Linear Regression and Boston Data Set

- Load Boston Data Set
- Assign `data` to `X` and `target` to `y`

```
import pandas as pd
df= pd.read_csv("/content/boston_house_prices.csv")
```

```
df.head()
```

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LSTAT	MEDV
0	0.00632	18.0	2.31	0	0.538	6.575	65.2	4.0900	1	296	15.3	396.90	4.98	24.0
1	0.02731	0.0	7.07	0	0.469	6.421	78.9	4.9671	2	242	17.8	396.90	9.14	21.6
2	0.02729	0.0	7.07	0	0.469	7.185	61.1	4.9671	2	242	17.8	392.83	4.03	34.7
3	0.03237	0.0	2.18	0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63	2.94	33.4
4	0.06905	0.0	2.18	0	0.458	7.147	54.2	6.0622	3	222	18.7	396.90	5.33	36.2

Next steps: View recommended plots

```
y = df['MEDV']
X = df.drop('MEDV',axis=1)
```

- Check the shape of the dataset

```
df.shape
```

```
(506, 14)
```

- Split the dataset into test and train datasets, you can set the random seed to 42 by `random_state=42`

```
from sklearn.model_selection import train_test_split

# Assuming X and y are your features and target variables respectively
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

- run cross validation for the train and test datasets for `cv=10`
- print the mean score for the cross validation using linear regressor (`LinearRegressor()`)
- do the same two steps above for random forest regressor. For that you can import

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

```
# cross valudation with LinearRegression
from sklearn.model_selection import cross_val_score
from sklearn.linear_model import LinearRegression
import numpy as np

# Initialize the model
linear_regressor = LinearRegression()

# Perform cross-validation
cv_scores = cross_val_score(linear_regressor, X_train, y_train, cv=10)

# Print the mean score
print("Mean cross-validation score for Linear Regression:", np.mean(cv_scores))
```

```
Mean cross-validation score for Linear Regression: 0.6986301933640767
```

```
# Cross-Validation with Random Forest Regressor
from sklearn.ensemble import RandomForestRegressor

# Initialize the model
random_forest_regressor = RandomForestRegressor(random_state=42)

# Perform cross-validation
cv_scores_rf = cross_val_score(random_forest_regressor, X_train, y_train, cv=10)

# Print the mean score
print("Mean cross-validation score for Random Forest Regressor:", np.mean(cv_scores_rf))
```

```
    Mean cross-validation score for Random Forest Regressor: 0.8211604949722642
```

Boston Housing Data with Polynomials

- Split the dataset into test and train datasets
- Transform the dataset using polynomial transformation, imputer and scaler
- Run cross validation
- Plot the coefficients of the model

Step 1 & 2: Load the Boston Housing dataset and Split It

```
# We already did this in the above one
```

Step 3: Transform the Dataset

```
from sklearn.preprocessing import PolynomialFeatures, StandardScaler
from sklearn.impute import SimpleImputer
from sklearn.pipeline import make_pipeline

# Create a pipeline for transformations
pipeline = make_pipeline(
    SimpleImputer(strategy='mean'), # Impute missing values
    PolynomialFeatures(degree=2, include_bias=False), # Polynomial transformation
    StandardScaler() # Feature scaling
)

# Fit and transform the training data
X_train_transformed = pipeline.fit_transform(X_train)

# Transform the test data (no fitting!)
X_test_transformed = pipeline.transform(X_test)
```

Step 4: Run Cross-Validation

```
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import cross_val_score
import numpy as np

# Initialize the Linear Regression model
linear_model = LinearRegression()

# Perform cross-validation
cv_scores = cross_val_score(linear_model, X_train_transformed, y_train, cv=10)

# Print the mean cross-validation score
print("Mean cross-validation score:", np.mean(cv_scores))
```

```
    Mean cross-validation score: 0.8042073305749259
```

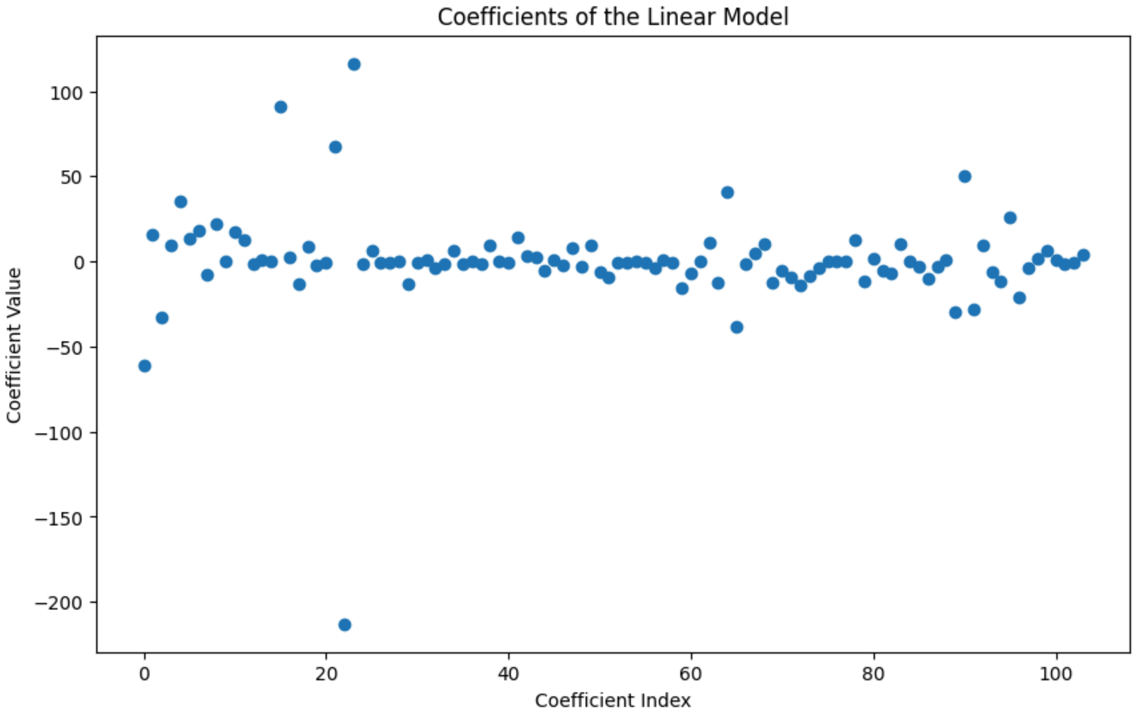
Step 5: Plot the Coefficients of the Model

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

# Fit the model to the transformed training data
linear_model.fit(X_train_transformed, y_train)

# Get the coefficients
coefficients = linear_model.coef_

# Plot the coefficients
plt.figure(figsize=(10, 6))
plt.plot(coefficients, 'o')
plt.title('Coefficients of the Linear Model')
plt.xlabel('Coefficient Index')
plt.ylabel('Coefficient Value')
plt.show()
```


Coefficients of the Linear Model
Coefficient Value
Coefficient Index