Ex 3 using the Least Squares Method

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.linear_model import LinearRegression
from sklearn.metrics import r2_score
from sklearn.linear_model import LinearRegression
```

```
data = pd.read_csv("headbrain1.csv")
data
```

	Gender	Age Range	Head Size	Brain Weight
0	1	1	4512	1530
1	1	1	3738	1297
2	1	1	4261	1335
3	1	1	3777	1282
4	1	1	4177	1590
...	...	...	...	...
232	2	2	3214	1110
233	2	2	3394	1215
234	2	2	3233	1104
235	2	2	3352	1170
236	2	2	3391	1120

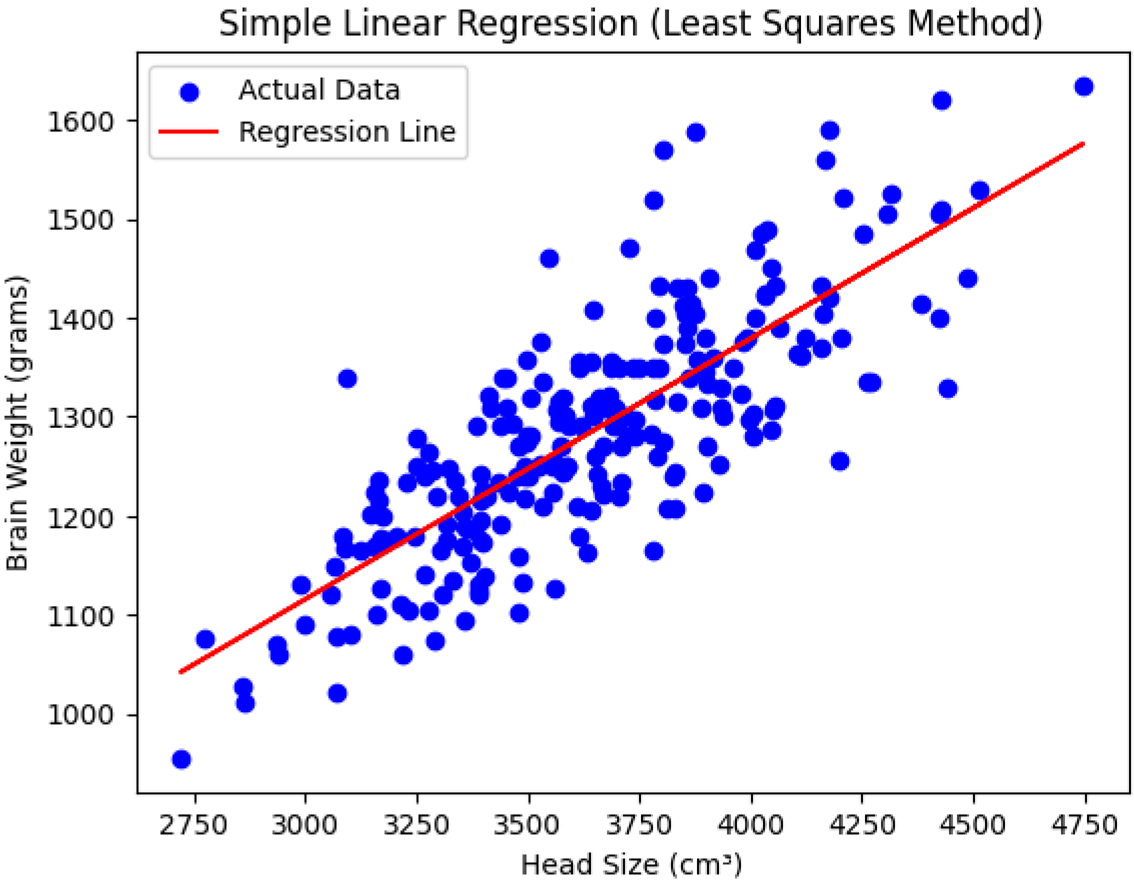
237 rows × 4 columns

```
data.isnull().sum()
```

```
Gender          0
Age Range       0
Head Size       0
Brain Weight    0
dtype: int64
```

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

def simple_linear_regression_least_squares(data):
    # Take Head Size as X and Brain Weight as Y
    X = data["Head Size"].values
    Y = data["Brain Weight"].va
    # Calculate means
    X_mean = np.mean(X)
    Y_mean = np.mean(Y)

    # Calculate slope (m) and intercept (c) using least squares method
    numerator = np.sum((X - X_mean) * (Y - Y_mean))
    denominator = np.sum((X - X_mean) ** 2)
    m = numerator / denominator
    c = Y_mean - m * X_mean

    # Predictions
    Y_pred = m * X + c

    # R² Score (manual)
    ss_total = np.sum((Y - Y_mean) ** 2)
    ss_residual = np.sum((Y - Y_pred) ** 2)
    r2 = 1 - (ss_residual / ss_total)

    print("Simple Linear Regression (Least Squares Method)")
    print(f"Slope (m): {m}")
    print(f"Intercept (c): {c}")
    print(f"R² Score: {r2}\n")

    # --- Plot ---
    plt.scatter(X, Y, color="blue", label="Actual Data")
    plt.plot(X, Y_pred, color="red", label="Regression Line")
    plt.xlabel("Head Size (cm³)")
    plt.ylabel("Brain Weight (grams)")
    plt.title("Simple Linear Regression (Least Squares Method)")
    plt.legend()
    plt.show()

    return m, c, r2, Y_pred

# ✅ Example call
m, c, r2, preds = simple_linear_regression_least_squares(data)
```

```
Simple Linear Regression (Least Squares Method)
Slope (m): 0.2634293394893993
Intercept (c): 325.5734210494428
R² Score: 0.639311719957
```



```
Start coding or generate with AI.
```