SIMPLE LINEAR REGRESSION

What is Simple Linear Regression?

Simple linear regression models the relationship between two variables by fitting a straight line:

=
+
y=mx+c

Where:

y is the dependent variable (target),

x is the independent variable (feature),

m is the slope (coefficient),

c is the intercept.

Python Code for Simple Linear Regression

```
import numpy as np
import matplotlib.pyplot as plt

class SimpleLinearRegression:
  def _init_(self):
     self.slope = 0
     self.intercept = 0

  def fit(self, X, y):
     # Calculate mean
     x_mean = np.mean(X)
     y_mean = np.mean(y)

     # Calculate slope (m) and intercept (c)
     numerator = np.sum((X - x_mean) * (y - y_mean))
     denominator = np.sum((X - x_mean) ** 2)
     self.slope = numerator / denominator
     self.intercept = y_mean - self.slope * x_mean

  def predict(self, X):
     return self.slope * X + self.intercept

  def score(self, X, y):
     # R-squared
     y_pred = self.predict(X)
     ss_total = np.sum((y - np.mean(y)) ** 2)
     ss_res = np.sum((y - y_pred) ** 2)
     return 1 - (ss_res / ss_total)

  def plot(self, X, y):
     plt.scatter(X, y, color='blue', label='Data Points')
     plt.plot(X, self.predict(X), color='red', label='Regression Line')
     plt.xlabel('X')
     plt.ylabel('y')
```

```
    plt.title('Simple Linear Regression')
    plt.legend()
    plt.grid(True)
    plt.show()
```

Example Usage

```
# Sample data
X = np.array([1, 2, 3, 4, 5])
y = np.array([2, 4, 5, 4, 5])

# Initialize and train the model
model = SimpleLinearRegression()
model.fit(X, y)

# Make predictions
predictions = model.predict(X)
print("Predictions:", predictions)

# Model evaluation
r2 = model.score(X, y)
print("R-squared:", r2)

# Plot results
model.plot(X, y)
```

Output Explanation

Predictions: The estimated
y values for the input
X.

R-squared: Shows how well the regression line fits the data (1 is perfect).

Plot: Blue dots are actual data, red line is the fitted regression line.