

Assessment 1: Implement an OLS regression model from scratch

For this assessment, write a program in Python (or another language of your choice) that implements Ordinary Least Squares (OLS) regression, from scratch, to estimate the parameters of a simple multivariate linear regression model.

The goal is to estimate the β parameters of the linear model:

$$y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \varepsilon$$

Where:

- y is the dependent variable (outcome)
- x_n are the independent variables (predictors)
- β_0 is the intercept or constant
- $\beta_{n>0}$ are the slopes or coefficients
- ε is the error term

Implement the OLS estimator using basic or matrix algebra and **without** relying on any statistical libraries. Your code should be well-documented, with comments explaining each step.

You *may* use a matrix algebra library (such as numpy in Python), but for the highest credit you will implement as much of the code as possible using only the basic capabilities of your chosen language. Credit will also be given for reporting additional statistics such as standard errors, t statistics, p values and overall R^2 .

Test the output of your implementation against OLS estimates from Stata, R, or statistical libraries in the language you are using.

Data

Your code should be able handle any data set where the number of observations is greater than the number of independent variables. For this assessment, use the student performance data set at <https://archive.ics.uci.edu/dataset/320/student+performance>.

Estimate the final grade in maths (variable G3 in file student-mat.csv) based on between 4 and 6 of the other variables in the data set.

Submission

Submit your report as a link to **either** a public code notebook (such as Google Colab) **or** a public GitHub repository that includes the source code, a LICENSE file, and a README file that explains how to run the code.

Within the notebook or README file, interpret the results you obtain and any challenges or interesting observations you encountered in completing the task.