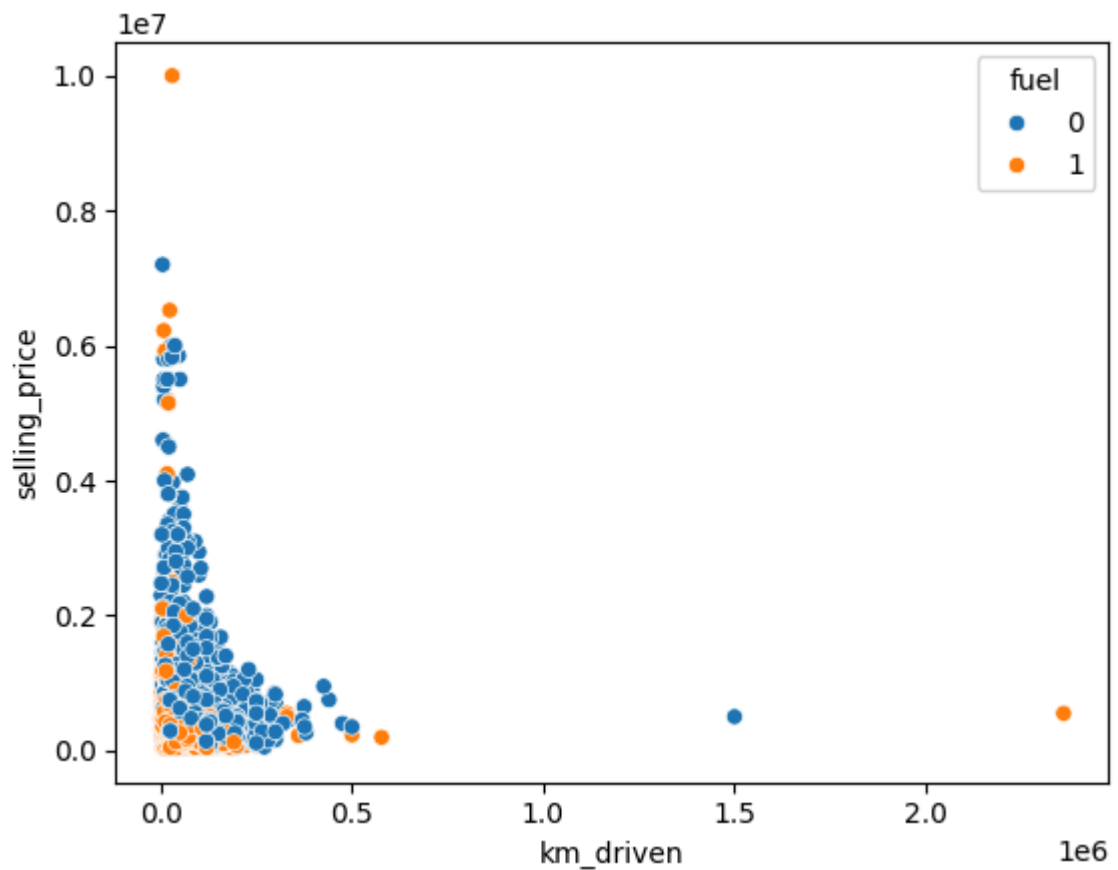
```
In [49]: sns.scatterplot(x=df['year'], y=df['selling_price'], hue=df['fuel'])
```

```
Out[49]: <Axes: xlabel='year', ylabel='selling_price'>
```



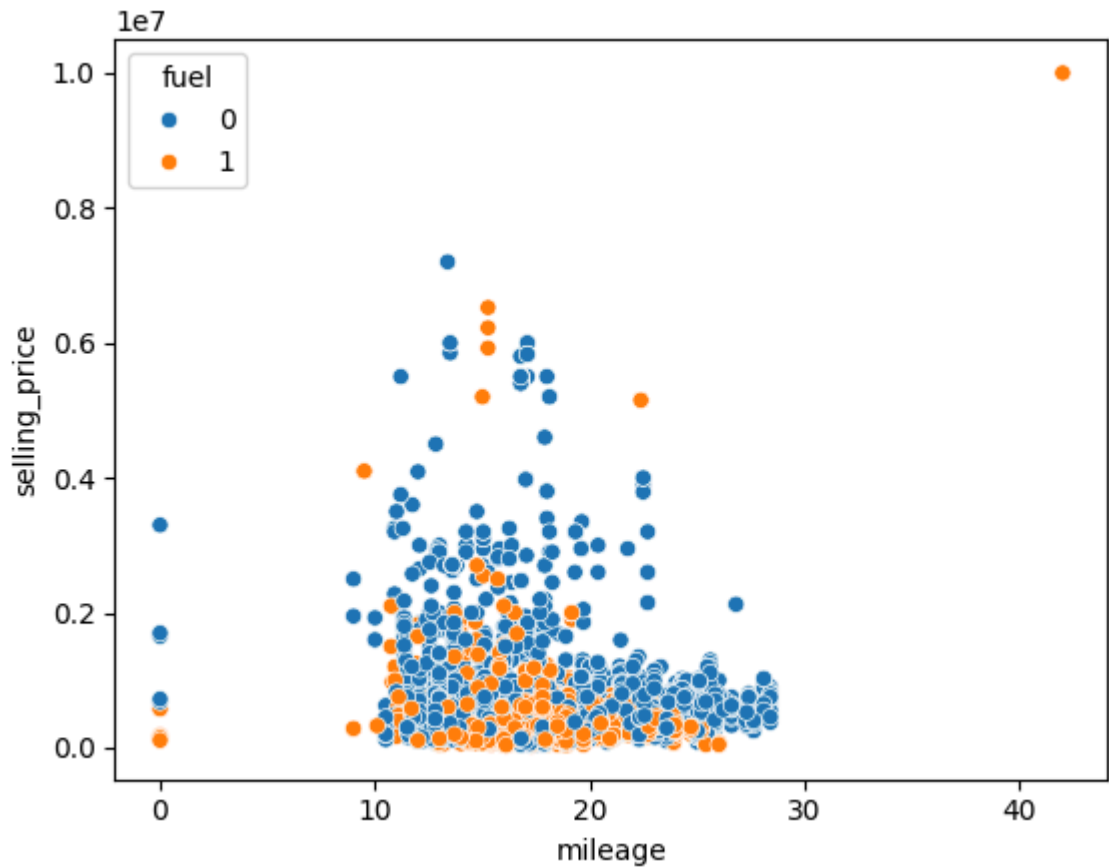
```
In [50]: sns.scatterplot(x=df['km_driven'], y=df['selling_price'], hue=df['fuel'])
```

```
Out[50]: <Axes: xlabel='km_driven', ylabel='selling_price'>
```



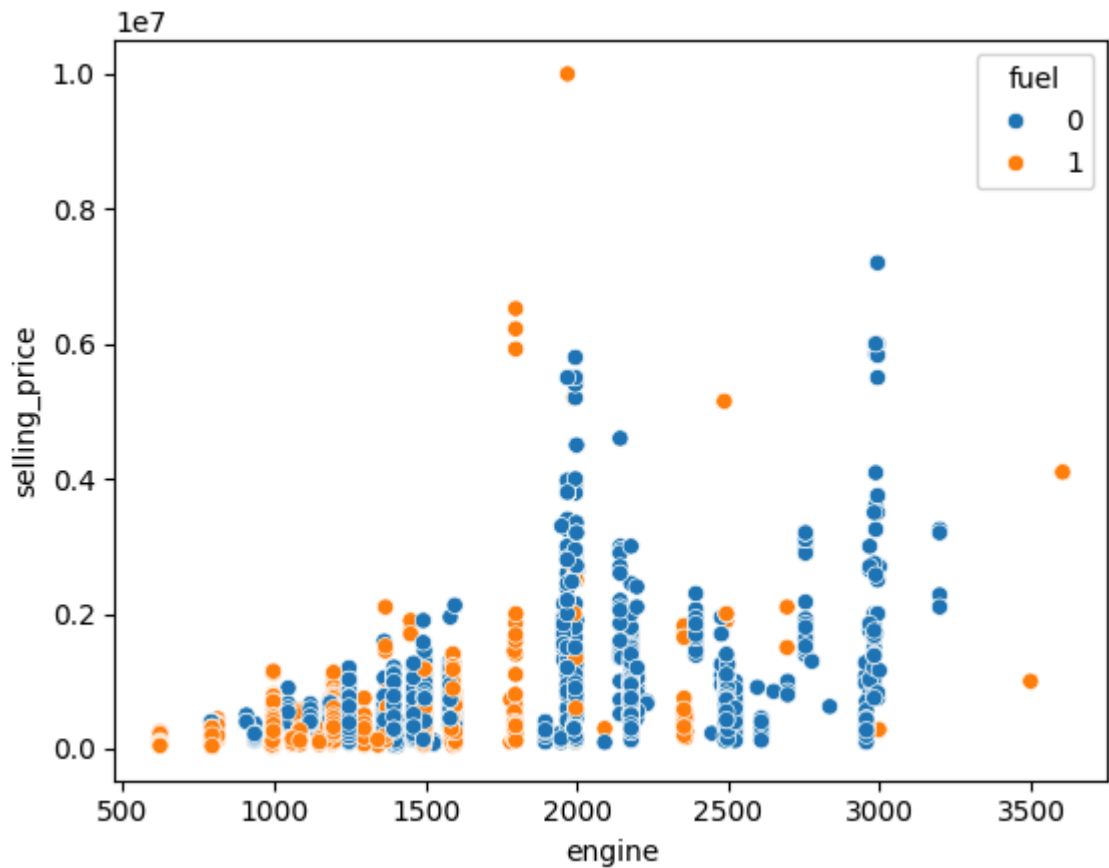
```
In [51]: sns.scatterplot(x=df['mileage'], y=df['selling_price'], hue=df['fuel'])
```

Out[51]: <Axes: xlabel='mileage', ylabel='selling_price'>



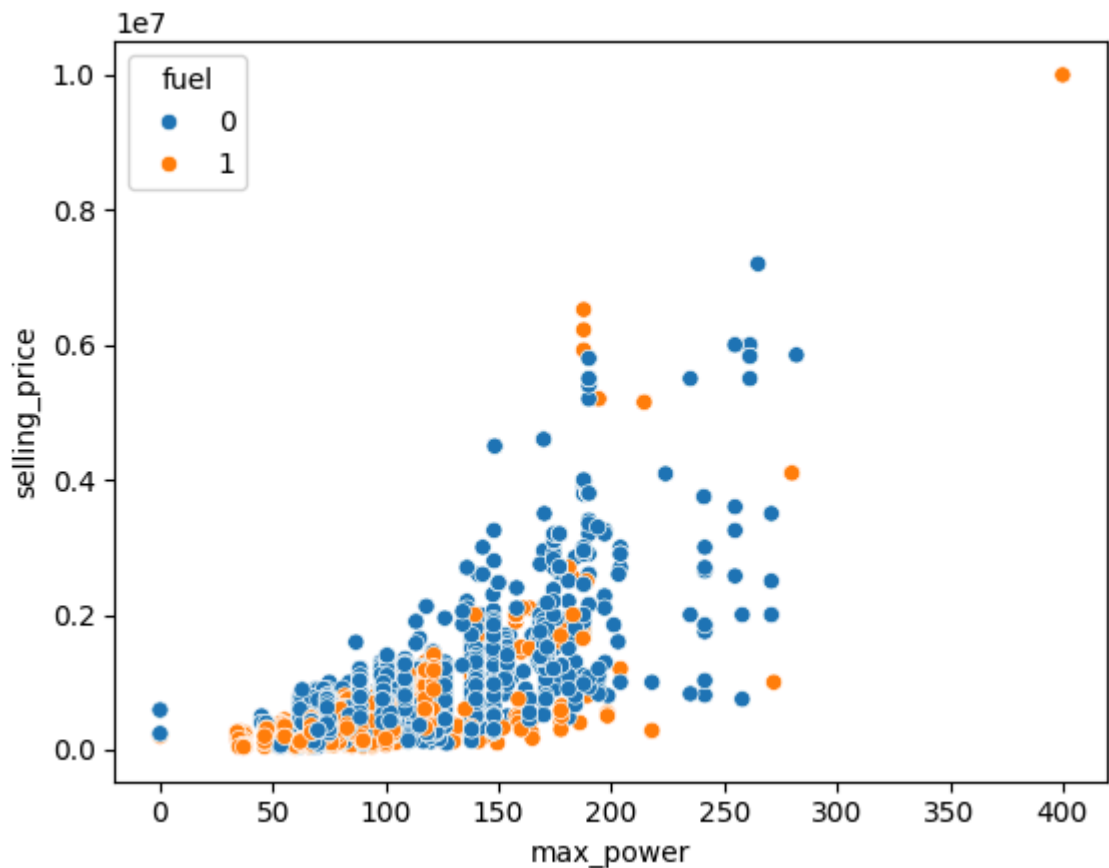
In [52]: `sns.scatterplot(x=df['engine'], y=df['selling_price'], hue=df['fuel'])`

Out[52]: <Axes: xlabel='engine', ylabel='selling_price'>



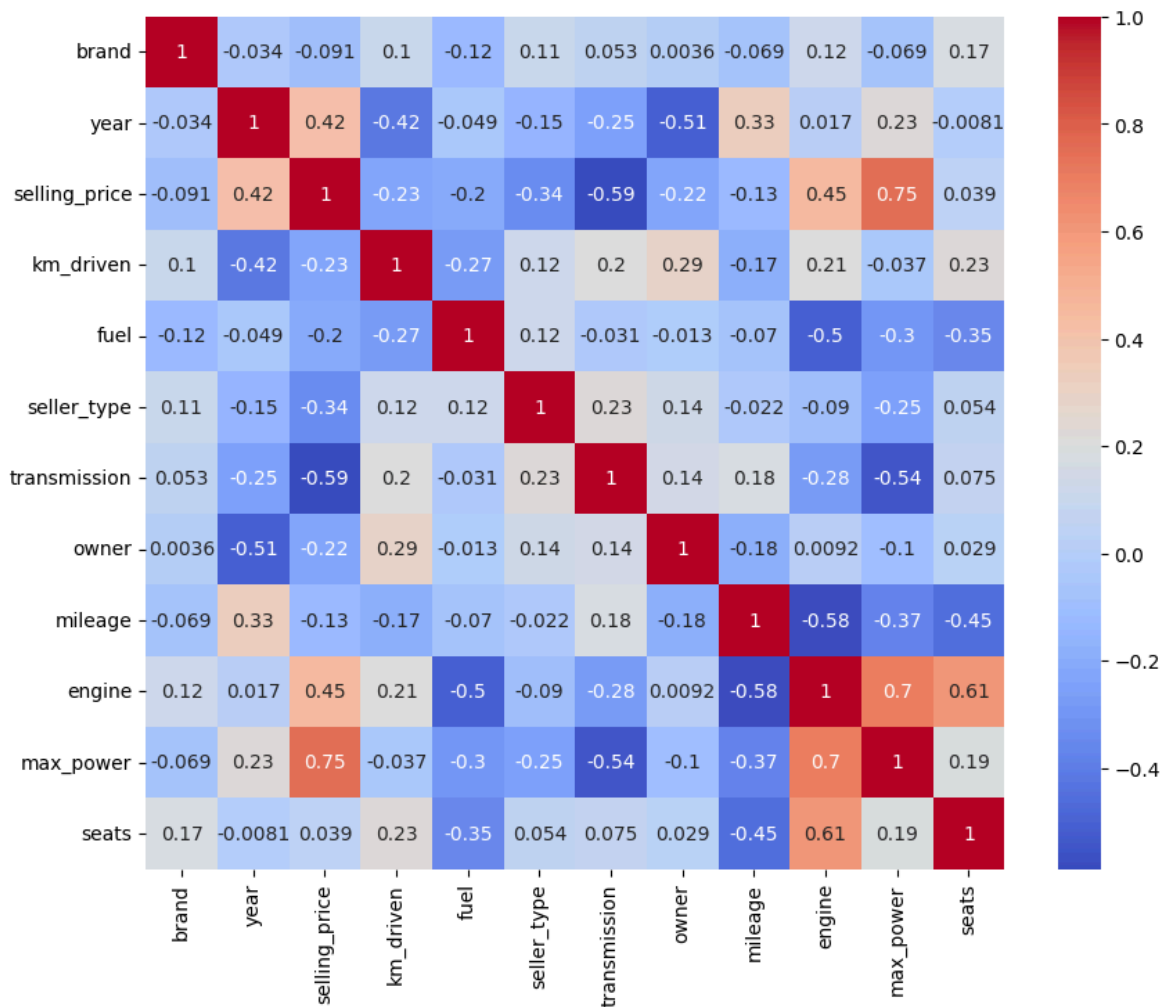

```
In [53]: sns.scatterplot(x=df['max_power'], y=df['selling_price'], hue=df['fuel'])
```

```
Out[53]: <Axes: xlabel='max_power', ylabel='selling_price'>
```



Correlation matrix

```
In [54]: plt.figure(figsize=(10,8))  
sns.heatmap(df.corr(), annot=True, cmap='coolwarm')  
plt.show()
```



Feature Selection

```
In [55]: #The important features that were selected based on the correlation and p
# Main features = max power, mileage, engine and brand

X = df[['max_power', 'mileage', 'year', 'brand']]

#Selling price is stored in variable Y, which is the target variable. Here
y = np.log(df['selling_price'])
```

Data Splitting

We are splitting the values into train set and test set.

```
In [56]: from sklearn.model_selection import train_test_split
#Splitting the dataset into training and testing sets using train_test_sp
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3,
```

Preprocessing

Checking for null values in X_train

```
In [57]: #Checking for null values in the training and testing sets  
X_train[['max_power', 'mileage', 'year', 'brand']].isnull().sum()
```

```
Out[57]: max_power      146  
         mileage      151  
         year          0  
         brand         0  
         dtype: int64
```

```
In [58]: X_test[['max_power', 'mileage', 'year', 'brand']].isnull().sum()
```

```
Out[58]: max_power      62  
         mileage      63  
         year          0  
         brand         0  
         dtype: int64
```

```
In [59]: #Checking for null values in y_train  
y_train.isnull().sum()
```

```
Out[59]: np.int64(0)
```

```
In [60]: #Checking for null values in y_train  
y_test.isnull().sum()
```

```
Out[60]: np.int64(0)
```

Finding the mean, median, and mode of the features to fill up the null values

Here only max_power and mileage have null values among the features.

```
In [61]: X_train['max_power'].median() #Finding the median of max_power because th
```

```
Out[61]: np.float64(83.1)
```

```
In [62]: X_train['mileage'].mean() #Finding the mean of mileage because the distri
```

```
Out[62]: np.float64(19.35297697368421)
```

```
In [63]: X_test['max_power'].median()
```

```
Out[63]: np.float64(82.0)
```

```
In [64]: X_test['mileage'].mean()
```

```
Out[64]: np.float64(19.47756710694504)
```

Filling the missing numerical values

Using the obtained median and mean of test and train dataset to fill in the null values.

```
In [65]: X_train['max_power'].fillna(X_train['max_power'].median(), inplace=True)
X_train['mileage'].fillna(X_train['mileage'].mean(), inplace=True)
X_test['max_power'].fillna(X_test['max_power'].median(), inplace=True)
X_test['mileage'].fillna(X_test['mileage'].mean(), inplace=True)
```

```
In [66]: #Verifying if the null values are filled in training set
X_train[['max_power', 'mileage', 'brand', 'year']].isnull().sum()
```

```
Out[66]: max_power      0
mileage      0
brand        0
year         0
dtype: int64
```

```
In [67]: #Verifying if the null values are filled in test set
X_test[['max_power', 'mileage', 'brand', 'year']].isnull().sum()
```

```
Out[67]: max_power      0
mileage      0
brand        0
year         0
dtype: int64
```

```
In [68]: #Verifying if the null values are filled in y_train and y_test
y_train.isnull().sum(), y_test.isnull().sum()
```

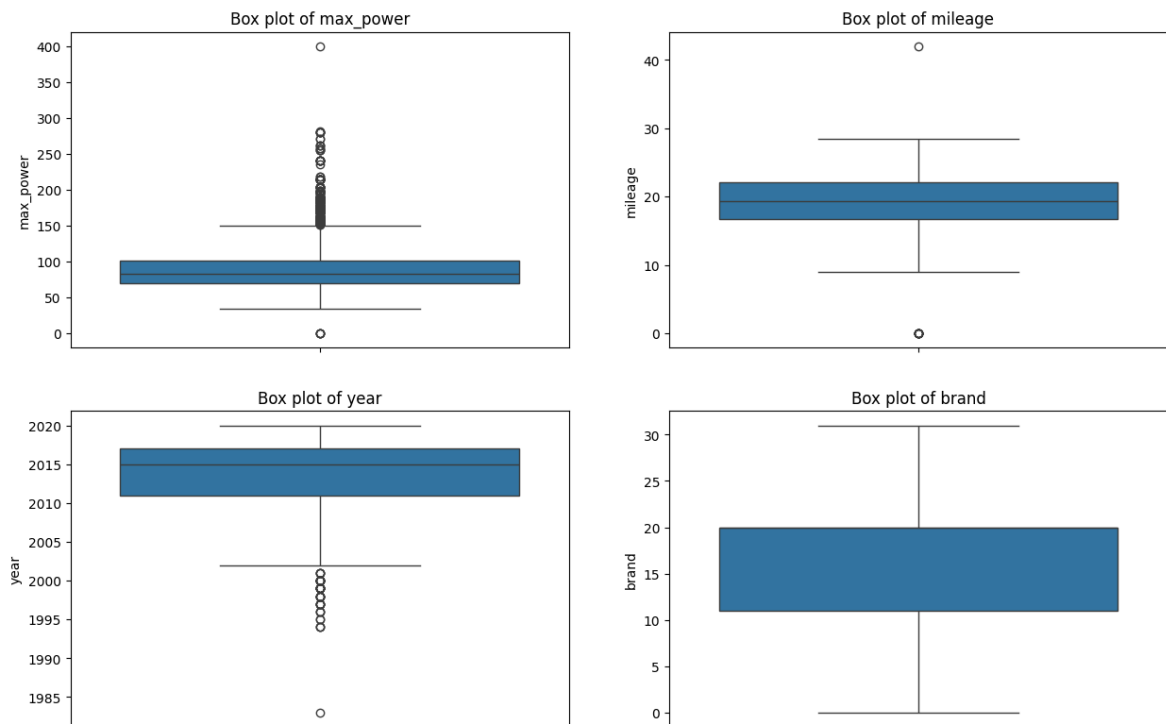
```
Out[68]: (np.int64(0), np.int64(0))
```

Checking for outliers

```
In [69]: #Checking the outliers in the training set using box plot
#Creating a dictionary to store the columns and their respective values

col_dict = {'max_power': 1, 'mileage': 2, 'year': 3, 'brand': 4}

#Using boxplot to visualize the outliers in the training set
plt.figure(figsize=(15,20))
for i, col in col_dict.items():
    plt.subplot(4,2,col)
    sns.boxplot(X_train[i])
    plt.title(f'Box plot of {i}')
plt.show()
```



In [70]: *#To check the impact of outliers on the efficiency of the model, we will*

```
def calculate_outliers(col, data=X_train):
    q75 = np.percentile(data[col], 75)
    q25 = np.percentile(data[col], 25)
    iqr = q75 - q25
    min_val = q25 - (1.5 * iqr)
    max_val = q75 + (1.5 * iqr)

    calculate_outliers = len(np.where((data[col] < min_val) | (data[col]
percentage_outliers = round(calculate_outliers / len(data) * 100, 2)

    if calculate_outliers > 0:
        print(f'Feature {col} has {calculate_outliers} outliers which is
    else:
        print(f'Feature {col} has no outliers')
```

In [71]: `for col in X_train.columns:`
`calculate_outliers(col)`

Feature max_power has 412 outliers which is 7.33% of the data
 Feature mileage has 13 outliers which is 0.23% of the data
 Feature year has 55 outliers which is 0.98% of the data
 Feature brand has no outliers

Since the percentage of the outliers are low in the dataset, we are neglecting them for analysis

Scaling the dataset

In [72]: *#Importing the library from sklearn for scaling the features, excluding t*
`from sklearn.preprocessing import MinMaxScaler`

```
num_cols = ['max_power', 'mileage', 'year']
scaler = MinMaxScaler()
X_train[num_cols] = scaler.fit_transform(X_train[num_cols])
X_test[num_cols] = scaler.transform(X_test[num_cols])
```

```
In [73]: #Verifying the changes made
print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(5623, 4)
(2410, 4)
(5623,)
(2410,)
```

Configure MLflow for experiment tracking in a Dockerized setup, and setting the experiment name and overriding the default user ID.

```
In [74]: #experiment tracking
import mlflow
import os
# This the dockerized method.
# We build two docker containers, one for python/jupyter and another for
# The url 'mlflow' is resolved into another container within the same com
#mlflow.set_tracking_uri("http://localhost:5000")
# In the dockerized way, the user who runs this code will be 'root'.
# The MLflow will also log the run user_id as 'root'.
# To change that, we need to set this environ["LOGNAME"] to your name.
os.environ["LOGNAME"] = "anushka"
# mlflow.create_experiment(name="chaky-diabetes-example") #create if you
mlflow.set_experiment(experiment_name="anushka-regularization-example")
```

```
Out[74]: <Experiment: artifact_location='file:///Projects/Python-for-Machine-Lear
ning/A2/mlruns/368821136563494397', creation_time=1757217537954, experim
ent_id='368821136563494397', last_update_time=1757217537954, lifecycle_s
tage='active', name='anushka-regularization-example', tags={}>
```

Creating a linear regression class

```
In [75]: from sklearn.model_selection import KFold

class LinearRegression(object):

    #in this class, we add cross validation as well for some spicy code..
    kfold = KFold(n_splits=3)

    def __init__(self, regularization, lr=0.01, method='batch', init='xav

        # Initialize hyperparameters and options
        self.lr = lr
        self.num_epochs = num_epochs
        self.batch_size = batch_size
        self.method = method
        self.polynomial = polynomial
        self.degree = degree
        self.init = init
        self.use_momentum = use_momentum
```

```

        self.momentum = momentum
        self.prev_step = 0
        self.cv = cv
        self.regularization = regularization

    def mse(self, ytrue, ypred):
        return ((ypred - ytrue) ** 2).sum() / ytrue.shape[0]

    def r2(self, ytrue, ypred):
        return 1 - (((ytrue - ypred) ** 2).sum() / ((ytrue - ytrue.mean())

# function to compute average mse for all kfold_scores
    def avgMse(self):
        return np.sum(np.array(self.kfold_scores))/len(self.kfold_scores)

# function to compute average r2 for all kfold_scores
    def avgr2(self):
        return np.sum(np.array(self.kfold_r2))/len(self.kfold_r2)

    def fit(self, X_train, y_train):

        # Store column names for later use

        self.columns = X_train.columns

        if self.polynomial == True:
            X_train = self._transform_features(X_train)
            print("Using Polynomial")
        else:
            print("Using Linear")
            X_train = X_train.to_numpy()

        y_train = y_train.to_numpy()

        #create a list of kfold scores
        self.kfold_scores = list()
        self.kfold_r2 = list()

        #reset val loss
        self.val_loss_old = np.inf

        #X_train = np.c_[np.ones((X_train.shape[0],1)), X_train]
        # Perform k-fold cross-validation
        for fold, (train_idx, val_idx) in enumerate(self.cv.split(X_train

            X_cross_train = X_train[train_idx]
            y_cross_train = y_train[train_idx]
            X_cross_val = X_train[val_idx]
            y_cross_val = y_train[val_idx]

            #initialize weights using Xavier method
            if self.init == 'xavier':
                #calculate the range for the weights with number of sampl
                n_features = X_cross_train.shape[1]
                lower, upper = -(1 / np.sqrt(n_features)), 1 / np.sqrt(n_
                #randomize weights then scale them using lower and upper
                self.theta = np.random.rand(X_cross_train.shape[1])
                self.theta = lower + self.theta * (upper - lower)

            #initialize weights with zero

```

```

elif self.init == 'zero':
    self.theta = np.zeros(X_cross_train.shape[1])

else:
    print("Wrong weights init method. Must be either 'xavier'")
    return
# Start training for the current fold
with mlflow.start_run(run_name=f"Fold-{fold}", nested=True):

    params = {
        "method": self.method,
        "lr": self.lr,
        "reg": type(self).__name__
    }

    mlflow.log_params(params=params)

    for epoch in range(self.num_epochs):
        perm = np.random.permutation(X_cross_train.shape[0])

        X_cross_train = X_cross_train[perm]
        y_cross_train = y_cross_train[perm]
        if self.method == 'sto':
            for batch_idx in range(X_cross_train.shape[0]):
                X_method_train = X_cross_train[batch_idx].res
                y_method_train = y_cross_train[batch_idx].res
                train_loss = self._train(X_method_train, y_me
        elif self.method == 'mini':
            for batch_idx in range(0, X_cross_train.shape[0],
                X_method_train = X_cross_train[batch_idx:batch_idx+batch_size]
                y_method_train = y_cross_train[batch_idx:batch_idx+batch_size]
                train_loss = self._train(X_method_train, y_me
        else:
            X_method_train = X_cross_train
            y_method_train = y_cross_train
            train_loss = self._train(X_method_train, y_method_train)
            mlflow.log_metric(key="train_loss", value=train_loss,
            yhat_val = self._predict(X_cross_val)
            val_loss_new = self.mse(y_cross_val, yhat_val)
            val_r2_new = self.r2(y_cross_val, yhat_val)
            mlflow.log_metric(key="val_loss", value=val_loss_new,
            mlflow.log_metric(key="val_r2", value=val_r2_new, step=epoch)

            if np.allclose(val_loss_new, self.val_loss_old):
                break
            self.val_loss_old = val_loss_new
            self.kfold_scores.append(val_loss_new)
            self.kfold_r2.append(val_r2_new)

    print(f"Fold {fold}: MSE {val_loss_new}")
    print(f"Fold {fold}: R2: {val_r2_new}")

def _transform_features(self, X):
    X = X.to_numpy() if hasattr(X, 'to_numpy') else X
    features = [np.ones((X.shape[0], 1))] # Bias term
    feature_names = ["bias"]
    orig_cols = self.columns if hasattr(self, 'columns') and self.columns
    # Adding original features
    features.append(X)

```



```

feature_names.extend(orig_cols)

# Adding polynomial features
for d in range(2, self.degree + 1):
    features.append(X ** d)
    feature_names.extend([f"{col}^{d}" for col in orig_cols])

X_poly = np.hstack(features)
self.poly_feature_names = feature_names
return X_poly

def _train(self, X, y):
    yhat = self._predict(X)
    m = X.shape[0]
    if self.regularization:
        # If regularization is enabled, compute the gradient with reg
        grad = (1/m) * X.T @ (yhat - y) + self.regularization.derivati
    else:
        # If no regularization, compute the gradient without regulari
        grad = (1/m) * X.T @ (yhat - y)

    if self.use_momentum == True:
        self.step = self.lr * grad
        self.theta = self.theta - self.step + self.momentum * self.pr
        self.prev_step = self.step
    else:
        self.theta = self.theta - self.lr * grad
    return self.mse(y, yhat)

def _predict(self, X):
    return X @ self.theta # Matrix multiplication of input features

def predict(self, X):
    if self.polynomial == True:
        X = self._transform_features(X)
    return X @ self.theta # Matrix multiplication of input features

def _coef(self):
    return self.theta[1:] # Return all weights except the first one (
def _bias(self):
    return self.theta[0] # Return the first weight, which represents

def feature_importance(self, width=5, height=10):
    if self.theta is not None:
        index_names = getattr(self, 'poly_feature_names',
                               self.columns if hasattr(self, 'columns') and
        if index_names is None:
            print("Feature names are not available.")
            return

        if len(self.theta) != len(index_names):
            raise ValueError(
                f"Mismatch: theta has {len(self.theta)} elements, "
                f"but feature names has {len(index_names)} names."
            )

        coefs = pd.DataFrame(data=self.theta, columns=['Coefficients']
        coefs.plot(kind="barh", figsize=(width, height))
        plt.title("Feature Importance")

```

```
plt.show()
else:
    print("Coefficients are not available to create the graph.")
```

```
In [76]: class LassoPenalty:
    def __init__(self, l):
        self.l = l # Lambda value for regularization

    def __call__(self, theta):
        return self.l * np.sum(np.abs(theta))

    def derivation(self, theta):
        return self.l * np.sign(theta)

# Define a class for Ridge (L2) regularization penalty
class RidgePenalty:
    def __init__(self, l):
        self.l = l # Lambda value for regularization

    def __call__(self, theta):
        return self.l * np.sum(np.square(theta))

    def derivation(self, theta):
        return self.l * 2 * theta

# Define a class for Elastic Net regularization penalty
class ElasticPenalty:
    def __init__(self, l=0.1, l_ratio=0.5):
        self.l = l # Total regularization strength
        self.l_ratio = l_ratio # Ratio between L1 and L2 regularization

    def __call__(self, theta):
        l1_contribution = self.l_ratio * self.l * np.sum(np.abs(theta))
        l2_contribution = (1 - self.l_ratio) * self.l * 0.5 * np.sum(np.square(theta))
        return (l1_contribution + l2_contribution)

    def derivation(self, theta):
        l1_derivation = self.l * self.l_ratio * np.sign(theta)
        l2_derivation = self.l * (1 - self.l_ratio) * theta
        return (l1_derivation + l2_derivation)

# Define classes for Lasso, Ridge, ElasticNet, and Normal (No Regularization)
class Lasso(LinearRegression):
    def __init__(self, l, lr, method, init, polynomial, degree, use_moment):
        self.regularization = LassoPenalty(l)
        super().__init__(self.regularization, lr, method, init, polynomial, degree, use_moment)

    def avgMSE(self):
        return np.sum(np.array(self.kfold_scores)) / len(self.kfold_scores)

class Ridge(LinearRegression):
    def __init__(self, l, lr, method, init, polynomial, degree, use_moment):
        self.regularization = RidgePenalty(l)
        super().__init__(self.regularization, lr, method, init, polynomial, degree, use_moment)

    def avgMSE(self):
        return np.sum(np.array(self.kfold_scores)) / len(self.kfold_scores)

class ElasticNet(LinearRegression):
    def __init__(self, l, lr, method, init, polynomial, degree, use_moment, l_ratio):
        self.regularization = ElasticPenalty(l, l_ratio)
        super().__init__(self.regularization, lr, method, init, polynomial, degree, use_moment)
```

```

def avgMSE(self):
    return np.sum(np.array(self.kfold_scores)) / len(self.kfold_score

class Normal(LinearRegression):
    def __init__(self, l, lr, method, init, polynomial, degree, use_momen
        self.regularization = None # No regularization
        super().__init__(self.regularization, lr, method, init, polynomia
    def avgMSE(self):
        return np.sum(np.array(self.kfold_scores)) / len(self.kfold_score

```

Experiment

```

In [77]: #helper function for looping classnames
import sys

def str_to_class(classname):
    return getattr(sys.modules[__name__], classname)

```

Looping through all regression methods

```

In [379... regs = ["Ridge", "Lasso", "ElasticNet"]

# Looping through all regression methods
for reg in regs:
    params = {"method": "batch", "l": 0.1, "lr": 0.01, "polynomial": True
    mlflow.start_run(run_name=f"method-{params['method']}-lr-{params['lr']

    print("="*5, reg, "="*5)
    type_of_regression = str_to_class(reg) #Ridge, Lasso, ElasticNet
    model = type_of_regression(**params)
    model.fit(X_train, y_train)
    mse = model.avgMSE()
    r2 = model.avgr2()

    #Predicting using the model
    yhat = model.predict(X_train)

    print("Test MSE: ", mse)
    print("Test R2: ", r2)
    # Logging the metrics in ml flow
    mlflow.log_metric(key="test_mse", value=mse)
    mlflow.log_metric(key="test_r2", value=r2)

    signature = mlflow.models.infer_signature(X_train, model.predict(X_tr
    mlflow.sklearn.log_model(model, artifact_path='model', signature=sign

    mlflow.end_run()

```

```

===== Ridge =====
Using Polynomial
Fold 0: MSE 15.225598808210824
Fold 0: R2: -19.96031673182778
Fold 1: MSE 13.0192821083375
Fold 1: R2: -17.838351096296673

```

```
2025/09/11 06:14:15 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 14.707521001270806
Fold 2: R2: -20.025257489167966
Test MSE: 14.31746730593971
Test R2: -19.274641772430808
```

```
2025/09/11 06:14:20 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
```

```
===== Lasso =====
```

```
Using Polynomial
```

```
Fold 0: MSE 10.38036998881748
Fold 0: R2: -13.290133708359647
Fold 1: MSE 8.50166457190145
Fold 1: R2: -11.301549407694464
```

```
2025/09/11 06:16:16 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 10.862791473937362
Fold 2: R2: -14.528992803813582
Test MSE: 9.914942011552098
Test R2: -13.040225306622565
```

```
2025/09/11 06:16:21 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
```

```
===== ElasticNet =====
```

```
Using Polynomial
```

```
Fold 0: MSE 12.107482167702125
Fold 0: R2: -15.667762250712748
Fold 1: MSE 9.638540307099646
Fold 1: R2: -12.946560559177904
```

```
2025/09/11 06:18:17 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 11.774627796958365
Fold 2: R2: -15.83251591133362
Test MSE: 11.17355009058671
Test R2: -14.815612907074756
```

```
2025/09/11 06:18:22 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
```

Looping through all regression methods and for each method checking the output with polynomial true or false

```
In [380]... # Setting up the experiment of polynomial and regularization type all of
regs = ["Ridge", "Lasso", "ElasticNet", "Normal"]
ispoly= [True, False]

for reg in regs:
    for t in ispoly:

        params = {"method": "batch", "polynomial": t, "l": 0.1, "lr": 0.0
"degree": 2, "use_momentum": True, "momentum": 0.5}
mlflow.start_run(run_name=f"method-{params['method']}-lr-{params['lr']}")

        print("="*5, reg, "="*5)

        type_of_regression = str_to_class(reg)
        model = type_of_regression(**params)
```

```

model.fit(X_train, y_train)
yhat = model.predict(X_train)
mse = model.avgMSE()
r2 = model.avgr2()

print("Test MSE: ", mse)
print("Test R2: ", r2)

mlflow.log_metric(key="test_mse", value=mse)
mlflow.log_metric(key="test_r2", value=r2)

signature = mlflow.models.infer_signature(X_train, model.predict(
mlflow.sklearn.log_model(model, artifact_path='model', signature=

mlflow.end_run()

```

===== Ridge =====

Using Polynomial

Fold 0: MSE 15.895259687645124

Fold 0: R2: -20.882205211398635

Fold 1: MSE 12.869400355505807

Fold 1: R2: -17.621478533026572

2025/09/11 06:34:31 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 15.180456372176275

Fold 2: R2: -20.701346134437518

Test MSE: 14.648372138442403

Test R2: -19.735009959620907

2025/09/11 06:34:36 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Ridge =====

Using Linear

Fold 0: MSE 168.4104693451718

Fold 0: R2: -230.8422298456307

Fold 1: MSE 169.13959322771768

Fold 1: R2: -243.73784460573657

2025/09/11 06:34:54 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.3166577681884

Fold 2: R2: -241.04801927353338

Test MSE: 168.95557344702596

Test R2: -238.54269790830025

2025/09/11 06:34:58 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Lasso =====

Using Polynomial

Fold 0: MSE 10.531555626950171

Fold 0: R2: -13.498263378691943

Fold 1: MSE 9.09924113358229

Fold 1: R2: -12.166217442551183

2025/09/11 06:36:55 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 10.649001878475472

Fold 2: R2: -14.22336813105582

Test MSE: 10.093266213002645

Test R2: -13.295949650766316

```
2025/09/11 06:37:00 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== Lasso =====
Using Linear
Fold 0: MSE 168.6094727071441
Fold 0: R2: -231.11618777334047
Fold 1: MSE 168.99210424338423
Fold 1: R2: -243.5244342773798

2025/09/11 06:37:19 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.39325901247918
Fold 2: R2: -241.1575252116901
Test MSE: 168.99827865433585
Test R2: -238.59938242080344

2025/09/11 06:37:23 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== ElasticNet =====
Using Polynomial
Fold 0: MSE 12.113780989409836
Fold 0: R2: -15.676433522016687
Fold 1: MSE 9.383438035355313
Fold 1: R2: -12.5774383510106

2025/09/11 06:39:23 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 11.199365254964887
Fold 2: R2: -15.01014461788171
Test MSE: 10.89886142657668
Test R2: -14.421338830303

2025/09/11 06:39:28 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== ElasticNet =====
Using Linear
Fold 0: MSE 168.55150518651706
Fold 0: R2: -231.03638680079374
Fold 1: MSE 169.05101849515987
Fold 1: R2: -243.60968071034665

2025/09/11 06:39:56 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.39315937933026
Fold 2: R2: -241.15738278030346
Test MSE: 168.99856102033573
Test R2: -238.60115009714795

2025/09/11 06:40:02 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== Normal =====
Using Polynomial
Fold 0: MSE 10.08595822244985
Fold 0: R2: -12.884831824973983
Fold 1: MSE 9.014296071094375
Fold 1: R2: -12.043305526384975

2025/09/11 06:42:10 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

Fold 2: MSE 10.620793754327588
 Fold 2: R2: -14.18304297541304
 Test MSE: 9.90701601595727
 Test R2: -13.037060108923997

2025/09/11 06:42:15 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Normal =====

Using Linear

Fold 0: MSE 168.74434215905802
 Fold 0: R2: -231.3018557700592
 Fold 1: MSE 169.12831512775585
 Fold 1: R2: -243.72152567163468

2025/09/11 06:42:58 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.30993953074275
 Fold 2: R2: -241.03841516199373
 Test MSE: 169.0608656058522
 Test R2: -238.68726553456256

2025/09/11 06:43:03 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

Normal with polynomial features was found to be best. So testing it with other methods here.

```
In [381... reg = "Normal"
ispoly= True
# Only testing with the method here
methods=["mini","batch","sto"]

for method in methods:
    params = {"method": method, "polynomial": ispoly, "l": 0.1, "lr": 0.0
    "degree":2, "use_momentum" :True, "momentum":0.5}
    mlflow.start_run(run_name=f"method-{params['method']}-lr-{params['lr']

    print("="*5, reg, "="*5)
    print("Method: ", method)

    type_of_regression = str_to_class(reg)
    model = type_of_regression(**params)
    model.fit(X_train, y_train)
    yhat = model.predict(X_train)
    mse = model.avgMSE()
    r2 = model.avgr2()

    print("Test MSE: ", mse)
    print("Test R2: ", r2)

    mlflow.log_metric(key="test_mse", value=mse)
    mlflow.log_metric(key="test_r2", value=r2)

    signature = mlflow.models.infer_signature(X_train, model.predict(X_tr
    mlflow.sklearn.log_model(model, artifact_path='model', signature=sign

    mlflow.end_run()
```


===== Normal =====

Method: mini

Using Polynomial

Fold 0: MSE 0.11197052804466119

Fold 0: R2: 0.8458558010092547

Fold 1: MSE 0.1184885680055888

Fold 1: R2: 0.8285520486911286

2025/09/11 06:44:45 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.11125773193379787

Fold 2: R2: 0.8409505951841371

Test MSE: 0.11390560932801597

Test R2: 0.8384528149615068

2025/09/11 06:44:51 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Normal =====

Method: batch

Using Polynomial

Fold 0: MSE 10.682273961214127

Fold 0: R2: -13.705749735272047

Fold 1: MSE 8.611067552556523

Fold 1: R2: -11.459850898007957

2025/09/11 06:47:01 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 10.7269432781625

Fold 2: R2: -14.334789899370435

Test MSE: 10.00676159731105

Test R2: -13.166796844216814

2025/09/11 06:47:07 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Normal =====

Method: sto

Using Polynomial

Fold 0: MSE 0.11461868022270306

Fold 0: R2: 0.8422102229860177

Fold 1: MSE 0.13539223038624038

Fold 1: R2: 0.8040931634707178

2025/09/11 06:50:12 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.11230156792355203

Fold 2: R2: 0.8394583708684862

Test MSE: 0.1207708261774985

Test R2: 0.8285872524417406

2025/09/11 06:50:18 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

Testing normal with mini-batch method with polynomial features

```
In [382... reg = "Normal"
ispoly= True
method="mini"
# Only testing with/without momentum here
momentums =[True, False]

for momentum in momentums:
```



```

params = {"method": method, "polynomial": ispoly, "l": 0.1, "lr": 0.0
"degree":2, "use_momentum":momentum, "momentum":0.5}
mlflow.start_run(run_name=f"method-{params['method']}-lr-{params['lr']}")
print("="*5, reg, "="*5)
print("Method: ", method)
print("Momentum: ", momentum)
print("Inititalization: ", "Xavier")
print("Learning Rate: ", "0.01")
print("="*10)

type_of_regression = str_to_class(reg)
model = type_of_regression(**params)
model.fit(X_train, y_train)
yhat = model.predict(X_train)
mse = model.avgMSE()
r2 = model.avgr2()

print("Test MSE: ", mse)
print("Test R2: ", r2)

mlflow.log_metric(key="test_mse", value=mse)
mlflow.log_metric(key="test_r2", value=r2)

signature = mlflow.models.infer_signature(X_train, model.predict(X_train))
mlflow.sklearn.log_model(model, artifact_path='model', signature=signature)

mlflow.end_run()

```

==== Normal =====

Method: mini
Momentum: True
Inititalization: Xavier
Learning Rate: 0.01

=====

Using Polynomial
Fold 0: MSE 0.11146255383590982
Fold 0: R2: 0.8465551035747003
Fold 1: MSE 0.11898121566469856
Fold 1: R2: 0.8278392083446449

2025/09/11 06:56:57 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.11465431447736231
Fold 2: R2: 0.8360949827015518
Test MSE: 0.11503269465932357
Test R2: 0.8368297648736324

2025/09/11 06:57:02 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

==== Normal =====

Method: mini
Momentum: False
Inititalization: Xavier
Learning Rate: 0.01

=====

Using Polynomial
Fold 0: MSE 0.11154738773932482
Fold 0: R2: 0.846438317003113
Fold 1: MSE 0.11905638709261655
Fold 1: R2: 0.8277304384647278

2025/09/11 06:58:14 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.11214946826398049

Fold 2: R2: 0.8396758061865273

Test MSE: 0.11425108103197396

Test R2: 0.8379481872181227

2025/09/11 06:58:20 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.

Testing the conditions with different theta initializations

```
In [383... #Testing

reg = "Normal"
ispoly= True
method="mini"
momentum =False
# Only testing diff initialization here
inits=["zero", 'xavier']

for init in inits:
    params = {"method": method, "polynomial": ispoly, "l": 0.1, "lr": 0.0
    "degree":2, "use_momentum" :momentum, "momentum":0.5}
    mlflow.start_run(run_name=f"method-{params['method']}-lr-{params['lr']

    print("="*5, reg, "="*5)
    print("Method: ", method)
    print("Momentum: ", momentum)
    print("Inititalization: ", init)
    print("Learning Rate: ", "0.01")
    print("="*10)
    type_of_regression = str_to_class(reg)
    model = type_of_regression(**params)
    model.fit(X_train, y_train)
    yhat = model.predict(X_train)
    mse = model.avgMSE()
    r2 = model.avgr2()
    print("Test MSE: ", mse)
    print("Test R2: ", r2)
    mlflow.log_metric(key="test_mse", value=mse)
    mlflow.log_metric(key="test_r2", value=r2)
    signature = mlflow.models.infer_signature(X_train, model.predict(X_tr
    mlflow.sklearn.log_model(model, artifact_path='model', signature=sign

    mlflow.end_run()
```

==== Normal =====

Method: mini

Momentum: False

Inititalization: zero

Learning Rate: 0.01

=====

Using Polynomial

Fold 0: MSE 0.11148367331907238

Fold 0: R2: 0.8465260294435693

Fold 1: MSE 0.11927668886051314

Fold 1: R2: 0.8274116711151739

```
2025/09/11 07:02:31 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 0.1148817236617844
```

```
Fold 2: R2: 0.8357698880334931
```

```
Test MSE: 0.11521402861378997
```

```
Test R2: 0.836569196197412
```

```
2025/09/11 07:02:38 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
```

```
===== Normal =====
```

```
Method: mini
```

```
Momentum: False
```

```
Initialization: xavier
```

```
Learning Rate: 0.01
```

```
=====
```

```
Using Polynomial
```

```
Fold 0: MSE 0.11069839108376912
```

```
Fold 0: R2: 0.8476070880333277
```

```
Fold 1: MSE 0.11922792999827574
```

```
Fold 1: R2: 0.827482223128583
```

```
2025/09/11 07:04:36 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 0.11026034674442098
```

```
Fold 2: R2: 0.8423764153764537
```

```
Test MSE: 0.11339555594215528
```

```
Test R2: 0.8391552421794547
```

```
2025/09/11 07:04:41 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
```

Testing the best model with different learning rates

```
In [384... reg = "Normal"
ispoly= True
method="mini"
momentum =False
init='xavier'
# Only testing diff learning rate here
lrs =[0.01,0.001,0.0001]

for lr in lrs:
    params = {"method": method,"polynomial": ispoly, "l": 0.1, "lr": lr,
mlflow.start_run(run_name=f"method-{params['method']}-lr-{params['lr']

    print("="*5, reg, "="*5)
    print("Method: ", method)
    print("Momentum: ", momentum)
    print("Initialization: ", init)
    print("Learning Rate: ", lr)
    print("="*10)

    type_of_regression = str_to_class(reg)
    model = type_of_regression(**params)
    model.fit(X_train, y_train)
    yhat = model.predict(X_train)
    mse = model.avgMSE()
    r2 = model.avgr2()
```

```

print("Test MSE: ", mse)
print("Test R2: ", r2)

mlflow.log_metric(key="test_mse", value=mse)
mlflow.log_metric(key="test_r2", value=r2)

signature = mlflow.models.infer_signature(X_train, model.predict(X_tr
mlflow.sklearn.log_model(model, artifact_path='model', signature=sign

mlflow.end_run()

```

===== Normal =====

Method: mini
Momentum: False
Inititalization: xavier
Learning Rate: 0.01

=====

Using Polynomial
Fold 0: MSE 0.11184453526273629
Fold 0: R2: 0.8460292489404878
Fold 1: MSE 0.11975716174867648
Fold 1: R2: 0.8267164471478188

2025/09/11 07:07:09 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.10972463965530009
Fold 2: R2: 0.843142239847251
Test MSE: 0.11377544555557095
Test R2: 0.8386293119785192

2025/09/11 07:07:13 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Normal =====

Method: mini
Momentum: False
Inititalization: xavier
Learning Rate: 0.001

=====

Using Polynomial
Fold 0: MSE 0.11274669188281772
Fold 0: R2: 0.844787295258612
Fold 1: MSE 0.11924386298330898
Fold 1: R2: 0.8274591687724694

2025/09/11 07:08:45 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.11149655434349633
Fold 2: R2: 0.8406091846461097
Test MSE: 0.11449570306987433
Test R2: 0.8376185495590637

2025/09/11 07:08:50 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Normal =====

Method: mini

Momentum: False

Initialization: xavier

Learning Rate: 0.0001

=====

Using Polynomial

Fold 0: MSE 5.486460712583999

Fold 0: R2: -6.552934746347996

Fold 1: MSE 4.498107013729175

Fold 1: R2: -5.508570786639577

2025/09/11 07:10:49 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 5.371079718593041

Fold 2: R2: -6.678271142261766

Test MSE: 5.118549148302072

Test R2: -6.246592225083114

2025/09/11 07:10:54 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.

Grid Search

This covers all regularization methods (Ridge, Lasso, ElasticNet, and Normal), testing both polynomial and linear features, and evaluating different training modes (stochastic, mini-batch, and full batch). It also explores learning rates of 0.01, 0.001, and 0.0001, as well as the effect of momentum on the model, with the goal of comparing the average MSE and R^2 across folds under different parameter settings.

```
In [84]: regs = ["Ridge", "Lasso", "ElasticNet", "Normal"]
ispoly= [True, False]
lrs=[0.01,0.001,0.0001]
methods = ["sto","mini","batch"]
inits = ['zero','xavier']
use_momentums = [True, False]
momentum = ""
for reg in regs:
    print("="*5, reg, "="*5)
    for method in methods:
        print("="*5, method, "="*5)
        for t in ispoly:
            if t==True:
                print("Polynomial")
            else:
                print("Linear")
        for init in inits:
            print("="*5, init, "="*5)
            for use_momentum in use_momentums:
                if(use_momentum== True):
                    momentum = "Momentum Used"
                else:
                    momentum = "Momentum not used"
            print("="*5, momentum, "="*5)
        for lr in lrs:
```

```

print("="*5, lr, "="*5)
params = {"method": method, "polynomial": t, "l":
"degree":2, "use_momentum":use_momentum, "momen
mlflow.start_run(run_name=f"method-{params['metho
type_of_regression = str_to_class(reg)
model = type_of_regression(**params)
model.fit(X_train, y_train)
yhat = model.predict(X_train)
mse = model.avgMSE()
r2 = model.avgr2()

print("Test MSE: ", mse)
print("Test R2: ", r2)

mlflow.log_metric(key="test_mse", value=mse)
mlflow.log_metric(key="test_r2", value=r2)

signature = mlflow.models.infer_signature(X_train
mlflow.sklearn.log_model(model, artifact_path='mo

mlflow.end_run()

```

```

===== Ridge =====
===== sto =====
Polynomial
===== zero =====
===== Momentum Used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 8.861428663552568
Fold 0: R2: -11.199083518764114
Fold 1: MSE 11.45200643777976
Fold 1: R2: -15.570569424391518

```

2025/09/10 07:22:17 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

```

Fold 2: MSE 6.843197668799786
Fold 2: R2: -8.78274945338222
Test MSE: 9.052210923377372
Test R2: -11.850800798845952

```

2025/09/10 07:22:23 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

```

===== 0.001 =====
Using Polynomial
Fold 0: MSE 8.092412852947875
Fold 0: R2: -10.140418098434955
Fold 1: MSE 6.433761438396594
Fold 1: R2: -8.309380950330034

```

2025/09/10 07:24:59 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

```

Fold 2: MSE 8.356069112680132
Fold 2: R2: -10.945487256227795
Test MSE: 7.6274144680082
Test R2: -9.798428768330927

```

2025/09/10 07:25:03 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 8.177782336901217

Fold 0: R2: -10.257941976834388

Fold 1: MSE 6.6842899770549185

Fold 1: R2: -8.6718851599796

2025/09/10 07:27:37 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 7.67446084401069

Fold 2: R2: -9.971088555435001

Test MSE: 7.512177719322275

Test R2: -9.633638564082998

2025/09/10 07:27:44 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 17.466667093608045

Fold 0: R2: -23.04548281766003

Fold 1: MSE 175.21161731013396

Fold 1: R2: -252.52380688675

2025/09/10 07:30:28 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 9.199345625530425

Fold 2: R2: -12.151000123808476

Test MSE: 67.2925433430908

Test R2: -95.90676327607285

2025/09/10 07:30:32 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 9.711143676703232

Fold 0: R2: -12.36884347577956

Fold 1: MSE 6.611610683418943

Fold 1: R2: -8.5667212930665

2025/09/10 07:33:05 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 7.828554175865141

Fold 2: R2: -10.19137394406873

Test MSE: 8.050436178662439

Test R2: -10.375646237638263

2025/09/10 07:33:10 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 8.162667082499663

Fold 0: R2: -10.237133565701955

Fold 1: MSE 6.537251649465055

Fold 1: R2: -8.45912691288883

2025/09/10 07:35:21 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 7.947418895379322

Fold 2: R2: -10.361297980481625

Test MSE: 7.549112542448014

Test R2: -9.685852819690803

```
2025/09/10 07:35:27 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 12.06124395956707
Fold 0: R2: -15.604108433228717
Fold 1: MSE 12.616846222208292
Fold 1: R2: -17.256043373523212

2025/09/10 07:38:26 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 9.84650584664465
Fold 2: R2: -13.076153335182289
Test MSE: 11.508198676140003
Test R2: -15.312101713978073

2025/09/10 07:38:31 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.001 =====
Using Polynomial
Fold 0: MSE 8.569785356486175
Fold 0: R2: -10.797592834172272
Fold 1: MSE 6.396659226864689
Fold 1: R2: -8.25569561795372

2025/09/10 07:41:13 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 7.838735875417148
Fold 2: R2: -10.205929276319473
Test MSE: 7.601726819589338
Test R2: -9.753072576148488

2025/09/10 07:41:17 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 8.562193727693373
Fold 0: R2: -10.787141820323031
Fold 1: MSE 6.5774310212435125
Fold 1: R2: -8.517264766120114

2025/09/10 07:43:13 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 7.773333422279216
Fold 2: R2: -10.112432662068203
Test MSE: 7.6376527237387
Test R2: -9.805613082837114

2025/09/10 07:43:18 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== Momentum not used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 12.118547046014655
Fold 0: R2: -15.682994712631071
Fold 1: MSE 108.24502599897843
Fold 1: R2: -155.62597885413732
```



```
2025/09/10 07:45:53 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 8.324298321291154
Fold 2: R2: -10.900069060358472
Test MSE: 42.89595712209475
Test R2: -60.73634754237562
```

```
2025/09/10 07:45:57 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
```

```
===== 0.001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 8.018285993117411
Fold 0: R2: -10.03837137567851
Fold 1: MSE 6.707121729111342
Fold 1: R2: -8.704921740476392
```

```
2025/09/10 07:47:45 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 7.307236575503648
Fold 2: R2: -9.446120085156103
Test MSE: 7.3442147659108
Test R2: -9.396471067103668
```

```
2025/09/10 07:47:49 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 8.152281348106666
Fold 0: R2: -10.222836047087945
Fold 1: MSE 6.50479747881728
Fold 1: R2: -8.412167099274347
```

```
2025/09/10 07:49:40 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 7.904731433805412
Fold 2: R2: -10.3002737690545
Test MSE: 7.52060342024312
Test R2: -9.645092305138931
```

```
2025/09/10 07:49:44 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
```

```
Linear
```

```
===== zero =====
```

```
===== Momentum Used =====
```

```
===== 0.01 =====
```

```
Using Linear
```

```
Fold 0: MSE 168.7576738208011
Fold 0: R2: -231.32020879881142
Fold 1: MSE 170.01427993192286
Fold 1: R2: -245.00347930786253
```

```
2025/09/10 07:51:24 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.70494751605227
Fold 2: R2: -241.6031020729077
Test MSE: 169.4923004229254
Test R2: -239.30893005986056
```

```
2025/09/10 07:51:30 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
```

===== 0.001 =====

Using Linear

Fold 0: MSE 168.5006028767861

Fold 0: R2: -230.96631214903246

Fold 1: MSE 168.95273175780105

Fold 1: R2: -243.46746395437904

2025/09/10 07:51:56 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.22717066658637

Fold 2: R2: -240.9200922521829

Test MSE: 168.89350176705784

Test R2: -238.4512894518648

2025/09/10 07:52:00 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.6128277102614

Fold 0: R2: -231.1208064375297

Fold 1: MSE 168.9312146056396

Fold 1: R2: -243.4363295443834

2025/09/10 07:52:04 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.2526657712268

Fold 2: R2: -240.95653898849775

Test MSE: 168.93223602904263

Test R2: -238.5045583234703

2025/09/10 07:52:08 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 169.86507589246065

Fold 0: R2: -232.8447135794673

Fold 1: MSE 170.0338774953976

Fold 1: R2: -245.03183615413846

2025/09/10 07:54:14 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 171.4691889156284

Fold 2: R2: -244.12518786125588

Test MSE: 170.45604743449553

Test R2: -240.66724586495388

2025/09/10 07:54:19 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.5973208575339

Fold 0: R2: -231.0994589326613

Fold 1: MSE 169.47201794277447

Fold 1: R2: -244.21884912220798

2025/09/10 07:55:38 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.31770648762617

Fold 2: R2: -241.04951847902223

Test MSE: 169.1290150959782

Test R2: -238.78927551129718

```
2025/09/10 07:55:44 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.6167585678256
Fold 0: R2: -231.12621785159695
Fold 1: MSE 168.95947394957798
Fold 1: R2: -243.47721962099686

2025/09/10 07:55:51 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.2338952946089
Fold 2: R2: -240.92970549942427
Test MSE: 168.93670927067083
Test R2: -238.51104765733933

2025/09/10 07:55:57 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 168.93053550624532
Fold 0: R2: -231.5581787941691
Fold 1: MSE 169.9635729584377
Fold 1: R2: -244.9301084597931

2025/09/10 07:58:38 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 170.8028418975186
Fold 2: R2: -243.17260600659205
Test MSE: 169.8989834540672
Test R2: -239.88696442018477

2025/09/10 07:58:42 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.001 =====
Using Linear
Fold 0: MSE 168.49768740995452
Fold 0: R2: -230.96229857235932
Fold 1: MSE 169.02135123754715
Fold 1: R2: -243.56675344213616

2025/09/10 07:58:59 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.28154519932724
Fold 2: R2: -240.99782381222153
Test MSE: 168.93352794894298
Test R2: -238.5089586089057

2025/09/10 07:59:04 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.66016904637578
Fold 0: R2: -231.18597887586623
Fold 1: MSE 168.9501445977579
Fold 1: R2: -243.463720443114

2025/09/10 07:59:07 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

Fold 2: MSE 169.2453531574619
Fold 2: R2: -240.9460851814073
Test MSE: 168.9518889338652
Test R2: -238.53192816679584

2025/09/10 07:59:11 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.5705607176734
Fold 0: R2: -231.0626195929198
Fold 1: MSE 173.0829942933997
Fold 1: R2: -249.44377932399996

2025/09/10 08:01:01 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 171.1279841985848
Fold 2: R2: -243.63741585455676
Test MSE: 170.92717973655263
Test R2: -241.38127159049216

2025/09/10 08:01:05 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 169.2364469188823
Fold 0: R2: -231.97931166267043
Fold 1: MSE 169.22999885739253
Fold 1: R2: -243.86865773189243

2025/09/10 08:02:19 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.4199128429949
Fold 2: R2: -241.19562841410047
Test MSE: 169.2954528730899
Test R2: -239.01453260288778

2025/09/10 08:02:23 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.64069411630283
Fold 0: R2: -231.15916871832817
Fold 1: MSE 168.9197708330011
Fold 1: R2: -243.41977088891866

2025/09/10 08:02:27 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.25801726694684
Fold 2: R2: -240.96418926317395
Test MSE: 168.9394940720836
Test R2: -238.51437629014026

2025/09/10 08:02:31 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

```

===== mini =====
Polynomial
===== zero =====
===== Momentum Used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 8.341563129255544
Fold 0: R2: -10.483410763026571
Fold 1: MSE 7.112413799676321
Fold 1: R2: -9.291362241443696
2025/09/10 08:04:03 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 7.725088958510847
Fold 2: R2: -10.043464392495844
Test MSE: 7.726355295814237
Test R2: -9.939412465655371
2025/09/10 08:04:08 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
===== 0.001 =====
Using Polynomial
Fold 0: MSE 8.85423777395642
Fold 0: R2: -11.189184182428155
Fold 1: MSE 6.650685098488721
Fold 1: R2: -8.623260320628972
2025/09/10 08:05:27 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 7.710274373549538
Fold 2: R2: -10.02228608084293
Test MSE: 7.738399081998227
Test R2: -9.944910194633353
2025/09/10 08:05:32 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 18.887229526215858
Fold 0: R2: -25.001099729668663
Fold 1: MSE 15.502480171090319
Fold 1: R2: -21.43143376848365
2025/09/10 08:07:03 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 17.967935954968755
Fold 2: R2: -24.686210474862147
Test MSE: 17.45254855075831
Test R2: -23.70624799100482
2025/09/10 08:07:07 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
===== Momentum not used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 8.645893716332067
Fold 0: R2: -10.902367388421627
Fold 1: MSE 6.514037552754074
Fold 1: R2: -8.42553709583242
2025/09/10 08:08:48 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

```

Fold 2: MSE 7.499165033940341
Fold 2: R2: -9.720492989861244
Test MSE: 7.553032101008827
Test R2: -9.68279915803843

2025/09/10 08:08:52 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 8.374300333203673
Fold 0: R2: -10.528478426526094
Fold 1: MSE 6.662319268305712
Fold 1: R2: -8.640094472765982

2025/09/10 08:09:46 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 7.785565713374465
Fold 2: R2: -10.12991943430792
Test MSE: 7.607395104961284
Test R2: -9.766164111199998

2025/09/10 08:09:51 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 12.006520651326001
Fold 0: R2: -15.528773604839063
Fold 1: MSE 9.669853913310552
Fold 1: R2: -12.991870024245449

2025/09/10 08:11:27 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 11.356616509942821
Fold 2: R2: -15.234944441463139
Test MSE: 11.01099702485979
Test R2: -14.585196023515882

2025/09/10 08:11:32 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== xavier =====

===== Momentum Used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 8.190312715532503
Fold 0: R2: -10.275191919394274
Fold 1: MSE 7.208390289558871
Fold 1: R2: -9.430236166929939

2025/09/10 08:12:50 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 7.780411317450045
Fold 2: R2: -10.122550925263964
Test MSE: 7.72637144084714
Test R2: -9.942659670529393

2025/09/10 08:12:55 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 8.27034850518843

Fold 0: R2: -10.385373168893997

Fold 1: MSE 6.828831243523762

Fold 1: R2: -8.881030265138643

2025/09/10 08:13:53 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 7.871635599022898

Fold 2: R2: -10.25296134651496

Test MSE: 7.65693844924503

Test R2: -9.839788260182532

2025/09/10 08:13:57 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 19.394906442921926

Fold 0: R2: -25.699993028095683

Fold 1: MSE 15.494818985070152

Fold 1: R2: -21.42034835602688

2025/09/10 08:15:38 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 17.654585138134852

Fold 2: R2: -24.238257240064478

Test MSE: 17.514770188708976

Test R2: -23.78619954139568

2025/09/10 08:15:43 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 8.505964450547316

Fold 0: R2: -10.709733800222862

Fold 1: MSE 6.443510215384041

Fold 1: R2: -8.323487018707752

2025/09/10 08:16:49 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 7.476574450017703

Fold 2: R2: -9.688198435003015

Test MSE: 7.475349705316353

Test R2: -9.573806417977877

2025/09/10 08:16:54 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 8.289929738638014

Fold 0: R2: -10.412329668948486

Fold 1: MSE 6.63034914993955

Fold 1: R2: -8.593835062349934

2025/09/10 08:17:48 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 7.713529410312862

Fold 2: R2: -10.026939345392385

Test MSE: 7.5446027662968085

Test R2: -9.677701358896934


```
2025/09/10 08:17:53 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 11.83366748114385
Fold 0: R2: -15.29081533201471
Fold 1: MSE 9.781772664708617
Fold 1: R2: -13.153811728523115

2025/09/10 08:19:25 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 11.553810192642986
Fold 2: R2: -15.516844290774934
Test MSE: 11.056416779498484
Test R2: -14.65382378377092

2025/09/10 08:19:29 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
Linear
===== zero =====
===== Momentum Used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 168.65353270507066
Fold 0: R2: -231.17684295829426
Fold 1: MSE 168.94603324267683
Fold 1: R2: -243.4577714860322

2025/09/10 08:19:32 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.2397285463166
Fold 2: R2: -240.9380444723309
Test MSE: 168.94643149802135
Test R2: -238.52421963888574

2025/09/10 08:19:36 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.001 =====
Using Linear
Fold 0: MSE 168.56096995839388
Fold 0: R2: -231.0494164765938
Fold 1: MSE 168.97215369795467
Fold 1: R2: -243.49556668113007

2025/09/10 08:19:43 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.25947496423524
Fold 2: R2: -240.9662731263095
Test MSE: 168.93086620686128
Test R2: -238.5037520946778

2025/09/10 08:19:47 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.64613621385325
Fold 0: R2: -231.1666605805386
Fold 1: MSE 169.18869924157136
Fold 1: R2: -243.8088989328659
```



```
2025/09/10 08:20:01 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.4615086560883  
Fold 2: R2: -241.25509205047297  
Test MSE: 169.0987813705043  
Test R2: -238.7435505212925
```

```
2025/09/10 08:20:06 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== Momentum not used =====  
===== 0.01 =====  
Using Linear  
Fold 0: MSE 168.67728616189223  
Fold 0: R2: -231.209543148594  
Fold 1: MSE 168.92661069864153  
Fold 1: R2: -243.4296678854899
```

```
2025/09/10 08:20:11 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.20748456412818  
Fold 2: R2: -240.89194982266636  
Test MSE: 168.937127141554  
Test R2: -238.5103869522501
```

```
2025/09/10 08:20:15 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== 0.001 =====  
Using Linear  
Fold 0: MSE 168.55950652729476  
Fold 0: R2: -231.0474018445429  
Fold 1: MSE 168.94128535562078  
Fold 1: R2: -243.45090149407847
```

```
2025/09/10 08:20:18 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.26506494580116  
Fold 2: R2: -240.9742643303862  
Test MSE: 168.9219522762389  
Test R2: -238.49085588966918
```

```
2025/09/10 08:20:23 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== 0.0001 =====  
Using Linear  
Fold 0: MSE 168.58777914622445  
Fold 0: R2: -231.08632333821086  
Fold 1: MSE 169.0318654142565  
Fold 1: R2: -243.58196701157038
```

```
2025/09/10 08:20:37 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.3454346865136  
Fold 2: R2: -241.08915755356574  
Test MSE: 168.9883597489982  
Test R2: -238.58581596778234
```

```
2025/09/10 08:20:41 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 168.61825273410568
Fold 0: R2: -231.1282747952269
Fold 1: MSE 168.94763375417526
Fold 1: R2: -243.46008735854267
2025/09/10 08:20:45 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 169.21886025186677
Fold 2: R2: -240.9082120305394
Test MSE: 168.9282489133826
Test R2: -238.49885806143632
2025/09/10 08:20:50 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
===== 0.001 =====
Using Linear
Fold 0: MSE 168.38526725466667
Fold 0: R2: -230.80753539413845
Fold 1: MSE 168.81879809695377
Fold 1: R2: -243.27366760634249
2025/09/10 08:20:54 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 169.28157447902706
Fold 2: R2: -240.997865669257
Test MSE: 168.82854661021585
Test R2: -238.35968955657935
2025/09/10 08:20:59 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.61995658655906
Fold 0: R2: -231.130620403274
Fold 1: MSE 169.20417435210427
Fold 1: R2: -243.83129076392444
2025/09/10 08:21:27 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 169.61981121986733
Fold 2: R2: -241.48139478118884
Test MSE: 169.1479807195102
Test R2: -238.81443531612908
2025/09/10 08:21:31 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
===== Momentum not used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 168.6433081543358
Fold 0: R2: -231.16276733312228
Fold 1: MSE 168.94108650990958
Fold 1: R2: -243.45061377273635
2025/09/10 08:21:39 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

Fold 2: MSE 169.26831843184385
Fold 2: R2: -240.97891537809022
Test MSE: 168.95090436536307
Test R2: -238.5307654946496

2025/09/10 08:21:44 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.48621363720574
Fold 0: R2: -230.94650320601917
Fold 1: MSE 168.90149249114847
Fold 1: R2: -243.39332290058778

2025/09/10 08:21:49 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.28262670457457
Fold 2: R2: -240.9993698869339
Test MSE: 168.8901109443096
Test R2: -238.44639866451362

2025/09/10 08:21:54 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.7588513606702
Fold 0: R2: -231.32182985877307
Fold 1: MSE 169.0167117866195
Fold 1: R2: -243.5600403526784

2025/09/10 08:22:11 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.3425716318348
Fold 2: R2: -241.0850646502259
Test MSE: 169.03937825970817
Test R2: -238.65564495389245

2025/09/10 08:22:16 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== batch =====

Polynomial

===== zero =====

===== Momentum Used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 15.578880607732987
Fold 0: R2: -20.4466620314019
Fold 1: MSE 12.700967827877445
Fold 1: R2: -17.377763782466875

2025/09/10 08:24:05 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 14.80566431149822
Fold 2: R2: -20.16555906468109
Test MSE: 14.361837582369551
Test R2: -19.329994959516622

2025/09/10 08:24:09 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 56.54688313202359

Fold 0: R2: -76.84525230007313

Fold 1: MSE 51.28165431293494

Fold 1: R2: -73.20238694477038

2025/09/10 08:25:42 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 53.814782566309276

Fold 2: R2: -75.93136457751615

Test MSE: 53.881106670422604

Test R2: -75.32633460745322

2025/09/10 08:25:47 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 133.56907481113078

Fold 0: R2: -182.8778329105002

Fold 1: MSE 134.31341155508701

Fold 1: R2: -193.34583126482542

2025/09/10 08:27:20 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 134.66702876986656

Fold 2: R2: -191.51435744630157

Test MSE: 134.1831717120281

Test R2: -189.2460072072091

2025/09/10 08:27:24 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 10.260723886970535

Fold 0: R2: -13.125422932643684

Fold 1: MSE 8.22994023170746

Fold 1: R2: -10.908375768826474

2025/09/10 08:28:50 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 9.669884849943562

Fold 2: R2: -12.823663338172391

Test MSE: 9.386849656207184

Test R2: -12.28582067988085

2025/09/10 08:28:54 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 41.13940613999716

Fold 0: R2: -55.63455301269496

Fold 1: MSE 34.87558121459172

Fold 1: R2: -49.4634923908092

2025/09/10 08:30:22 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 39.02929150848185

Fold 2: R2: -54.794644353370195

Test MSE: 38.34809295435691

Test R2: -53.29756325229145

```
2025/09/10 08:30:27 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 110.37358711360417
Fold 0: R2: -150.94577066364894
Fold 1: MSE 110.57009362180709
Fold 1: R2: -158.99025346136997

2025/09/10 08:31:59 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 111.07488945562483
Fold 2: R2: -157.78802084889705
Test MSE: 110.67285673034536
Test R2: -155.90801499130532

2025/09/10 08:32:03 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 15.519828031298628
Fold 0: R2: -20.365367317053646
Fold 1: MSE 12.664204306616483
Fold 1: R2: -17.324568520601655

2025/09/10 08:33:30 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 14.859675094307956
Fold 2: R2: -20.242770623017
Test MSE: 14.347902477407692
Test R2: -19.310902153557432

2025/09/10 08:33:34 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.001 =====
Using Polynomial
Fold 0: MSE 57.74005975600177
Fold 0: R2: -78.48783859639065
Fold 1: MSE 53.89916257751497
Fold 1: R2: -76.98981080388157

2025/09/10 08:35:05 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 52.90114205553761
Fold 2: R2: -74.62526227857336
Test MSE: 54.84678812968479
Test R2: -76.70097055961519

2025/09/10 08:35:09 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 136.7839365450973
Fold 0: R2: -187.3035714999495
Fold 1: MSE 147.16232996506506
Fold 1: R2: -211.93767328811384

2025/09/10 08:36:37 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 132.62157899120248
Fold 2: R2: -188.5902679091282
Test MSE: 138.85594850045493
Test R2: -195.94383756573052
```

```
2025/09/10 08:36:40 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== Momentum not used =====
```

```
===== 0.01 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 10.166986619188128
Fold 0: R2: -12.99637954676149
Fold 1: MSE 8.250744864850843
Fold 1: R2: -10.938479193909622
```

```
2025/09/10 08:38:06 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 9.681304681062095
Fold 2: R2: -12.839988651576954
Test MSE: 9.366345388367021
Test R2: -12.258282464082688
```

```
2025/09/10 08:38:10 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 40.9995289936209
Fold 0: R2: -55.441991174666654
Fold 1: MSE 33.61229379587948
Fold 1: R2: -47.63556887465809
```

```
2025/09/10 08:39:36 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 39.441714576441974
Fold 2: R2: -55.38422713877536
Test MSE: 38.017845788647456
Test R2: -52.82059572936671
```

```
2025/09/10 08:39:41 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 108.57130744757713
Fold 0: R2: -148.46466281921477
Fold 1: MSE 109.65462161303992
Fold 1: R2: -157.6656041468779
```

```
2025/09/10 08:41:09 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 110.62938189940917
Fold 2: R2: -157.1511418614732
Test MSE: 109.6184369866754
Test R2: -154.4271362758553
```

```
2025/09/10 08:41:13 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

Linear

===== zero =====

===== Momentum Used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.60924165510085

Fold 0: R2: -231.1158696956038

Fold 1: MSE 169.08665014434675

Fold 1: R2: -243.66123820114663

2025/09/10 08:41:28 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.38915150993392

Fold 2: R2: -241.15165329767797

Test MSE: 169.02834776979384

Test R2: -238.6429203981428

2025/09/10 08:41:33 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.76542926544397

Fold 0: R2: -231.33088532970905

2025/09/10 08:41:33 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 1: MSE 169.58394313641435

Fold 1: R2: -244.38080014813735

Fold 2: MSE 169.74178746069308

Fold 2: R2: -241.65576691845797

Test MSE: 169.3637199541838

Test R2: -239.12248413210145

2025/09/10 08:41:38 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.76675056858727

Fold 0: R2: -231.33270430134561

Fold 1: MSE 169.58507037142908

Fold 1: R2: -244.3824312095737

Fold 2: MSE 169.74292886367536

Fold 2: R2: -241.65739862046945

Test MSE: 169.36491660123056

Test R2: -239.12417804379626

2025/09/10 08:41:38 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

2025/09/10 08:41:42 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.57752273213268

Fold 0: R2: -231.07220384835668

Fold 1: MSE 169.00530696370575

Fold 1: R2: -243.5435380558196

2025/09/10 08:41:55 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.32134409739544
 Fold 2: R2: -241.0547186539557
 Test MSE: 168.96805793107796
 Test R2: -238.55682018604398

2025/09/10 08:42:00 WARNING mlflow.utils.environment: Failed to resolve in stalled pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.76494048575924
 Fold 0: R2: -231.33021245128018
 Fold 1: MSE 169.58219924205665
 Fold 1: R2: -244.37827680668798
 Fold 2: MSE 169.74046191795694
 Fold 2: R2: -241.65387197794843
 Test MSE: 169.36253388192426
 Test R2: -239.12078707863884

2025/09/10 08:42:00 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

2025/09/10 08:42:04 WARNING mlflow.utils.environment: Failed to resolve in stalled pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.7667015037945
 Fold 0: R2: -231.33263675631113
 Fold 1: MSE 169.58489552137675
 Fold 1: R2: -244.38217820893607

2025/09/10 08:42:05 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.7427959656636
 Fold 2: R2: -241.65720863502477
 Test MSE: 169.36479766361163
 Test R2: -239.12400786675732

2025/09/10 08:42:10 WARNING mlflow.utils.environment: Failed to resolve in stalled pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== xavier =====

===== Momentum Used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.64937802764393
 Fold 0: R2: -231.17112342267012
 Fold 1: MSE 169.05308574798252
 Fold 1: R2: -243.6126719378317

2025/09/10 08:42:34 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.52392240318548
 Fold 2: R2: -241.34431613544746
 Test MSE: 169.07546205960398
 Test R2: -238.70937049864975

2025/09/10 08:42:38 WARNING mlflow.utils.environment: Failed to resolve in stalled pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 169.24782302510815

Fold 0: R2: -231.9949725764166

Fold 1: MSE 170.28848702417147

Fold 1: R2: -245.4002453840478

Fold 2: MSE 169.82702598287244

Fold 2: R2: -241.77762034818707

Test MSE: 169.787778677384

Test R2: -239.72427943621713

2025/09/10 08:42:58 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

2025/09/10 08:43:02 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 169.24922523072598

Fold 0: R2: -231.99690292242417

Fold 1: MSE 169.72526193553708

Fold 1: R2: -244.58528247920816

2025/09/10 08:43:03 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.49465820993066

Fold 2: R2: -241.30248126753582

Test MSE: 169.4897151253979

Test R2: -239.29488888972273

2025/09/10 08:43:07 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.72517538298686

Fold 0: R2: -231.27546983264943

Fold 1: MSE 168.96446962846468

Fold 1: R2: -243.48444815725938

2025/09/10 08:43:25 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.32876489245112

Fold 2: R2: -241.0653271124992

Test MSE: 169.00613663463423

Test R2: -238.608415034136

2025/09/10 08:43:29 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 169.05956939537202

Fold 0: R2: -231.73581326485913

Fold 1: MSE 169.3958039743423

Fold 1: R2: -244.10857073021833

2025/09/10 08:43:39 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.89796992926802

Fold 2: R2: -241.87903884965553

Test MSE: 169.4511144329941

Test R2: -239.24114094824435

```
2025/09/10 08:43:43 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Linear
```

```
Fold 0: MSE 168.80328915108194
```

```
Fold 0: R2: -231.38300513165564
```

```
Fold 1: MSE 169.85612783689865
```

```
Fold 1: R2: -244.77463990889345
```

```
2025/09/10 08:43:45 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 169.92878075154536
```

```
Fold 2: R2: -241.92308471379388
```

```
Test MSE: 169.52939924650866
```

```
Test R2: -239.36024325144766
```

```
2025/09/10 08:43:50 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== Lasso =====
```

```
===== sto =====
```

```
Polynomial
```

```
===== zero =====
```

```
===== Momentum Used =====
```

```
===== 0.01 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 0.18271261769177088
```

```
Fold 0: R2: 0.7484687212659512
```

```
Fold 1: MSE 0.18188378413206543
```

```
Fold 1: R2: 0.7368218496464843
```

```
2025/09/10 08:46:43 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 0.25180973476836377
```

```
Fold 2: R2: 0.6400233247107736
```

```
Test MSE: 0.20546871219740004
```

```
Test R2: 0.7084379652077364
```

```
2025/09/10 08:46:48 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 0.17405803210662152
```

```
Fold 0: R2: 0.7603830543133723
```

```
Fold 1: MSE 0.15760581936710205
```

```
Fold 1: R2: 0.7719510388245121
```

```
2025/09/10 08:49:25 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 0.14305802116957284
```

```
Fold 2: R2: 0.7954902304255613
```

```
Test MSE: 0.15824062421443214
```

```
Test R2: 0.7759414411878153
```

```
2025/09/10 08:49:29 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 0.15378106731092245

Fold 0: R2: 0.7882973327487646

Fold 1: MSE 0.15058929044093047

Fold 1: R2: 0.7821036597054971

2025/09/10 08:51:10 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.14712885408357929

Fold 2: R2: 0.7896707377860491

Test MSE: 0.1504997372784774

Test R2: 0.7866905767467703

2025/09/10 08:51:14 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 0.16761507417405797

Fold 0: R2: 0.7692527507146427

Fold 1: MSE 0.15540926024563403

Fold 1: R2: 0.7751293670602516

2025/09/10 08:53:42 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 8.739327680592277

Fold 2: R2: -11.493377690964307

Test MSE: 3.0207840050039896

Test R2: -3.316331857729804

2025/09/10 08:53:47 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 0.1525182362895302

Fold 0: R2: 0.790035808753589

Fold 1: MSE 0.14539190838901572

Fold 1: R2: 0.7896240519253461

2025/09/10 08:56:17 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.14608476025509237

Fold 2: R2: 0.7911633306971789

Test MSE: 0.1479983016445461

Test R2: 0.7902743971253714

2025/09/10 08:56:21 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 0.15462819374632036

Fold 0: R2: 0.787131136356655

Fold 1: MSE 0.15269528159914716

Fold 1: R2: 0.7790563794857394

2025/09/10 08:58:49 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.15285239590037747

Fold 2: R2: 0.7814886015553544

Test MSE: 0.15339195708194833

Test R2: 0.7825587057992496

```
2025/09/10 08:58:54 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 0.7366297500405812
Fold 0: R2: -0.014081158280045525
Fold 1: MSE 0.1608379815568063
Fold 1: R2: 0.7672742367072256

2025/09/10 09:01:32 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 0.219123563658091
Fold 2: R2: 0.6867501091817328
Test MSE: 0.3721970984184928
Test R2: 0.4799810625363043

2025/09/10 09:01:36 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.001 =====
Using Polynomial
Fold 0: MSE 0.15415516247374186
Fold 0: R2: 0.7877823347378942
Fold 1: MSE 0.15206917186164268
Fold 1: R2: 0.779962333820377

2025/09/10 09:04:10 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 0.1372936737034927
Fold 2: R2: 0.8037307007074597
Test MSE: 0.1478393360129591
Test R2: 0.7904917897552437

2025/09/10 09:04:14 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 0.15340047784416208
Fold 0: R2: 0.7888212711415057
Fold 1: MSE 0.15139641860187658
Fold 1: R2: 0.7809357793608601

2025/09/10 09:06:12 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 0.14960450010830054
Fold 2: R2: 0.7861316576706917
Test MSE: 0.15146713218477972
Test R2: 0.785296236057686

2025/09/10 09:06:16 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== Momentum not used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 0.22087598181098228
Fold 0: R2: 0.6959311357452185
Fold 1: MSE 0.20534090506883318
Fold 1: R2: 0.7028803868040643
```

2025/09/10 09:08:48 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 4.286073152534547
Fold 2: R2: -5.127191090984147
Test MSE: 1.5707633464714539
Test R2: -1.2427931894782882

2025/09/10 09:08:52 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 0.1547679927940988
Fold 0: R2: 0.7869386820330415
Fold 1: MSE 0.14834136217733596
Fold 1: R2: 0.7853563169193509

2025/09/10 09:11:33 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.16972298365147095
Fold 2: R2: 0.7573711142215137
Test MSE: 0.15761077954096858
Test R2: 0.7765553710579688

2025/09/10 09:11:39 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 0.15287380734893244
Fold 0: R2: 0.7895463119449826
Fold 1: MSE 0.14914523262376223
Fold 1: R2: 0.7841931503499733

2025/09/10 09:13:42 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.1479969990747944
Fold 2: R2: 0.7884296739808945
Test MSE: 0.15000534634916302
Test R2: 0.7873897120919501

2025/09/10 09:13:46 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

Linear

===== zero =====

===== Momentum Used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 169.0577593187814
Fold 0: R2: -231.73332142338043
Fold 1: MSE 172.70467098294313
Fold 1: R2: -248.89636147937622

2025/09/10 09:15:47 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.4447630379
Fold 2: R2: -241.23115321440437
Test MSE: 170.40239777987483
Test R2: -240.62027870572035

2025/09/10 09:15:52 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.6871870232317

Fold 0: R2: -231.22317316684203

Fold 1: MSE 169.05082621326798

Fold 1: R2: -243.60940248657374

2025/09/10 09:16:23 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.23678972739026

Fold 2: R2: -240.93384325958846

Test MSE: 168.99160098796332

Test R2: -238.58880630433475

2025/09/10 09:16:27 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.54111053689252

Fold 0: R2: -231.0220770090285

Fold 1: MSE 168.9366300082855

Fold 1: R2: -243.44416540319054

2025/09/10 09:16:30 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.20827564077422

Fold 2: R2: -240.89308071278543

Test MSE: 168.89533872865073

Test R2: -238.45310770833484

2025/09/10 09:16:34 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 173.30550377659858

Fold 0: R2: -237.5809777522534

Fold 1: MSE 172.33127767837067

Fold 1: R2: -248.35607714495524

2025/09/10 09:19:12 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.47056744833654

Fold 2: R2: -241.2680421213614

Test MSE: 171.70244963443528

Test R2: -242.40169900619003

2025/09/10 09:19:17 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.58445785334126

Fold 0: R2: -231.08175108120687

Fold 1: MSE 169.02857849941526

Fold 1: R2: -243.57721098467985

2025/09/10 09:20:22 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.7934570265842

Fold 2: R2: -241.72963157091166

Test MSE: 169.1354977931136

Test R2: -238.79619787893282

```
2025/09/10 09:20:27 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.5991054161237
Fold 0: R2: -231.10191564479064
Fold 1: MSE 168.93493232272343
Fold 1: R2: -243.44170892391594

2025/09/10 09:20:30 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.21509291752002
Fold 2: R2: -240.9028264067704
Test MSE: 168.91637688545572
Test R2: -238.48215032515898

2025/09/10 09:20:34 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 170.67156336544193
Fold 0: R2: -233.95496435428893
Fold 1: MSE 171.58740268616708
Fold 1: R2: -247.2797214628004

2025/09/10 09:23:09 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.77906194898935
Fold 2: R2: -241.7090529694613
Test MSE: 170.67934266686612
Test R2: -240.9812462621836

2025/09/10 09:23:13 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.001 =====
Using Linear
Fold 0: MSE 168.51334099022858
Fold 0: R2: -230.98384806966737
Fold 1: MSE 169.02577729324196
Fold 1: R2: -243.57315775770874

2025/09/10 09:23:30 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.14218983063094
Fold 2: R2: -240.79860719991248
Test MSE: 168.89376937136717
Test R2: -238.45187100909618

2025/09/10 09:23:34 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.53721845485674
Fold 0: R2: -231.01671897528254
Fold 1: MSE 168.9110294945672
Fold 1: R2: -243.4071225415598

2025/09/10 09:23:38 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```



```
Fold 2: MSE 169.1969208318236
Fold 2: R2: -240.87684835235527
Test MSE: 168.8817229270825
Test R2: -238.43356328973255
```

```
2025/09/10 09:23:42 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== Momentum not used =====
```

```
===== 0.01 =====
```

```
Using Linear
```

```
Fold 0: MSE 170.03331717561684
Fold 0: R2: -233.07632289918888
Fold 1: MSE 171.4213891785221
Fold 1: R2: -247.0395069319438
```

```
2025/09/10 09:25:32 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 170.4451838176222
Fold 2: R2: -242.66131295984047
Test MSE: 170.63329672392038
Test R2: -240.9257142636577
```

```
2025/09/10 09:25:36 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.001 =====
```

```
Using Linear
```

```
Fold 0: MSE 168.85778710373245
Fold 0: R2: -231.4580297243288
Fold 1: MSE 169.06948427627728
Fold 1: R2: -243.6363999153737
```

```
2025/09/10 09:27:25 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 169.19892490927626
Fold 2: R2: -240.87971329774385
Test MSE: 169.042065429762
Test R2: -238.65804764581546
```

```
2025/09/10 09:27:30 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Linear
```

```
Fold 0: MSE 168.6044021863948
Fold 0: R2: -231.1092074422389
Fold 1: MSE 168.939967086609
Fold 1: R2: -243.4489940145203
```

```
2025/09/10 09:27:34 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 169.21528856874394
Fold 2: R2: -240.90310610158505
Test MSE: 168.91988594724924
Test R2: -238.4871025194481
```

```
2025/09/10 09:27:38 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```



```

===== mini =====
Polynomial
===== zero =====
===== Momentum Used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 0.15253300932596012
Fold 0: R2: 0.7900154714567404
Fold 1: MSE 0.15065541390489842
Fold 1: R2: 0.7820079818471047
2025/09/10 09:28:40 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 0.14902479660409396
Fold 2: R2: 0.7869603775781637
Test MSE: 0.15073773994498416
Test R2: 0.7863279436273363
2025/09/10 09:28:44 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
===== 0.001 =====
Using Polynomial
Fold 0: MSE 0.16935368400721473
Fold 0: R2: 0.7668592939294565
Fold 1: MSE 0.1597177958723687
Fold 1: R2: 0.768895098060477
2025/09/10 09:30:19 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 0.15954263268633373
Fold 2: R2: 0.7719245185888177
Test MSE: 0.1628713708553057
Test R2: 0.7692263035262504
2025/09/10 09:30:23 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 14.98452264591003
Fold 0: R2: -19.628439294232805
Fold 1: MSE 12.276608885166144
Fold 1: R2: -16.76373432315212
2025/09/10 09:32:03 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 14.457258693417698
Fold 2: R2: -19.66749295073961
Test MSE: 13.90613007483129
Test R2: -18.68655552270818
2025/09/10 09:32:08 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
===== Momentum not used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 0.1534760361248126
Fold 0: R2: 0.7887172538536409
Fold 1: MSE 0.15133849754250908
Fold 1: R2: 0.7810195886863786
2025/09/10 09:33:42 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

```

Fold 2: MSE 0.16076278059963642
Fold 2: R2: 0.7701802461142218
Test MSE: 0.15519243808898606
Test R2: 0.779972362884747

2025/09/10 09:33:46 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 0.15568459944974336
Fold 0: R2: 0.7856768357133782
Fold 1: MSE 0.153383305718634
Fold 1: R2: 0.7780608376564926

2025/09/10 09:34:59 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.1483755865848738
Fold 2: R2: 0.7878884610952617
Test MSE: 0.15248116391775038
Test R2: 0.7838753781550442

2025/09/10 09:35:03 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 5.597740757633225
Fold 0: R2: -6.706128392098468
Fold 1: MSE 4.398528200345077
Fold 1: R2: -5.364484451258541

2025/09/10 09:36:39 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 5.383214229631118
Fold 2: R2: -6.695618132217361
Test MSE: 5.126494395869806
Test R2: -6.255410325191456

2025/09/10 09:36:44 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== xavier =====

===== Momentum Used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 0.1545111525409906
Fold 0: R2: 0.7872922611022423
Fold 1: MSE 0.1504970963765258
Fold 1: R2: 0.7822370606211387

2025/09/10 09:38:15 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.15267572909034607
Fold 2: R2: 0.7817411570451871
Test MSE: 0.15256132600262085
Test R2: 0.7837568262561895

2025/09/10 09:38:20 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 0.16883850183154014

Fold 0: R2: 0.767568519340736

Fold 1: MSE 0.1595424197223236

Fold 1: R2: 0.769148859939279

2025/09/10 09:39:49 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.20038820335071603

Fold 2: R2: 0.7135333974449867

Test MSE: 0.17625637496819327

Test R2: 0.7500835922416672

2025/09/10 09:39:53 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 14.6162144886336

Fold 0: R2: -19.12140796307316

Fold 1: MSE 12.693958536494224

Fold 1: R2: -17.367621634004724

2025/09/10 09:41:33 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 13.980437767454147

Fold 2: R2: -18.985849678311787

Test MSE: 13.763536930860658

Test R2: -18.49162642512989

2025/09/10 09:41:38 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 0.1525661713955933

Fold 0: R2: 0.7899698189020035

Fold 1: MSE 0.1486590945590469

Fold 1: R2: 0.7848965715884236

2025/09/10 09:43:17 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.14586140325010313

Fold 2: R2: 0.7914826325388354

Test MSE: 0.14902888973491446

Test R2: 0.7887830076764208

2025/09/10 09:43:22 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 0.15342261620848008

Fold 0: R2: 0.7887907943678907

Fold 1: MSE 0.15311845042145011

Fold 1: R2: 0.7784440720803684

2025/09/10 09:44:21 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.1705794619735978

Fold 2: R2: 0.7561467285990114

Test MSE: 0.159040176201176

Test R2: 0.7744605316824235

```
2025/09/10 09:44:25 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 5.762791084123718
Fold 0: R2: -6.933344882136724
Fold 1: MSE 4.373777836846205
Fold 1: R2: -5.3286717210732

2025/09/10 09:46:00 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 5.529047051175078
Fold 2: R2: -6.904094640465671
Test MSE: 5.221871990715001
Test R2: -6.3887037478918645

2025/09/10 09:46:05 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
Linear
===== zero =====
===== Momentum Used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 168.61225623748243
Fold 0: R2: -231.12001971967368
Fold 1: MSE 168.9451020922036
Fold 1: R2: -243.4564241506421

2025/09/10 09:46:17 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.17869846692213
Fold 2: R2: -240.85079842088945
Test MSE: 168.91201893220273
Test R2: -238.47574743040173

2025/09/10 09:46:21 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.001 =====
Using Linear
Fold 0: MSE 168.54619512976774
Fold 0: R2: -231.02907671251862
Fold 1: MSE 168.97045815627996
Fold 1: R2: -243.4931133039699

2025/09/10 09:46:27 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.2815439777524
Fold 2: R2: -240.9978220659092
Test MSE: 168.9327324212667
Test R2: -238.50667069413257

2025/09/10 09:46:31 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.64233969502183
Fold 0: R2: -231.16143410385368
Fold 1: MSE 169.21443593841101
Fold 1: R2: -243.84613884571903
```

```
2025/09/10 09:46:46 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.48838285611183  
Fold 2: R2: -241.29351028392378  
Test MSE: 169.11505282984822  
Test R2: -238.76702774449882
```

```
2025/09/10 09:46:51 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== Momentum not used =====  
===== 0.01 =====
```

```
Using Linear  
Fold 0: MSE 168.6262213615568  
Fold 0: R2: -231.13924480418328  
Fold 1: MSE 168.91515962929358  
Fold 1: R2: -243.41309867199487
```

```
2025/09/10 09:47:02 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.17517904055592  
Fold 2: R2: -240.84576719601088  
Test MSE: 168.90552001046876  
Test R2: -238.4660368907297
```

```
2025/09/10 09:47:06 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== 0.001 =====
```

```
Using Linear  
Fold 0: MSE 168.52091225712735  
Fold 0: R2: -230.99427105232036  
Fold 1: MSE 168.94679526175875  
Fold 1: R2: -243.4588740954455
```

```
2025/09/10 09:47:11 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.2087079433005  
Fold 2: R2: -240.89369871441383  
Test MSE: 168.89213848739553  
Test R2: -238.44894795405992
```

```
2025/09/10 09:47:16 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Linear  
Fold 0: MSE 168.55945775865789  
Fold 0: R2: -231.04733470721135  
Fold 1: MSE 169.05651610984705  
Fold 1: R2: -243.61763552650376
```

```
2025/09/10 09:47:34 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.32950350329688  
Fold 2: R2: -241.06638299970245  
Test MSE: 168.98182579060062  
Test R2: -238.57711774447253
```

```
2025/09/10 09:47:38 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 168.56576028546328
Fold 0: R2: -231.05601107913705
Fold 1: MSE 168.9350291490161
Fold 1: R2: -243.44184902747014
2025/09/10 09:47:46 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 169.17369510271584
Fold 2: R2: -240.84364582047908
Test MSE: 168.89149484573173
Test R2: -238.44716864236207
2025/09/10 09:47:51 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
===== 0.001 =====
Using Linear
Fold 0: MSE 168.4927422292476
Fold 0: R2: -230.95549079059526
Fold 1: MSE 168.97896916520955
Fold 1: R2: -243.50542837426832
2025/09/10 09:47:58 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 169.30185976658132
Fold 2: R2: -241.02686466875073
Test MSE: 168.92452372034617
Test R2: -238.49592794453812
2025/09/10 09:48:03 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.6139271067289
Fold 0: R2: -231.1223199213974
Fold 1: MSE 169.20063694706167
Fold 1: R2: -243.8261722882967
Fold 2: MSE 169.29327931126815
Fold 2: R2: -241.01459840835798
Test MSE: 169.03594778835293
Test R2: -238.6543635393507
2025/09/10 09:48:16 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
2025/09/10 09:48:20 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
===== Momentum not used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 168.6223334788004
Fold 0: R2: -231.13389255137434
Fold 1: MSE 168.90279305901916
Fold 1: R2: -243.39520476734268
2025/09/10 09:48:27 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

Fold 2: MSE 169.20420001567248
Fold 2: R2: -240.88725436943454
Test MSE: 168.9097755178307
Test R2: -238.47211722938388

2025/09/10 09:48:31 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.46322259988995
Fold 0: R2: -230.91485260033843
Fold 1: MSE 168.92559649772343
Fold 1: R2: -243.42820037961525

2025/09/10 09:48:38 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.23964079018117
Fold 2: R2: -240.93791901982644
Test MSE: 168.87615329593152
Test R2: -238.42699066659338

2025/09/10 09:48:42 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.62113161280155
Fold 0: R2: -231.1322380028523
Fold 1: MSE 169.1032513177786
Fold 1: R2: -243.68525939763938

2025/09/10 09:49:00 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.31966874997957
Fold 2: R2: -241.05232364729216
Test MSE: 169.0146838935199
Test R2: -238.6232736825946

2025/09/10 09:49:04 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== batch =====

Polynomial

===== zero =====

===== Momentum Used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 10.624291455361968
Fold 0: R2: -13.625928133318967
Fold 1: MSE 8.622870956914193
Fold 1: R2: -11.476929925374524

2025/09/10 09:50:37 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 10.284055846845384
Fold 2: R2: -13.70165653302311
Test MSE: 9.843739419707182
Test R2: -12.934838197238868

2025/09/10 09:50:41 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 56.18169132411615

Fold 0: R2: -76.34251109048071

Fold 1: MSE 50.82322702359349

Fold 1: R2: -72.53906202739975

2025/09/10 09:52:15 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 53.41775667470242

Fold 2: R2: -75.36379295207503

Test MSE: 53.474225007470686

Test R2: -74.74845535665183

2025/09/10 09:52:19 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 133.73414302731481

Fold 0: R2: -183.10507402838056

Fold 1: MSE 134.48514634392436

Fold 1: R2: -193.5943242478213

2025/09/10 09:54:00 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 134.83557511179418

Fold 2: R2: -191.75530425423605

Test MSE: 134.35162149434444

Test R2: -189.4849008434793

2025/09/10 09:54:05 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 3.0273002359488523

Fold 0: R2: -3.167532100846244

Fold 1: MSE 2.3153573410403343

Fold 1: R2: -2.350224239781489

2025/09/10 09:55:40 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 2.87580809330598

Fold 2: R2: -3.1111350883651268

Test MSE: 2.7394885567650555

Test R2: -2.8762971429976196

2025/09/10 09:55:44 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 40.21731647917654

Fold 0: R2: -54.365158515348746

Fold 1: MSE 33.851458053544334

Fold 1: R2: -47.98162944989444

2025/09/10 09:57:16 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 38.20697004823611

Fold 2: R2: -53.61908795341392

Test MSE: 37.42524819365233

Test R2: -51.988625306219035


```
2025/09/10 09:57:19 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 110.51522791472205
Fold 0: R2: -151.14076043652932
Fold 1: MSE 110.72592945620329
Fold 1: R2: -159.2157413290812

2025/09/10 09:58:48 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 111.22956900352003
Fold 2: R2: -158.00914426748838
Test MSE: 110.82357545814845
Test R2: -156.12188201103297

2025/09/10 09:58:52 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 10.980270184562208
Fold 0: R2: -14.115986160449353
Fold 1: MSE 8.3942152150145
Fold 1: R2: -11.146074728425367

2025/09/10 10:00:21 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 10.839383606587868
Fold 2: R2: -14.495529894717421
Test MSE: 10.071289668721525
Test R2: -13.25253026119738

2025/09/10 10:00:25 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.001 =====
Using Polynomial
Fold 0: MSE 57.166188735695805
Fold 0: R2: -77.69781920205698
Fold 1: MSE 49.483450545525585
Fold 1: R2: -70.60046207431633

2025/09/10 10:01:56 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 52.57911469305206
Fold 2: R2: -74.16490541665006
Test MSE: 53.07625132475781
Test R2: -74.15439556434113

2025/09/10 10:02:00 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 142.49659644829586
Fold 0: R2: -195.16790330459958
Fold 1: MSE 125.21487035805663
Fold 1: R2: -180.18062660088984

2025/09/10 10:03:30 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 130.997646739514
Fold 2: R2: -186.2687622159686
Test MSE: 132.90303784862218
Test R2: -187.20576404048597
```

```
2025/09/10 10:03:34 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== Momentum not used =====
```

```
===== 0.01 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 2.987433829194958
Fold 0: R2: -3.1126500221150692
Fold 1: MSE 2.2793888404654363
Fold 1: R2: -2.2981793392563397
```

```
2025/09/10 10:05:13 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 2.992654136320203
Fold 2: R2: -3.278173309201402
Test MSE: 2.7531589353268657
Test R2: -2.8963342235242706
```

```
2025/09/10 10:05:17 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 40.737588318117616
Fold 0: R2: -55.08139061027131
Fold 1: MSE 34.64858094740154
Fold 1: R2: -49.135032595814565
```

```
2025/09/10 10:06:59 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 37.45465547098689
Fold 2: R2: -52.54361046824476
Test MSE: 37.613608245502014
Test R2: -52.25334455811021
```

```
2025/09/10 10:07:05 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 120.47878856437299
Fold 0: R2: -164.85709367400023
Fold 1: MSE 108.9624767500205
Fold 1: R2: -156.66409977585673
```

```
2025/09/10 10:08:47 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 110.2334192306607
Fold 2: R2: -156.5850901750051
Test MSE: 113.22489484835141
Test R2: -159.36876120828734
```

```
2025/09/10 10:08:51 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

Linear

===== zero =====

===== Momentum Used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.59038861325192

Fold 0: R2: -231.08991566033137

Fold 1: MSE 169.17435405278565

Fold 1: R2: -243.78814205083208

2025/09/10 10:09:06 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.396991182248

Fold 2: R2: -241.16286056564786

Test MSE: 169.05391128276187

Test R2: -238.68030609227046

2025/09/10 10:09:10 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.76550474954453

Fold 0: R2: -231.3309892448769

2025/09/10 10:09:10 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 1: MSE 169.58401495769505

Fold 1: R2: -244.3809040704958

Fold 2: MSE 169.74179984641162

Fold 2: R2: -241.6557846245637

Test MSE: 169.36377318455038

Test R2: -239.1225593133121

2025/09/10 10:09:15 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.7667581841734

Fold 0: R2: -231.33271478534033

Fold 1: MSE 169.5850775356387

Fold 1: R2: -244.3824415758823

Fold 2: MSE 169.74293012256734

Fold 2: R2: -241.65740042012885

Test MSE: 169.36492194745983

Test R2: -239.12418559378384

2025/09/10 10:09:15 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

2025/09/10 10:09:20 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.54537411282806

Fold 0: R2: -231.02794645975712

Fold 1: MSE 169.04607527471387

Fold 1: R2: -243.60252807923126

2025/09/10 10:09:33 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

```
Fold 2: MSE 169.30027397706908
Fold 2: R2: -241.02459769032416
Test MSE: 168.96390778820367
Test R2: -238.55169074310416
```

```
2025/09/10 10:09:37 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.001 =====
```

```
Using Linear
```

```
Fold 0: MSE 168.76501577123912
Fold 0: R2: -231.33031609301696
Fold 1: MSE 169.582423341516
Fold 1: R2: -244.3786010691366
```

```
2025/09/10 10:09:38 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 169.7406291232097
Fold 2: R2: -241.65411100759133
Test MSE: 169.36268941198827
Test R2: -239.12100938991497
```

```
2025/09/10 10:09:43 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Linear
```

```
Fold 0: MSE 168.76670911739225
Fold 0: R2: -231.33264723756855
Fold 1: MSE 169.584917998506
Fold 1: R2: -244.38221073239234
Fold 2: MSE 169.74281276458524
Fold 2: R2: -241.65723265006125
Test MSE: 169.3648132934945
Test R2: -239.12403020667406
```

```
2025/09/10 10:09:43 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
2025/09/10 10:09:47 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== xavier =====
```

```
===== Momentum Used =====
```

```
===== 0.01 =====
```

```
Using Linear
```

```
Fold 0: MSE 168.52666667940554
Fold 0: R2: -231.00219287628795
Fold 1: MSE 169.16161624255415
Fold 1: R2: -243.7697109776483
```

```
2025/09/10 10:10:10 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 169.30420176810813
Fold 2: R2: -241.03021269627607
Test MSE: 168.9974948966893
Test R2: -238.60070551673743
```

```
2025/09/10 10:10:14 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

===== 0.001 =====

Using Linear

Fold 0: MSE 169.28662530785417
 Fold 0: R2: -232.0483897291026
 Fold 1: MSE 170.4098605193522
 Fold 1: R2: -245.57586770307992
 Fold 2: MSE 170.50082227771722
 Fold 2: R2: -242.74085137761307
 Test MSE: 170.06576936830788
 Test R2: -240.12170293659855

2025/09/10 10:10:46 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

2025/09/10 10:10:51 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.85473862204557
 Fold 0: R2: -231.4538330327889
 Fold 1: MSE 169.04595895532086
 Fold 1: R2: -243.6023597699845

2025/09/10 10:10:52 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 171.25867582739815
 Fold 2: R2: -243.824247146332
 Test MSE: 169.7197911349215
 Test R2: -239.62681331636847

2025/09/10 10:10:57 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.5252373936247
 Fold 0: R2: -231.00022525038082
 Fold 1: MSE 169.05550979170042
 Fold 1: R2: -243.61617942666638

2025/09/10 10:11:03 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.28092844519162
 Fold 2: R2: -240.99694212627955
 Test MSE: 168.95389187683892
 Test R2: -238.53778226777558

2025/09/10 10:11:07 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.695462527975
 Fold 0: R2: -231.2345656383448
 Fold 1: MSE 169.60538521817145
 Fold 1: R2: -244.4118259344299
 Fold 2: MSE 169.819422751664
 Fold 2: R2: -241.7667510865424
 Test MSE: 169.37342349927016
 Test R2: -239.1377142197724

```
2025/09/10 10:11:15 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.  
2025/09/10 10:11:19 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Linear
```

```
Fold 0: MSE 168.83788345700987  
Fold 0: R2: -231.43062937412392  
Fold 1: MSE 170.95967240126546  
Fold 1: R2: -246.37142226455333  
Fold 2: MSE 170.75677799599296  
Fold 2: R2: -243.10675497769003  
Test MSE: 170.18477795142277  
Test R2: -240.30293553878911
```

```
2025/09/10 10:11:20 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.  
2025/09/10 10:11:24 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== ElasticNet =====
```

```
===== sto =====
```

```
Polynomial
```

```
===== zero =====
```

```
===== Momentum Used =====
```

```
===== 0.01 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 1.7349423430879805  
Fold 0: R2: -1.3884079359146582  
Fold 1: MSE 1.8212290724204738  
Fold 1: R2: -1.635241513897935
```

```
2025/09/10 10:14:17 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 1.2649546308953419  
Fold 2: R2: -0.8083262858772704  
Test MSE: 1.607042015467932  
Test R2: -1.2773252452299546
```

```
2025/09/10 10:14:22 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== 0.001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 1.2692623614478242  
Fold 0: R2: -0.7473297074783722  
Fold 1: MSE 1.0162268612395795  
Fold 1: R2: -0.47043732874172783
```

```
2025/09/10 10:16:18 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 1.2638696994813472  
Fold 2: R2: -0.8067753132602431  
Test MSE: 1.183119640722917  
Test R2: -0.674847449826781
```

```
2025/09/10 10:16:23 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 1.28425901689574

Fold 0: R2: -0.7679748493914043

Fold 1: MSE 1.0411488452320383

Fold 1: R2: -0.5064983865296657

2025/09/10 10:18:41 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 1.158694317366269

Fold 2: R2: -0.6564209816023057

Test MSE: 1.1613673931646824

Test R2: -0.6436314058411252

2025/09/10 10:18:45 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 2.7580378621545174

Fold 0: R2: -2.7968521223583385

Fold 1: MSE 0.7381760610587882

Fold 1: R2: -0.06810956958997161

2025/09/10 10:21:29 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 1.5670499512363747

Fold 2: R2: -1.2401891331847184

Test MSE: 1.6877546248165602

Test R2: -1.3683836083776761

2025/09/10 10:21:33 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 1.5611968256579318

Fold 0: R2: -1.1492212134781519

Fold 1: MSE 1.0445292461755435

Fold 1: R2: -0.511389683860048

2025/09/10 10:24:22 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 1.2204330883453942

Fold 2: R2: -0.7446801489214423

Test MSE: 1.27538638672629

Test R2: -0.8017636820865475

2025/09/10 10:24:26 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 1.2770403029418773

Fold 0: R2: -0.7580372086604645

Fold 1: MSE 1.0263730101848858

Fold 1: R2: -0.4851183775519843

2025/09/10 10:27:35 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 1.125384022502727

Fold 2: R2: -0.6088019758918555

Test MSE: 1.14293244520983

Test R2: -0.6173191873681014


```
2025/09/10 10:27:39 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 1.2258433906746304
Fold 0: R2: -0.6875569923924256
Fold 1: MSE 1.145008407085935
Fold 1: R2: -0.6567787840685042
```

```
2025/09/10 10:30:39 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 1.9634580386998286
Fold 2: R2: -1.8068775716365542
Test MSE: 1.444769945486798
Test R2: -1.050404449365828
```

```
2025/09/10 10:30:43 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.001 =====
Using Polynomial
Fold 0: MSE 1.3260628526209617
Fold 0: R2: -0.8255240892238249
Fold 1: MSE 0.9985476878331443
Fold 1: R2: -0.44485631183531504
Fold 2: MSE 1.0908822328190027
Fold 2: R2: -0.5594796589715028
Test MSE: 1.1384975910910364
Test R2: -0.6099533533435476
```

```
2025/09/10 10:34:32 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
2025/09/10 10:34:37 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 1.2871350581345782
Fold 0: R2: -0.7719341508322999
Fold 1: MSE 1.040403885440185
Fold 1: R2: -0.5054204611882545
```

```
2025/09/10 10:37:29 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 1.1431410277086063
Fold 2: R2: -0.6341866485812806
Test MSE: 1.156893323761123
Test R2: -0.6371804202006116
```

```
2025/09/10 10:37:34 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== Momentum not used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 4.8430695474745145
Fold 0: R2: -5.6672104623295585
Fold 1: MSE 1.2179543410822982
Fold 1: R2: -0.7623284683165128
```


2025/09/10 10:40:21 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 1.4925125219915882
 Fold 2: R2: -1.1336335387839442
 Test MSE: 2.5178454701828
 Test R2: -2.5210574898100053

2025/09/10 10:40:26 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 1.2705265001340424
 Fold 0: R2: -0.7490699836796473
 Fold 1: MSE 1.038103708713182
 Fold 1: R2: -0.5020922026555459

2025/09/10 10:43:19 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 1.0555205334385063
 Fold 2: R2: -0.5089280510788303
 Test MSE: 1.1213835807619101
 Test R2: -0.5866967458046745

2025/09/10 10:43:24 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 1.268269095299414
 Fold 0: R2: -0.7459623278874656
 Fold 1: MSE 1.0623705885624934
 Fold 1: R2: -0.5372053524290055

2025/09/10 10:46:15 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 1.1300441722801127
 Fold 2: R2: -0.6154639312954315
 Test MSE: 1.1535612853806734
 Test R2: -0.6328772038706342

2025/09/10 10:46:19 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

Linear

===== zero =====

===== Momentum Used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.4400338805024
 Fold 0: R2: -230.88292985568376
 Fold 1: MSE 169.7449906669131
 Fold 1: R2: -244.61382911989492

2025/09/10 10:48:25 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.5065669939816
 Fold 2: R2: -241.31950556762234
 Test MSE: 169.23053051379904
 Test R2: -238.93875484773366

2025/09/10 10:48:29 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.62364999018752

Fold 0: R2: -231.13570492644098

Fold 1: MSE 168.97411597622417

Fold 1: R2: -243.49840601487227

2025/09/10 10:48:40 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.13714412977544

Fold 2: R2: -240.79139407679736

Test MSE: 168.91163669872904

Test R2: -238.47516833937019

2025/09/10 10:48:45 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.5452682322354

Fold 0: R2: -231.02780069926615

Fold 1: MSE 168.90834794189294

Fold 1: R2: -243.40324244814602

2025/09/10 10:48:48 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.22352107421932

Fold 2: R2: -240.91487494742836

Test MSE: 168.89237908278255

Test R2: -238.44863936494684

2025/09/10 10:48:52 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 170.7763777164062

Fold 0: R2: -234.0992570039197

Fold 1: MSE 171.26065499253346

Fold 1: R2: -246.80693135645242

2025/09/10 10:50:36 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 171.76215284173946

Fold 2: R2: -244.54399684891538

Test MSE: 171.2663951835597

Test R2: -241.81672840309582

2025/09/10 10:50:39 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.81987546170743

Fold 0: R2: -231.40583867196509

Fold 1: MSE 169.00744369019318

Fold 1: R2: -243.54662980876205

2025/09/10 10:52:26 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.26320191875593

Fold 2: R2: -240.97160102476641

Test MSE: 169.03017369021885

Test R2: -238.64135650183118

```
2025/09/10 10:52:30 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.60697470288574
Fold 0: R2: -231.1127488964127
Fold 1: MSE 168.90376551601398
Fold 1: R2: -243.39661187152416

2025/09/10 10:52:32 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.22175326043524
Fold 2: R2: -240.91234775470838
Test MSE: 168.91083115977833
Test R2: -238.47390284088178

2025/09/10 10:52:36 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 170.98227847332427
Fold 0: R2: -234.38271022862955
Fold 1: MSE 170.9303676647796
Fold 1: R2: -246.3290195490955

2025/09/10 10:54:41 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.59111551293975
Fold 2: R2: -241.44037259757724
Test MSE: 170.50125388368122
Test R2: -240.7173674584341

2025/09/10 10:54:46 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.001 =====
Using Linear
Fold 0: MSE 168.73000659746648
Fold 0: R2: -231.28212072283563
Fold 1: MSE 168.9474228205821
Fold 1: R2: -243.45978214654613

2025/09/10 10:55:28 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.32259703724648
Fold 2: R2: -241.05650980441433
Test MSE: 169.00000881843167
Test R2: -238.59947089126536

2025/09/10 10:55:32 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.6690816921963
Fold 0: R2: -231.19824846747113
Fold 1: MSE 168.87622327363684
Fold 1: R2: -243.35675941056954

2025/09/10 10:55:37 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 169.22885103795508
Fold 2: R2: -240.92249444087952
Test MSE: 168.9247186679294
Test R2: -238.4925007729734
```

```
2025/09/10 10:55:41 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== Momentum not used =====
```

```
===== 0.01 =====
```

```
Using Linear
```

```
Fold 0: MSE 170.13992707698208
Fold 0: R2: -233.22308739282306
Fold 1: MSE 172.31824231168085
Fold 1: R2: -248.3372155201492
```

```
2025/09/10 10:58:07 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 172.39833222868677
Fold 2: R2: -245.45345231858377
Test MSE: 171.61883387244987
Test R2: -242.33791841051868
```

```
2025/09/10 10:58:11 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.001 =====
```

```
Using Linear
```

```
Fold 0: MSE 168.4155556704965
Fold 0: R2: -230.84923193409693
Fold 1: MSE 169.1424613597852
Fold 1: R2: -243.74199467164868
```

```
2025/09/10 11:00:13 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 169.42157522073398
Fold 2: R2: -241.198004879856
Test MSE: 168.99319741700523
Test R2: -238.59641049520056
```

```
2025/09/10 11:00:17 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Linear
```

```
Fold 0: MSE 168.6496210700706
Fold 0: R2: -231.17145800696503
Fold 1: MSE 168.9394916546577
Fold 1: R2: -243.44830608457565
```

```
2025/09/10 11:00:24 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 169.22065681595785
Fold 2: R2: -240.910780323497
Test MSE: 168.93658984689537
Test R2: -238.5101814716792
```

```
2025/09/10 11:00:28 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```

===== mini =====
Polynomial
===== zero =====
===== Momentum Used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 1.2773445276811257
Fold 0: R2: -0.7584560195704739
Fold 1: MSE 1.0323069899520247
Fold 1: R2: -0.4937045955416919
2025/09/10 11:01:59 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 1.137848434043169
Fold 2: R2: -0.6266205778211746
Test MSE: 1.149166650558773
Test R2: -0.6262603976444469
2025/09/10 11:02:03 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
===== 0.001 =====
Using Polynomial
Fold 0: MSE 1.3119989765169409
Fold 0: R2: -0.8061630577576282
Fold 1: MSE 1.1826156751390138
Fold 1: R2: -0.7111949118903864
2025/09/10 11:03:28 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 1.189956604789985
Fold 2: R2: -0.7011122414500537
Test MSE: 1.228190418815313
Test R2: -0.7394900703660228
2025/09/10 11:03:33 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 15.96483722133234
Fold 0: R2: -20.977989105475565
Fold 1: MSE 13.017650854391002
Fold 1: R2: -17.835990740762814
2025/09/10 11:05:11 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 15.324084989877992
Fold 2: R2: -20.90667160497269
Test MSE: 14.768857688533778
Test R2: -19.906883817070355
2025/09/10 11:05:16 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
===== Momentum not used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 1.2907115523181816
Fold 0: R2: -0.7768577306416826
Fold 1: MSE 1.0088537524121721
Fold 1: R2: -0.45976875181051935
2025/09/10 11:06:53 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

```

```
Fold 2: MSE 1.533385425841145
Fold 2: R2: -1.19206373430722
Test MSE: 1.2776502435238328
Test R2: -0.809563405586474
```

```
2025/09/10 11:06:57 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 1.297285749085313
Fold 0: R2: -0.7859080969512244
Fold 1: MSE 1.0477147437066543
Fold 1: R2: -0.51599896418811
```

```
2025/09/10 11:08:13 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 1.1598137321169653
Fold 2: R2: -0.6580212501566409
Test MSE: 1.1682714083029773
Test R2: -0.6533094370986584
```

```
2025/09/10 11:08:17 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 7.190935144733221
Fold 0: R2: -8.89939904040805
Fold 1: MSE 5.652326077794379
Fold 1: R2: -7.178677002171595
```

```
2025/09/10 11:10:01 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 6.8650767605027285
Fold 2: R2: -8.81402688869193
Test MSE: 6.569445994343443
Test R2: -8.297367643757193
```

```
2025/09/10 11:10:05 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== xavier =====
```

```
===== Momentum Used =====
```

```
===== 0.01 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 1.2853627142677222
Fold 0: R2: -0.7694942540981906
Fold 1: MSE 1.0355611888812157
Fold 1: R2: -0.49841328388987893
```

```
2025/09/10 11:11:45 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 1.164202526791968
Fold 2: R2: -0.6642952876440633
Test MSE: 1.1617088099803021
Test R2: -0.6440676085440443
```

```
2025/09/10 11:11:49 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

===== 0.001 =====

Using Polynomial

Fold 0: MSE 1.3104417859477382

Fold 0: R2: -0.8040193517560814

Fold 1: MSE 1.0937853521849263

Fold 1: R2: -0.5826611879967418

2025/09/10 11:13:22 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 1.1890150944168234

Fold 2: R2: -0.6997662975603434

Test MSE: 1.1977474108498294

Test R2: -0.695482279104389

2025/09/10 11:13:26 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 15.732355419707115

Fold 0: R2: -20.65794309232153

Fold 1: MSE 12.965305070664849

Fold 1: R2: -17.760248603520655

2025/09/10 11:15:03 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 14.685167708140913

Fold 2: R2: -19.993302155312165

Test MSE: 14.460942732837628

Test R2: -19.470497950384782

2025/09/10 11:15:07 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 1.352159828704342

Fold 0: R2: -0.8614504847200468

Fold 1: MSE 1.0188796264726485

Fold 1: R2: -0.47427576794450066

2025/09/10 11:16:23 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 1.1211749518679393

Fold 2: R2: -0.602784864382794

Test MSE: 1.1640714690149767

Test R2: -0.6461703723491138

2025/09/10 11:16:27 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 1.3166982788597805

Fold 0: R2: -0.812632351134216

Fold 1: MSE 1.061064277930241

Fold 1: R2: -0.5353151761407573

2025/09/10 11:17:21 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 1.1665022480025506

Fold 2: R2: -0.667582872995913

Test MSE: 1.181421601597524

Test R2: -0.671843466756962


```
2025/09/10 11:17:25 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 7.149228673346334
Fold 0: R2: -8.841983837167264
Fold 1: MSE 5.58675050702519
Fold 1: R2: -7.08379192208727

2025/09/10 11:19:04 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 7.118895044885627
Fold 2: R2: -9.176874902585515
Test MSE: 6.618291408419051
Test R2: -8.367550220613351

2025/09/10 11:19:08 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
Linear
===== zero =====
===== Momentum Used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 168.6167946245106
Fold 0: R2: -231.12626748902318
Fold 1: MSE 168.9432746371417
Fold 1: R2: -243.45377990038452

2025/09/10 11:19:10 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.20975550785613
Fold 2: R2: -240.89519626893144
Test MSE: 168.9232749231695
Test R2: -238.49174788611307

2025/09/10 11:19:15 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.001 =====
Using Linear
Fold 0: MSE 168.55655564526046
Fold 0: R2: -231.04333951353996
Fold 1: MSE 168.9419333965103
Fold 1: R2: -243.45183918186342

2025/09/10 11:19:20 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.25634872423907
Fold 2: R2: -240.96180398423678
Test MSE: 168.9182792553366
Test R2: -238.4856608932134

2025/09/10 11:19:25 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.6409207440076
Fold 0: R2: -231.15948070530035
Fold 1: MSE 169.1739522934199
Fold 1: R2: -243.78756072200568
```



```
2025/09/10 11:19:43 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.44243737466724  
Fold 2: R2: -241.22782854342154  
Test MSE: 169.0857701373649  
Test R2: -238.72495665690917
```

```
2025/09/10 11:19:47 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== Momentum not used =====  
===== 0.01 =====  
Using Linear  
Fold 0: MSE 168.7137571666634  
Fold 0: R2: -231.25975094804812  
Fold 1: MSE 168.94194388238083  
Fold 1: R2: -243.451854354475
```

```
2025/09/10 11:19:55 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.2167140918984  
Fold 2: R2: -240.9051439699231  
Test MSE: 168.95747171364755  
Test R2: -238.53891642414874
```

```
2025/09/10 11:19:59 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== 0.001 =====  
Using Linear  
Fold 0: MSE 168.5412363376449  
Fold 0: R2: -231.0222501926023  
Fold 1: MSE 168.9219920676655  
Fold 1: R2: -243.42298492162243
```

```
2025/09/10 11:20:03 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.23434547101888  
Fold 2: R2: -240.93034905280996  
Test MSE: 168.89919129210978  
Test R2: -238.45852805567824
```

```
2025/09/10 11:20:07 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== 0.0001 =====  
Using Linear  
Fold 0: MSE 168.57178377501387  
Fold 0: R2: -231.06430331449684  
Fold 1: MSE 169.02608483821834  
Fold 1: R2: -243.57360276229466
```

```
2025/09/10 11:20:24 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.3319953972528  
Fold 2: R2: -241.06994530718134  
Test MSE: 168.97662133682834  
Test R2: -238.56928379465762
```

```
2025/09/10 11:20:28 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 168.65106084174303
Fold 0: R2: -231.17344006827216
Fold 1: MSE 168.93931592199533
Fold 1: R2: -243.44805180683855
2025/09/10 11:20:37 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 169.21618208250476
Fold 2: R2: -240.90438343152323
Test MSE: 168.9355196154144
Test R2: -238.5086251022113
2025/09/10 11:20:41 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
===== 0.001 =====
Using Linear
Fold 0: MSE 168.3937162782059
Fold 0: R2: -230.8191667402475
Fold 1: MSE 168.95989380441497
Fold 1: R2: -243.47782713320555
2025/09/10 11:20:46 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 169.26691651847054
Fold 2: R2: -240.97691126130883
Test MSE: 168.8735088670305
Test R2: -238.42463504492062
2025/09/10 11:20:50 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.82663833914987
Fold 0: R2: -231.41514878547835
Fold 1: MSE 169.2503881076072
Fold 1: R2: -243.89816011542922
2025/09/10 11:21:21 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 169.4735551692381
Fold 2: R2: -241.2723132423243
Test MSE: 169.18352720533173
Test R2: -238.86187404774395
2025/09/10 11:21:24 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
===== Momentum not used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 168.63612364676504
Fold 0: R2: -231.15287678259995
Fold 1: MSE 168.92806431883665
Fold 1: R2: -243.43177121249118
2025/09/10 11:21:26 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

Fold 2: MSE 169.23760756239952
Fold 2: R2: -240.9350124023455
Test MSE: 168.93393184266708
Test R2: -238.5065534658122

2025/09/10 11:21:30 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.62956360860412
Fold 0: R2: -231.14384590773204
Fold 1: MSE 168.9529970644481
Fold 1: R2: -243.46784784188714

2025/09/10 11:21:34 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.22770369535155
Fold 2: R2: -240.92085424783372
Test MSE: 168.93675478946793
Test R2: -238.5108493324843

2025/09/10 11:21:38 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.6473731569801
Fold 0: R2: -231.16836341798
Fold 1: MSE 169.06840139225662
Fold 1: R2: -243.63483302795177

2025/09/10 11:22:05 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.32081651934405
Fold 2: R2: -241.0539644504176
Test MSE: 169.01219702286025
Test R2: -238.61905363211645

2025/09/10 11:22:10 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== batch =====

Polynomial

===== zero =====

===== Momentum Used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 11.880895560227389
Fold 0: R2: -15.355831855088528
Fold 1: MSE 9.59384838910495
Fold 1: R2: -12.881893242244061

2025/09/10 11:23:50 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 11.419853221397508
Fold 2: R2: -15.325345001896686
Test MSE: 10.964865723576615
Test R2: -14.521023366409759

2025/09/10 11:23:54 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 56.179371080337155

Fold 0: R2: -76.33931692747173

Fold 1: MSE 50.796557497706274

Fold 1: R2: -72.50047235033044

2025/09/10 11:25:32 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 53.392707534309274

Fold 2: R2: -75.3279837476141

Test MSE: 53.4562120374509

Test R2: -74.7225910084721

2025/09/10 11:25:36 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 133.63243057611095

Fold 0: R2: -182.965051608267

Fold 1: MSE 134.38000277660907

Fold 1: R2: -193.44218594863403

2025/09/10 11:27:17 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 134.7314075426794

Fold 2: R2: -191.60639064993316

Test MSE: 134.24794696513314

Test R2: -189.33787606894472

2025/09/10 11:27:22 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 4.73873123473846

Fold 0: R2: -5.5235731506047285

Fold 1: MSE 3.6593243361109438

Fold 1: R2: -4.294887693902461

2025/09/10 11:29:01 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 4.483866487679897

Fold 2: R2: -5.4099481783758945

Test MSE: 4.2939740195097675

Test R2: -5.076136340961028

2025/09/10 11:29:05 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 40.377883008975964

Fold 0: R2: -54.586202387811184

Fold 1: MSE 33.97062978331366

Fold 1: R2: -48.15406590740925

2025/09/10 11:30:44 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 38.31157803021125

Fold 2: R2: -53.768631153539864

Test MSE: 37.553363607500295

Test R2: -52.169633149586765

```
2025/09/10 11:30:49 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 110.38945100075081
Fold 0: R2: -150.96760967985975
Fold 1: MSE 110.59144558040094
Fold 1: R2: -159.02114884325334

2025/09/10 11:32:30 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 111.09514259488476
Fold 2: R2: -157.81697389053252
Test MSE: 110.69201305867882
Test R2: -155.93524413788188

2025/09/10 11:32:35 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 12.073291519823771
Fold 0: R2: -15.620693703995869
Fold 1: MSE 9.942279438580695
Fold 1: R2: -13.386058248290876

2025/09/10 11:34:16 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 11.34623377205902
Fold 2: R2: -15.220101713213385
Test MSE: 11.120601576821164
Test R2: -14.74228455516671

2025/09/10 11:34:20 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.001 =====
Using Polynomial
Fold 0: MSE 58.764627745100064
Fold 0: R2: -79.89830985832953
Fold 1: MSE 48.02040759128489
Fold 1: R2: -68.48350073869098

2025/09/10 11:36:02 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 55.31226061541803
Fold 2: R2: -78.07209662638884
Test MSE: 54.03243198393432
Test R2: -75.48463574113644

2025/09/10 11:36:06 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 130.32658008456366
Fold 0: R2: -178.4140533688065
Fold 1: MSE 127.42886492820223
Fold 1: R2: -183.38418319415143

2025/09/10 11:37:44 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 138.3804983483025
Fold 2: R2: -196.82297839323485
Test MSE: 132.04531445368946
Test R2: -186.20707165206423
```

```
2025/09/10 11:37:49 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== Momentum not used =====
```

```
===== 0.01 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 4.81594100975442
Fold 0: R2: -5.629863967768184
Fold 1: MSE 3.7437275781301538
Fold 1: R2: -4.417015618744441
```

```
2025/09/10 11:39:29 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 4.423451202230681
Fold 2: R2: -5.323581010670231
Test MSE: 4.3277065967050845
Test R2: -5.123486865727618
```

```
2025/09/10 11:39:34 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 39.8567446079106
Fold 0: R2: -53.86877734036033
Fold 1: MSE 34.617655067670945
Fold 1: R2: -49.090284154581106
```

```
2025/09/10 11:41:17 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 38.50488523328266
Fold 2: R2: -54.04497505396577
Test MSE: 37.65976163628807
Test R2: -52.334678849635736
```

```
2025/09/10 11:41:21 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 109.67591500961029
Fold 0: R2: -149.98532053890338
Fold 1: MSE 113.33031194026773
Fold 1: R2: -162.98417273840076
```

```
2025/09/10 11:43:03 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 104.19898300349693
Fold 2: R2: -147.95851228556208
Test MSE: 109.06840331779165
Test R2: -153.64266852095543
```

```
2025/09/10 11:43:07 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

Linear

===== zero =====

===== Momentum Used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.59817689375822

Fold 0: R2: -231.10063739471207

Fold 1: MSE 169.08903444761847

Fold 1: R2: -243.66468818723487

2025/09/10 11:43:26 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.38767214466816

Fold 2: R2: -241.14953845890736

Test MSE: 169.02496116201496

Test R2: -238.6382880136181

2025/09/10 11:43:31 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.76546694730158

Fold 0: R2: -231.33093720442872

Fold 1: MSE 169.58399850737584

Fold 1: R2: -244.38088026757902

Fold 2: MSE 169.74184352363832

Fold 2: R2: -241.655847063702

Test MSE: 169.3637696594386

Test R2: -239.12255484523658

2025/09/10 11:43:31 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

2025/09/10 11:43:35 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.7667543757767

Fold 0: R2: -231.332709542512

Fold 1: MSE 169.58507590061362

Fold 1: R2: -244.3824392100701

2025/09/10 11:43:36 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.74293448455964

Fold 2: R2: -241.65740665585074

Test MSE: 169.36492158698331

Test R2: -239.1241851361443

2025/09/10 11:43:40 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.56080140649976

Fold 0: R2: -231.04918443967156

Fold 1: MSE 168.99563093632426

Fold 1: R2: -243.52953725304778

2025/09/10 11:43:56 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.30431279955957
 Fold 2: R2: -241.03037142219975
 Test MSE: 168.95358171412786
 Test R2: -238.5363643716397

2025/09/10 11:44:01 WARNING mlflow.utils.environment: Failed to resolve in stalled pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.76497806836585
 Fold 0: R2: -231.33026418936603
 Fold 1: MSE 169.58231120741112
 Fold 1: R2: -244.37843881582492
 Fold 2: MSE 169.74054544483687
 Fold 2: R2: -241.65399138448595
 Test MSE: 169.36261157353795
 Test R2: -239.1208981298923

2025/09/10 11:44:01 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

2025/09/10 11:44:05 WARNING mlflow.utils.environment: Failed to resolve in stalled pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.76670530998982
 Fold 0: R2: -231.33264199610895
 Fold 1: MSE 169.5849067590963
 Fold 1: R2: -244.38219446944143

2025/09/10 11:44:06 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.74280436436518
 Fold 2: R2: -241.65722064145766
 Test MSE: 169.3648054778171
 Test R2: -239.12401903566933

2025/09/10 11:44:10 WARNING mlflow.utils.environment: Failed to resolve in stalled pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== xavier =====

===== Momentum Used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.5937978812379
 Fold 0: R2: -231.09460902823827
 Fold 1: MSE 169.20056072676314
 Fold 1: R2: -243.82606200074528

2025/09/10 11:44:36 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.4172686612313
 Fold 2: R2: -241.19184840233487
 Test MSE: 169.07054242307746
 Test R2: -238.70417314377278

2025/09/10 11:44:41 WARNING mlflow.utils.environment: Failed to resolve in stalled pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.55646410651252

Fold 0: R2: -231.04321349674586

Fold 1: MSE 169.2140544271097

Fold 1: R2: -243.84558681498632

2025/09/10 11:44:41 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.58092246464648

Fold 2: R2: -241.42580104164017

Test MSE: 169.11714699942289

Test R2: -238.77153378445746

2025/09/10 11:44:46 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 169.01926299685576

Fold 0: R2: -231.68032547158006

Fold 1: MSE 170.6466782325921

Fold 1: R2: -245.9185329276838

2025/09/10 11:44:46 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 170.63512406285875

Fold 2: R2: -242.93284359802954

Test MSE: 170.10035509743554

Test R2: -240.17723399909778

2025/09/10 11:44:50 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.54982076455696

Fold 0: R2: -231.03406794173023

Fold 1: MSE 168.978971997135

Fold 1: R2: -243.50543247194477

2025/09/10 11:45:04 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.32593776480522

Fold 2: R2: -241.06128556894444

Test MSE: 168.95157684216574

Test R2: -238.5335953275398

2025/09/10 11:45:08 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.8366436236301

Fold 0: R2: -231.42892255781658

Fold 1: MSE 169.69790612434798

Fold 1: R2: -244.54569977630518

2025/09/10 11:45:31 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.924576239846

Fold 2: R2: -241.91707411954843

Test MSE: 169.4863753292747

Test R2: -239.2972321512234

```
2025/09/10 11:45:35 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Linear
```

```
Fold 0: MSE 169.91775119595152
```

```
Fold 0: R2: -232.91722902263783
```

```
Fold 1: MSE 170.07199161016473
```

```
Fold 1: R2: -245.08698566773936
```

```
2025/09/10 11:45:36 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 170.23398760637988
```

```
Fold 2: R2: -242.3593956808019
```

```
Test MSE: 170.0745768041654
```

```
Test R2: -240.1212034570597
```

```
2025/09/10 11:45:40 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== Normal =====
```

```
===== sto =====
```

```
Polynomial
```

```
===== zero =====
```

```
===== Momentum Used =====
```

```
===== 0.01 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 0.1566925846227261
```

```
Fold 0: R2: 0.7842891931810325
```

```
Fold 1: MSE 0.12865299702326072
```

```
Fold 1: R2: 0.8138445493885622
```

```
2025/09/10 11:48:13 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 0.809169702951787
```

```
Fold 2: R2: -0.15675519725757092
```

```
Test MSE: 0.3648384281992579
```

```
Test R2: 0.4804595151040079
```

```
2025/09/10 11:48:17 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 0.1124458986719637
```

```
Fold 0: R2: 0.8452013821559289
```

```
Fold 1: MSE 0.11825505081622045
```

```
Fold 1: R2: 0.8288899381971502
```

```
2025/09/10 11:50:36 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 0.11111233181871293
```

```
Fold 2: R2: 0.8411584531133116
```

```
Test MSE: 0.11393776043563236
```

```
Test R2: 0.8384165911554634
```

```
2025/09/10 11:50:40 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 0.112211296557698

Fold 0: R2: 0.8455243470969408

Fold 1: MSE 0.11843466445438706

Fold 1: R2: 0.8286300448520864

2025/09/10 11:52:04 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.11211161659483844

Fold 2: R2: 0.839729917351151

Test MSE: 0.1142525258689745

Test R2: 0.8379614364333928

2025/09/10 11:52:08 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 0.21607647075382683

Fold 0: R2: 0.7025383814229147

Fold 1: MSE 0.29588880930933903

Fold 1: R2: 0.5718613953633511

2025/09/10 11:54:35 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.13585557322903277

Fold 2: R2: 0.8057865490566275

Test MSE: 0.21594028443073288

Test R2: 0.6933954419476311

2025/09/10 11:54:39 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 0.11114048299702821

Fold 0: R2: 0.8469984823132366

Fold 1: MSE 0.12040831910170328

Fold 1: R2: 0.8257742499718779

2025/09/10 11:56:39 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.11035367122573045

Fold 2: R2: 0.8422430025974132

Test MSE: 0.11396749110815398

Test R2: 0.8383385782941759

2025/09/10 11:56:43 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 0.11235841156673347

Fold 0: R2: 0.8453218212571212

Fold 1: MSE 0.11847168395606907

Fold 1: R2: 0.8285764791973681

2025/09/10 11:58:49 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.11167443115197007

Fold 2: R2: 0.8403548993930621

Test MSE: 0.11416817555825753

Test R2: 0.8380843999491837

```
2025/09/10 11:58:53 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 0.11966095939457612
Fold 0: R2: 0.8352687706448616
Fold 1: MSE 0.5568150190610666
Fold 1: R2: 0.19431219498300334

2025/09/10 12:01:31 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 0.11597191316209945
Fold 2: R2: 0.8342113986759643
Test MSE: 0.264149297205914
Test R2: 0.6212641214346097

2025/09/10 12:01:35 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.001 =====
Using Polynomial
Fold 0: MSE 0.11411446830043159
Fold 0: R2: 0.8429043462007364
Fold 1: MSE 0.12468116636642437
Fold 1: R2: 0.819591620523967

2025/09/10 12:04:11 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 0.11527612360147174
Fold 2: R2: 0.8352060703591941
Test MSE: 0.1180239194227759
Test R2: 0.8325673456946324

2025/09/10 12:04:15 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 0.11250859232030952
Fold 0: R2: 0.8451150749608586
Fold 1: MSE 0.11826009846632404
Fold 1: R2: 0.8288826344607328

2025/09/10 12:06:14 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 0.11157350540566789
Fold 2: R2: 0.8404991786229272
Test MSE: 0.11411406539743381
Test R2: 0.8381656293481728

2025/09/10 12:06:18 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== Momentum not used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 0.12750105098690037
Fold 0: R2: 0.8244757105457714
Fold 1: MSE 0.13756966429781936
Fold 1: R2: 0.8009425086055744
```

2025/09/10 12:08:53 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.1275504424149164

Fold 2: R2: 0.8176592170496177

Test MSE: 0.13087371923321203

Test R2: 0.8143591454003212

2025/09/10 12:08:58 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 0.11373304855802326

Fold 0: R2: 0.8434294275922374

Fold 1: MSE 0.1183163759763877

Fold 1: R2: 0.8288012032816108

2025/09/10 12:11:27 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.10569740567900991

Fold 2: R2: 0.8488994052671277

Test MSE: 0.11258227673780696

Test R2: 0.8403766787136586

2025/09/10 12:11:32 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 0.11258347061125575

Fold 0: R2: 0.8450119937806475

Fold 1: MSE 0.11866534416731421

Fold 1: R2: 0.828296261054581

2025/09/10 12:13:11 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.11264747581505588

Fold 2: R2: 0.8389638754000945

Test MSE: 0.11463209686454194

Test R2: 0.8374240434117745

2025/09/10 12:13:15 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

Linear

===== zero =====

===== Momentum Used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 169.34904946253891

Fold 0: R2: -232.13432592579284

Fold 1: MSE 169.73706156832267

Fold 1: R2: -244.60235604926928

2025/09/10 12:15:00 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 170.69122967155232

Fold 2: R2: -243.01304983191946

Test MSE: 169.925780234138

Test R2: -239.91657726899385

2025/09/10 12:15:05 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.59682457928747

Fold 0: R2: -231.09877573133943

Fold 1: MSE 169.03626003685562

Fold 1: R2: -243.5883258447817

2025/09/10 12:15:37 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.43328551339593

Fold 2: R2: -241.21474542494647

Test MSE: 169.022123376513

Test R2: -238.63394900035587

2025/09/10 12:15:41 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.69554667484016

Fold 0: R2: -231.23468147910535

Fold 1: MSE 168.9013599392348

Fold 1: R2: -243.3931311035695

2025/09/10 12:15:45 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.23826685967478

Fold 2: R2: -240.93595490618236

Test MSE: 168.94505782458324

Test R2: -238.52125582961904

2025/09/10 12:15:50 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 170.6890735674493

Fold 0: R2: -233.97906976943455

Fold 1: MSE 170.4722702322427

Fold 1: R2: -245.66617192058334

2025/09/10 12:17:33 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 178.2884183520048

Fold 2: R2: -253.87367333104646

Test MSE: 173.14992071723225

Test R2: -244.50630500702144

2025/09/10 12:17:37 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.62100470051342

Fold 0: R2: -231.13206328908308

Fold 1: MSE 169.33916619707844

Fold 1: R2: -244.02661825968025

2025/09/10 12:18:40 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.23268232740182

Fold 2: R2: -240.92797149218725

Test MSE: 169.06428440833122

Test R2: -238.69555101365017

```
2025/09/10 12:18:44 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.76637165762423
Fold 0: R2: -231.3321826736646
Fold 1: MSE 168.90756265226335
Fold 1: R2: -243.40210616723348

2025/09/10 12:18:49 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.2514962612753
Fold 2: R2: -240.95486710593747
Test MSE: 168.97514352372096
Test R2: -238.56305198227855

2025/09/10 12:18:53 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 168.7002933110565
Fold 0: R2: -231.24121593464687
Fold 1: MSE 169.4709469424232
Fold 1: R2: -244.21729942995358

2025/09/10 12:21:28 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 171.47026643016244
Fold 2: R2: -244.12672823101127
Test MSE: 169.88050222788073
Test R2: -239.8617478652039

2025/09/10 12:21:32 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.001 =====
Using Linear
Fold 0: MSE 168.87649663356058
Fold 0: R2: -231.48378619381424
Fold 1: MSE 169.06552108647986
Fold 1: R2: -243.63066534719673

2025/09/10 12:22:00 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.32033623246744
Fold 2: R2: -241.05327785236696
Test MSE: 169.08745131750263
Test R2: -238.7225764644593

2025/09/10 12:22:04 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.68947195317938
Fold 0: R2: -231.2263187150741
Fold 1: MSE 168.91835339326576
Fold 1: R2: -243.41771991351388

2025/09/10 12:22:09 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```



```
Fold 2: MSE 169.25757038214033
Fold 2: R2: -240.96355041532706
Test MSE: 168.9551319095285
Test R2: -238.53586301463835
```

```
2025/09/10 12:22:13 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== Momentum not used =====
```

```
===== 0.01 =====
```

```
Using Linear
```

```
Fold 0: MSE 169.04371057624172
Fold 0: R2: -231.71398122553174
Fold 1: MSE 169.55643808016487
Fold 1: R2: -244.3410014939382
```

```
2025/09/10 12:24:34 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 172.6796957719669
Fold 2: R2: -245.85567788365472
Test MSE: 170.42661480945785
Test R2: -240.6368868677082
```

```
2025/09/10 12:24:39 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.001 =====
```

```
Using Linear
```

```
Fold 0: MSE 168.889644657424
Fold 0: R2: -231.50188641752604
Fold 1: MSE 169.02225181122407
Fold 1: R2: -243.56805653419397
```

```
2025/09/10 12:26:04 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 170.00036722155198
Fold 2: R2: -242.0254217401697
Test MSE: 169.30408789673334
Test R2: -239.0317882306299
```

```
2025/09/10 12:26:08 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Linear
```

```
Fold 0: MSE 168.72309467390886
Fold 0: R2: -231.27260542502577
Fold 1: MSE 168.9548545967306
Fold 1: R2: -243.47053561261203
```

```
2025/09/10 12:26:12 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 169.26284518289353
Fold 2: R2: -240.97109105008332
Test MSE: 168.98026481784436
Test R2: -238.57141069590702
```

```
2025/09/10 12:26:17 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```



```

===== mini =====
Polynomial
===== zero =====
===== Momentum Used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 0.11139677891294814
Fold 0: R2: 0.8466456526056879
Fold 1: MSE 0.11888307147596577
Fold 1: R2: 0.8279812188387738
2025/09/10 12:27:21 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 0.11462393074570226
Fold 2: R2: 0.8361384180147892
Test MSE: 0.11496792704487206
Test R2: 0.8369217631530836
2025/09/10 12:27:25 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
===== 0.001 =====
Using Polynomial
Fold 0: MSE 0.11900892186505559
Fold 0: R2: 0.8361663979442502
Fold 1: MSE 0.12222593708193535
Fold 1: R2: 0.8231442335557941
2025/09/10 12:29:09 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 0.1131495110163395
Fold 2: R2: 0.8382461868532143
Test MSE: 0.11812812332111015
Test R2: 0.8325189394510861
2025/09/10 12:29:13 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 15.027616669387882
Fold 0: R2: -19.68776467070716
Fold 1: MSE 12.099354257027631
Fold 1: R2: -16.507254365921728
2025/09/10 12:30:57 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 14.464750407824754
Fold 2: R2: -19.678202792624592
Test MSE: 13.863907111413424
Test R2: -18.624407276417827
2025/09/10 12:31:02 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
===== Momentum not used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 0.11325717979254676
Fold 0: R2: 0.8440845322073539
Fold 1: MSE 0.11931561603770896
Fold 1: R2: 0.8273553451345936
2025/09/10 12:32:46 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

```

```
Fold 2: MSE 0.11075811672530027
Fold 2: R2: 0.8416648242104467
Test MSE: 0.11444363751851866
Test R2: 0.8377015671841314
```

```
2025/09/10 12:32:51 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 0.11224700192195337
Fold 0: R2: 0.8454751933163083
Fold 1: MSE 0.11925686058825949
Fold 1: R2: 0.8274403617873045
```

```
2025/09/10 12:34:02 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 0.11312341480599689
Fold 2: R2: 0.8382834929051245
Test MSE: 0.11487575910540326
Test R2: 0.8370663493362458
```

```
2025/09/10 12:34:06 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 5.748926637758367
Fold 0: R2: -6.914258395569608
Fold 1: MSE 4.396433196539763
Fold 1: R2: -5.361453069274177
```

```
2025/09/10 12:35:51 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 5.524890276657721
Fold 2: R2: -6.898152289300964
Test MSE: 5.22341670365195
Test R2: -6.391287918048249
```

```
2025/09/10 12:35:55 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== xavier =====
```

```
===== Momentum Used =====
```

```
===== 0.01 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 0.11182138913337893
Fold 0: R2: 0.8460611130535882
Fold 1: MSE 0.11838753133148927
Fold 1: R2: 0.8286982444893648
```

```
2025/09/10 12:37:22 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 0.11170521153729453
Fold 2: R2: 0.8403108970403197
Test MSE: 0.11397137733405423
Test R2: 0.8383567515277575
```

```
2025/09/10 12:37:26 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

===== 0.001 =====

Using Polynomial

Fold 0: MSE 0.11873306434139536

Fold 0: R2: 0.8365461571341257

Fold 1: MSE 0.12243394685660373

Fold 1: R2: 0.8228432522010576

2025/09/10 12:39:08 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.1148201375677055

Fold 2: R2: 0.835857928940295

Test MSE: 0.11866238292190152

Test R2: 0.8317491127584927

2025/09/10 12:39:13 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 15.292936842099966

Fold 0: R2: -20.053017619076552

Fold 1: MSE 12.155524953599404

Fold 1: R2: -16.5885309904343

2025/09/10 12:40:59 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 13.936956321214517

Fold 2: R2: -18.923690419582144

Test MSE: 13.795139372304627

Test R2: -18.521746343030998

2025/09/10 12:41:03 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 0.11174150103006399

Fold 0: R2: 0.8461710909907242

Fold 1: MSE 0.11855444406893983

Fold 1: R2: 0.8284567288109754

2025/09/10 12:42:25 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.11065027772232071

Fold 2: R2: 0.8418189863431966

Test MSE: 0.11364874094044151

Test R2: 0.8388156020482986

2025/09/10 12:42:29 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 0.11305204237850006

Fold 0: R2: 0.8443669345762939

Fold 1: MSE 0.11963313553993743

Fold 1: R2: 0.8268959078312825

2025/09/10 12:43:33 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.11084786992713468

Fold 2: R2: 0.8415365167833228

Test MSE: 0.11451101594852404

Test R2: 0.8375997863969663

```
2025/09/10 12:43:37 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 5.684400741379026
Fold 0: R2: -6.825428836709387
Fold 1: MSE 4.060662087764758
Fold 1: R2: -4.875606462490409

2025/09/10 12:45:23 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 5.281632301261392
Fold 2: R2: -6.550400851886081
Test MSE: 5.008898376801725
Test R2: -6.083812050361959

2025/09/10 12:45:27 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
Linear
===== zero =====
===== Momentum Used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 168.758183713043
Fold 0: R2: -231.32091074183666
Fold 1: MSE 168.91828925009327
Fold 1: R2: -243.41762710105357

2025/09/10 12:45:33 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.29305501740274
Fold 2: R2: -241.0142777672198
Test MSE: 168.98984266017965
Test R2: -238.58427187003667

2025/09/10 12:45:38 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.001 =====
Using Linear
Fold 0: MSE 168.5611571257983
Fold 0: R2: -231.04967414055355
Fold 1: MSE 168.9482335599453
Fold 1: R2: -243.4609552521478

2025/09/10 12:45:42 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 169.29186602749135
Fold 2: R2: -241.01257803692283
Test MSE: 168.93375223774498
Test R2: -238.50773580987473

2025/09/10 12:45:46 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.64107476689517
Fold 0: R2: -231.15969274086945
Fold 1: MSE 169.1484768989343
Fold 1: R2: -243.75069890261793
```

```
2025/09/10 12:46:04 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.46111767480193
Fold 2: R2: -241.25453311996256
Test MSE: 169.0835564468771
Test R2: -238.72164158781666
```

```
2025/09/10 12:46:08 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== Momentum not used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 168.7285597320578
Fold 0: R2: -231.28012889593825
Fold 1: MSE 168.9195220499361
Fold 1: R2: -243.4194109103356
```

```
2025/09/10 12:46:23 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.2486844649517
Fold 2: R2: -240.95084747940047
Test MSE: 168.96558874898187
Test R2: -238.55012909522475
```

```
2025/09/10 12:46:28 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== 0.001 =====
Using Linear
Fold 0: MSE 168.55756819936317
Fold 0: R2: -231.04473344588823
Fold 1: MSE 168.90351368475052
Fold 1: R2: -243.3962474823268
```

```
2025/09/10 12:46:31 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.24764128767143
Fold 2: R2: -240.94935619674837
Test MSE: 168.90290772392837
Test R2: -238.46344570832113
```

```
2025/09/10 12:46:35 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.58335176188768
Fold 0: R2: -231.08022838068828
Fold 1: MSE 168.99544650065536
Fold 1: R2: -243.52927038242797
```

```
2025/09/10 12:46:52 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.32694025286682
Fold 2: R2: -241.06271868398966
Test MSE: 168.96857950513663
Test R2: -238.55740581570194
```

```
2025/09/10 12:46:57 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```

===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 168.72242433233671
Fold 0: R2: -231.27168259947072
Fold 1: MSE 168.93323636720865
Fold 1: R2: -243.43925494794667
2025/09/10 12:47:02 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 169.29147392103354
Fold 2: R2: -241.01201749791443
Test MSE: 168.98237820685964
Test R2: -238.57431834844397
2025/09/10 12:47:05 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
===== 0.001 =====
Using Linear
Fold 0: MSE 168.78248178557052
Fold 0: R2: -231.35436067720968
Fold 1: MSE 168.8910713090499
Fold 1: R2: -243.37824389042592
2025/09/10 12:47:14 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 169.2414523002931
Fold 2: R2: -240.94050867899094
Test MSE: 168.97166846497115
Test R2: -238.55770441554216
2025/09/10 12:47:18 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
===== 0.0001 =====
Using Linear
Fold 0: MSE 168.6723174095123
Fold 0: R2: -231.20270291689226
Fold 1: MSE 169.16377107594153
Fold 1: R2: -243.7728289305099
2025/09/10 12:47:44 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
Fold 2: MSE 169.6395988188186
Fold 2: R2: -241.50968230585102
Test MSE: 169.1585624347575
Test R2: -238.82840471775106
2025/09/10 12:47:48 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.
===== Momentum not used =====
===== 0.01 =====
Using Linear
Fold 0: MSE 168.68312079046518
Fold 0: R2: -231.21757538853686
Fold 1: MSE 168.9415601046652
Fold 1: R2: -243.45129904433654
2025/09/10 12:47:56 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

```

Fold 2: MSE 169.22138019651496
Fold 2: R2: -240.9118144381159
Test MSE: 168.94868703054843
Test R2: -238.52689629032977

2025/09/10 12:48:01 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.56399819351796
Fold 0: R2: -231.05358529570813
Fold 1: MSE 168.81836260429878
Fold 1: R2: -243.27303746687195

2025/09/10 12:48:05 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.2372937125456
Fold 2: R2: -240.9345637357082
Test MSE: 168.8732181701208
Test R2: -238.42039549942942

2025/09/10 12:48:08 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.65702670414683
Fold 0: R2: -231.18165297123497
Fold 1: MSE 169.0110996887565
Fold 1: R2: -243.55191988420322

2025/09/10 12:48:34 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.3028469510913
Fold 2: R2: -241.02827590647803
Test MSE: 168.9903244479982
Test R2: -238.58728292063873

2025/09/10 12:48:38 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== batch =====

Polynomial

===== zero =====

===== Momentum Used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 10.732717030424338
Fold 0: R2: -13.775192173687103
Fold 1: MSE 8.53300848584454
Fold 1: R2: -11.346902726769862

2025/09/10 12:50:23 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 10.366857093410424
Fold 2: R2: -13.820025735372276
Test MSE: 9.877527536559768
Test R2: -12.980706878609746

2025/09/10 12:50:27 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 55.81829436753644

Fold 0: R2: -75.84224076251269

Fold 1: MSE 50.26854613546687

Fold 1: R2: -71.7364622196697

2025/09/10 12:52:13 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 52.93225448758697

Fold 2: R2: -74.66973931143944

Test MSE: 53.006364996863425

Test R2: -74.08281409787395

2025/09/10 12:52:17 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Polynomial

Fold 0: MSE 133.49300443749888

Fold 0: R2: -182.7731106499627

Fold 1: MSE 134.2365591410606

Fold 1: R2: -193.23462906903765

2025/09/10 12:54:03 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 134.59061169196985

Fold 2: R2: -191.40511478472663

Test MSE: 134.10672509017644

Test R2: -189.13761816790898

2025/09/10 12:54:07 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Polynomial

Fold 0: MSE 3.1718434013206114

Fold 0: R2: -3.3665174127394746

Fold 1: MSE 2.3464624670419147

Fold 1: R2: -2.395232042795225

2025/09/10 12:55:52 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 3.0225220423348467

Fold 2: R2: -3.320871219649118

Test MSE: 2.8469426368991244

Test R2: -3.027540225061273

2025/09/10 12:55:57 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Polynomial

Fold 0: MSE 39.956153655205576

Fold 0: R2: -54.005628780067795

Fold 1: MSE 33.32150110931272

Fold 1: R2: -47.214804144299265

2025/09/10 12:57:41 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 37.828337401247886

Fold 2: R2: -53.07781054194227

Test MSE: 37.035330721922065

Test R2: -51.4327478221031


```
2025/09/10 12:57:45 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 110.15865410988164
Fold 0: R2: -150.64988319867004
Fold 1: MSE 110.34578487659145
Fold 1: R2: -158.6656881849454

2025/09/10 12:59:32 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 110.8522734218716
Fold 2: R2: -157.46977826875903
Test MSE: 110.45223746944822
Test R2: -155.59511655079146

2025/09/10 12:59:36 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== xavier =====
===== Momentum Used =====
===== 0.01 =====
Using Polynomial
Fold 0: MSE 11.055272726325615
Fold 0: R2: -14.219238390516349
Fold 1: MSE 8.661611463741812
Fold 1: R2: -11.532985801819493

2025/09/10 13:01:32 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 10.120808630019512
Fold 2: R2: -13.468285132917178
Test MSE: 9.945897606695645
Test R2: -13.073503108417674

2025/09/10 13:01:37 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.001 =====
Using Polynomial
Fold 0: MSE 54.901342195768585
Fold 0: R2: -74.57991878816598
Fold 1: MSE 47.12197277932942
Fold 1: R2: -67.18350352809873

2025/09/10 13:03:22 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
Fold 2: MSE 55.17681368631068
Fold 2: R2: -77.87846735600718
Test MSE: 52.40004288713623
Test R2: -73.21396322409063

2025/09/10 13:03:27 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
===== 0.0001 =====
Using Polynomial
Fold 0: MSE 129.7283586498372
Fold 0: R2: -177.59051198264612
Fold 1: MSE 126.97485366883014
Fold 1: R2: -182.7272480855523

2025/09/10 13:05:10 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 133.7377248761867
Fold 2: R2: -190.18586342962686
Test MSE: 130.14697906495135
Test R2: -183.50120783260843
```

```
2025/09/10 13:05:14 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== Momentum not used =====
```

```
===== 0.01 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 3.102120536365942
Fold 0: R2: -3.2705334484101227
Fold 1: MSE 2.254925761697431
Fold 1: R2: -2.2627822979376853
```

```
2025/09/10 13:06:58 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 2.9190777686397698
Fold 2: R2: -3.1729916082563454
Test MSE: 2.7587080222343814
Test R2: -2.902102451534718
```

```
2025/09/10 13:07:02 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 38.60429653163077
Fold 0: R2: -52.14459501428744
Fold 1: MSE 33.31567377180529
Fold 1: R2: -47.20637223315331
```

```
2025/09/10 13:08:47 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 35.917879267961894
Fold 2: R2: -50.34669942055462
Test MSE: 35.94594985713265
Test R2: -49.899222222665124
```

```
2025/09/10 13:08:52 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Polynomial
```

```
Fold 0: MSE 104.96377035147636
Fold 0: R2: -143.49834779222795
Fold 1: MSE 112.38285379667582
Fold 1: R2: -161.61324083835385
```

```
2025/09/10 13:10:35 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 122.9709725394369
Fold 2: R2: -174.79416416346874
Test MSE: 113.43919889586302
Test R2: -159.9685842646835
```

```
2025/09/10 13:10:39 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

Linear

===== zero =====

===== Momentum Used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.60504588065638

Fold 0: R2: -231.1100935837806

Fold 1: MSE 169.05027160808456

Fold 1: R2: -243.6085999963075

2025/09/10 13:10:58 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.37149804688195

Fold 2: R2: -241.12641664452536

Test MSE: 169.00893851187428

Test R2: -238.61503674153786

2025/09/10 13:11:02 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.76542906981342

Fold 0: R2: -231.3308850603943

Fold 1: MSE 169.5839432351731

Fold 1: R2: -244.38080029103713

2025/09/10 13:11:03 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.74178737895264

Fold 2: R2: -241.65576680160527

Test MSE: 169.36371989464638

Test R2: -239.12248405101226

2025/09/10 13:11:06 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 168.76675056662458

Fold 0: R2: -231.33270429864368

Fold 1: MSE 169.58507037242168

Fold 1: R2: -244.38243121100996

2025/09/10 13:11:07 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.74292886285525

Fold 2: R2: -241.65739861929703

Test MSE: 169.36491660063385

Test R2: -239.12417804298354

2025/09/10 13:11:11 WARNING mlflow.utils.environment: Failed to resolve installed pip version. `pip` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.5746918517606

Fold 0: R2: -231.06830671761153

Fold 1: MSE 168.96967478040045

Fold 1: R2: -243.49197979217286

2025/09/10 13:11:26 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

```
Fold 2: MSE 169.3053982380752
Fold 2: R2: -241.0319231197481
Test MSE: 168.9499216234121
Test R2: -238.53073654317748
```

```
2025/09/10 13:11:29 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.001 =====
```

```
Using Linear
```

```
Fold 0: MSE 168.76494029036613
Fold 0: R2: -231.33021218229229
Fold 1: MSE 169.5821989424835
Fold 1: R2: -244.37827637321828
Fold 2: MSE 169.74046165874796
Fold 2: R2: -241.6538716073941
Test MSE: 169.3625336305325
Test R2: -239.12078672096823
```

```
2025/09/10 13:11:30 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
2025/09/10 13:11:34 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Linear
```

```
Fold 0: MSE 168.76670150183205
Fold 0: R2: -231.33263675360948
Fold 1: MSE 169.58489551837593
Fold 1: R2: -244.382178204594
```

```
2025/09/10 13:11:35 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
Fold 2: MSE 169.74279596306494
Fold 2: R2: -241.65720863130989
Test MSE: 169.36479766109096
Test R2: -239.1240078631711
```

```
2025/09/10 13:11:38 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

```
===== xavier =====
```

```
===== Momentum Used =====
```

```
===== 0.01 =====
```

```
Using Linear
```

```
Fold 0: MSE 168.82994082943182
Fold 0: R2: -231.41969515788614
Fold 1: MSE 169.06670789038185
Fold 1: R2: -243.6323826022959
Fold 2: MSE 169.32085344014735
Fold 2: R2: -241.05401723085532
Test MSE: 169.072500719987
Test R2: -238.70203166367912
```

```
2025/09/10 13:12:05 WARNING mlflow.models.model: `artifact_path` is deprec
ated. Please use `name` instead.
```

```
2025/09/10 13:12:09 WARNING mlflow.utils.environment: Failed to resolve in
stalled pip version. ``pip`` will be added to conda.yaml environment spec
without a version specifier.
```

===== 0.001 =====

Using Linear

Fold 0: MSE 169.73948637086707
 Fold 0: R2: -232.67182079646682
 Fold 1: MSE 170.4807985528811
 Fold 1: R2: -245.67851204019294
 Fold 2: MSE 169.77124021526956
 Fold 2: R2: -241.69787134575625
 Test MSE: 169.99717504633927
 Test R2: -240.0160680608053

2025/09/10 13:12:36 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

2025/09/10 13:12:40 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.0001 =====

Using Linear

Fold 0: MSE 169.76130527241136
 Fold 0: R2: -232.70185778173553
 Fold 1: MSE 169.80175729968224
 Fold 1: R2: -244.69596803890448

2025/09/10 13:12:40 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.9121795695422
 Fold 2: R2: -241.89935235766052
 Test MSE: 169.8250807138786
 Test R2: -239.76572605943352

2025/09/10 13:12:44 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== Momentum not used =====

===== 0.01 =====

Using Linear

Fold 0: MSE 168.44412427766977
 Fold 0: R2: -230.88856089990523
 Fold 1: MSE 168.98866980346406
 Fold 1: R2: -243.51946478793354

2025/09/10 13:13:05 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.27474269352135
 Fold 2: R2: -240.98809923415516
 Test MSE: 168.9025122582184
 Test R2: -238.46537497399797

2025/09/10 13:13:09 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

===== 0.001 =====

Using Linear

Fold 0: MSE 168.8266467344795
 Fold 0: R2: -231.41516034290677
 Fold 1: MSE 169.77609463747336
 Fold 1: R2: -244.65883525103388

2025/09/10 13:13:51 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 169.8433326977942
 Fold 2: R2: -241.80093174648476
 Test MSE: 169.4820246899157
 Test R2: -239.29164244680848

```
2025/09/10 13:13:55 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

```
===== 0.0001 =====
```

```
Using Linear
```

```
Fold 0: MSE 169.06643120009548
```

```
Fold 0: R2: -231.74525956658871
```

```
Fold 1: MSE 171.08879101938282
```

```
Fold 1: R2: -246.55825144921366
```

```
2025/09/10 13:13:56 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.
```

```
Fold 2: MSE 169.93658480110673
```

```
Fold 2: R2: -241.93424105696496
```

```
Test MSE: 170.03060234019503
```

```
Test R2: -240.07925069092244
```

```
2025/09/10 13:14:00 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.
```

Testing on the best parameters

Using the best-performing parameter configuration: Normal regression with polynomial features of degree 2, optimized through stochastic gradient descent (sto). The weights are initialized using the Xavier method, momentum is disabled, and the learning rate is set to 0.001.

```
In [401]: reg = "Normal"
         ispoly= True
         method="sto"
         momentum = False
         init='xavier'
         lrs =[0.001]

         for lr in lrs:
             params = {"method": method, "polynomial": ispoly, "l": 0.1, "lr": lr,
                        "degree":2, "use_momentum":momentum, "momentum":0.5}
             mlflow.start_run(run_name=f"method-{params['method']}-lr-{params['lr']}")

             print("="*5, reg, "="*5)
             print("Method:", method)
             print("Polynomial: ", ispoly)
             print("Momentum: ", momentum)
             print("Initialization: ", init)
             print("Learning Rate: ", lr)
             print("="*10)

             type_of_regression = str_to_class(reg)
             model = type_of_regression(**params)
             model.fit(X_train, y_train)
             yhat = model.predict(X_test)
             mse = model.mse(yhat, y_test)
             r2 = model.r2(yhat, y_test)
```

```

print("Best MSE: ", mse)
print("Best R2: ", r2)

mlflow.log_metric(key="test_mse", value=mse)
mlflow.log_metric(key="test_r2", value=r2)

signature = mlflow.models.infer_signature(X_train, model.predict(X_tr
mlflow.sklearn.log_model(model, artifact_path='model', signature=sign

mlflow.end_run()

```

===== Normal =====

Method: sto

Polynomial: True

Momentun: False

Initialization: xavier

Learning Rate: 0.001

=====

Using Polynomial

Fold 0: MSE 0.12160948455162385

Fold 0: R2: 0.832586333982362

Fold 1: MSE 0.11898526036125794

Fold 1: R2: 0.8278333558396274

2025/09/11 10:08:09 WARNING mlflow.models.model: `artifact_path` is deprecated. Please use `name` instead.

Fold 2: MSE 0.12485649334670772

Fold 2: R2: 0.8215103740744418

Best MSE: 0.11695287123595349

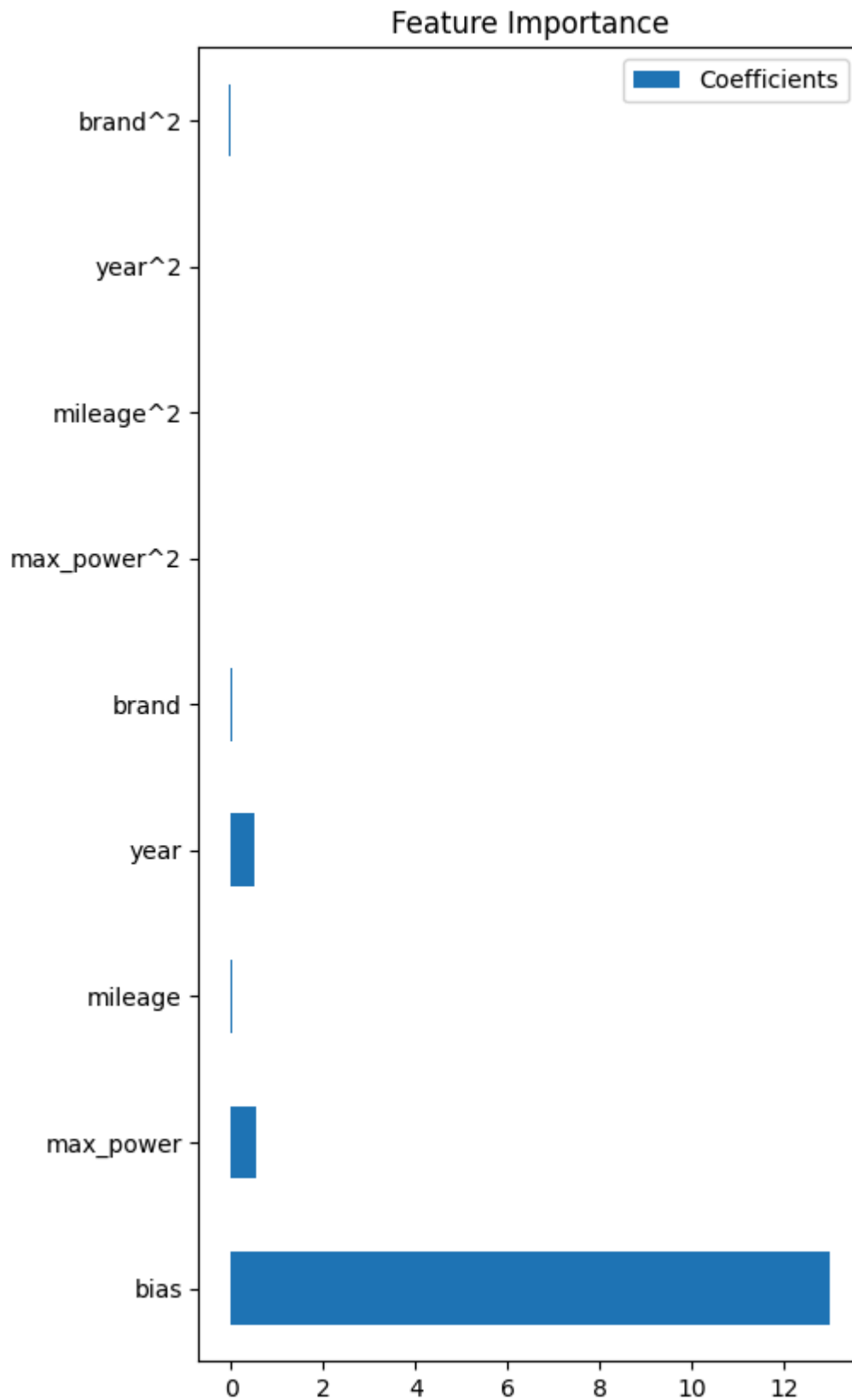
Best R2: 0.8151665559871876

2025/09/11 10:08:14 WARNING mlflow.utils.environment: Failed to resolve installed pip version. ``pip`` will be added to conda.yaml environment spec without a version specifier.

Feature Importance

A simple plot to visualize the feature importance of our custom Normal linear model based on the selected features.

In [402... `model.feature_importance()`



Inference

Comparing the newly created model with the old model

```
In [403... import pickle
```



```
filename = 'model/A2_car_prediction.model'
pickle.dump(model, open(filename, 'wb'))

scaler_path = 'model/A2_prediction_scalar.model'
pickle.dump(scaler, open(scaler_path, 'wb'))

label_path = 'model/A2_brand-label.model'
pickle.dump(original_brands, open(label_path, 'wb'))
```

```
In [404... new_model_path = 'model/A2_car_prediction.model'
new_scalar_path = 'model/A2_prediction_scalar.model'
new_brand_path = 'model/A2_brand-label.model'

#Loading components
new_model = pickle.load(open(new_model_path, 'rb'))
new_scalar = pickle.load(open(new_scalar_path, 'rb'))
new_brand = pickle.load(open(new_brand_path, 'rb'))

#For the old model
old_model_path = 'model/old_car_prediction.model'
old_scalar_path = 'model/old_prediction_scalar.model'
old_brand_path = 'model/old_brand-label.model'

old_model = pickle.load(open(old_model_path, 'rb'))
old_scalar = pickle.load(open(old_scalar_path, 'rb'))
old_brand = pickle.load(open(old_brand_path, 'rb'))
```

```
In [405... old_y_pred = old_model.predict(X_test)
print(f"Predicted old model selling price: {np.exp(old_model.predict(X_te
new_y_pred = new_model.predict(X_test)
print(f"Predicted new model selling price: {np.exp(new_model.predict(X_te
```

```
Predicted old model selling price: 1181972.4139687722
Predicted new model selling price: 1046775.3576793356
```

Report

The car prediction model is a basic machine learning model which predicts the price of a car based on the values of the features that the user has selected.

The initial data set contained the features like: name(brand), year, km_driven, fuel, setter_type, transmission, owner, mileage, engine, max_power, torque, and seats. For the analysis we dropped and cleaned the data first for the analysis. We separated the string from the numerical values for the features fuel, mileage, engine, and maximum power. After performing the initial cleaning, an explanatory data analysis was performed to understand the nature of the features and their interdependency. A univariate analysis was performed using a distribution plot to observe the distribution of the data sets. Scatter plot was used to see the relationship between features and selling price.

A correlation matrix was used to see the relation of the features with the selling price and select the most influential features. After analyzing the correlation matrix, maximum power, mileage, year, and brand were selected as important features for

the analysis. After feature selection, the datasets were separated into train and test sets. About 30% of the dataset were separated into the test set. During the preprocessing step, median was used to fill the missing values of the maximum power and mean was used to fill the missing values of mileage. Our test set has no null values of the features that were selected.

Feature Selection

The features that were selected for analysis were as follows:

- Brand: The selling price of a car depends on the brand to some influential extent. The selling price of some luxury brands like BMW, Mercedes, etc. are higher than other brands.
- Year of manufacture: It influences the selling price of the car because newly manufactured cars are sold for higher selling price than old price.
- Maximum power: The cars with high power are priced higher due to their better performance and the use of higher level equipment.
- Mileage: Cars which provide good mileage and better fuel efficiency can increase the demand of the product, and hence create a rise in its price.

The other features like seats, seller type, and owner have lower influence than that of the selected features on the selling price.

Models

We have used the following models:

- Ridge
- Normal
- Lasso
- Elastic Net

For each model the following were evaluated:

Initialization

- Xavier
- Zero

Optimization

- Batch
- Mini-batch

- Stochastic

Feature Transformation

- Linear
- Polynomial

Learning Rates:

- 0.01
- 0.001
- 0.0001

Momentum:

- True
- False

Findings

From the experimentation it was found following as the best model:

- Model : Normal
- Initialization : Xavier
- Optimization : Stochastic
- Feature Transformation : Polynomial
- Learning Rates: 0.001
- Momentum : False

Model comparision table

Model	Best Avg R-squared (R2)	Best Mean Squared Error (MSE)	Best Model
Ridge	-9.39	7.34	No
Normal	0.81	0.11	Yes
Elastic Net	-8.04	8.98	No
Lasso	0.79	0.148	No

Conclusions

ML Flow Screenshots

