Ridge Regression vs. Ordinary Least Squares (OLS)

1. Importing necessary libraries

First, we need to import the libraries required for our analysis. We will use `numpy` for numerical operations, `pandas` for data manipulation, `matplotlib` for visualisation, and `sklearn` for loading the dataset and performing regression.

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.datasets import load_diabetes
from sklearn.linear_model import LinearRegression, Ridge
from sklearn.model_selection import train_test_split
```

2. Loading the dataset

We load the diabetes dataset from `sklearn`. For the sake of simplicity, we will focus on only one feature (BMI) along with the target variable (diabetes progression) for our regression analysis. We also split the dataset into training and testing sets for evaluating our models.

```
diabetes = load_diabetes()
X = diabetes.data[:, np.newaxis, 2]    # Using only one feature (BMI)
y = diabetes.target

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

3. Implementing OLS regression

Now, we fit an Ordinary Least Squares (OLS) regression model to our training data, and use this model to make predictions on our testing set.

```
ols_model = LinearRegression()
ols_model.fit(X_train, y_train)

y_pred_ols = ols_model.predict(X_test)
```

4. Implementing ridge regression

Next, we fit ridge regression models using different values for the tuning parameter (`λ`), and store the predictions for each model to compare against the OLS predictions.

```
ridge_models = {}
lambdas = [0.1, 1.0, 10.0]

for l in lambdas:
  ridge_model = Ridge(alpha=l)
  ridge_model.fit(X_train, y_train)
  ridge_models[l] = ridge_model.predict(X_test)
```

5. Visualising the results

Finally, we visualise the results by plotting the test data, the OLS regression line, and the ridge regression lines for the different `λ` values. This will help us compare the two regression methods.

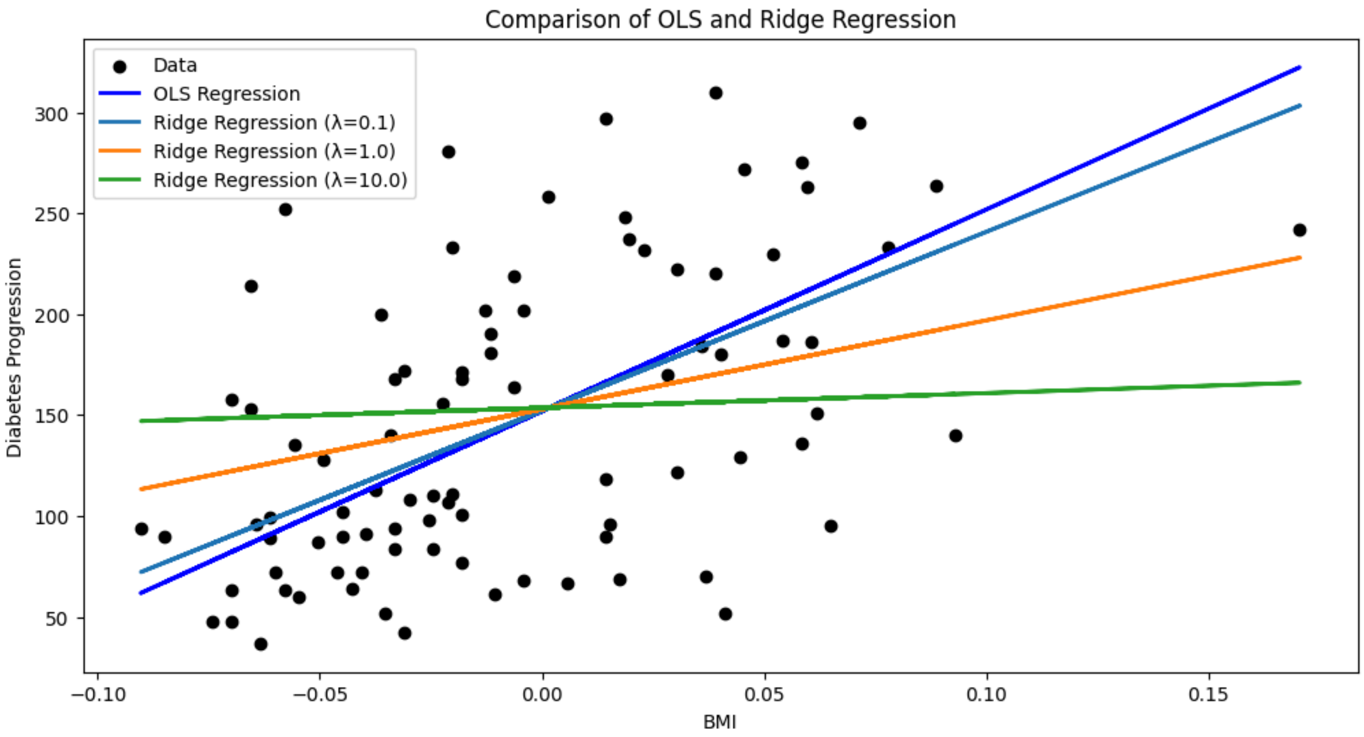
```
plt.figure(figsize=(12,6))

# Scatterplot of the test data
plt.scatter(X_test, y_test, color='black', label='Data')

# Plotting the OLS regression line
plt.plot(X_test, y_pred_ols, color='blue', linewidth=2, label='OLS Regression')

# Plotting the ridge regression lines
for l, y_pred_ridge in ridge_models.items():
    plt.plot(X_test, y_pred_ridge, linewidth=2, label=f'Ridge Regression (λ={l})')

plt.title('Comparison of OLS and Ridge Regression')
plt.xlabel('BMI')
plt.ylabel('Diabetes Progression')
plt.legend()
plt.show()
```


Comparison of OLS and Ridge Regression
● Data
OLS Regression
Ridge Regression (λ=0.1)
Ridge Regression (λ=1.0)
Ridge Regression (λ=10.0)
Diabetes Progression
300
250
200
150
100
50
−0.10
−0.05
0.00
0.05
0.10
0.15
BMI