Group 3: Regression

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Introduction

A Brief Recap

- **Initial Plan:**
    - Focus: Linear Regression
    - Task: Implement five regression models
    - Validation: Compare with established implementations

- **Received Feedback:**
    - Focus on 1 or 2 models
    - Add educational value to the project

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Introduction

Our New Approach

- Chose OLS and LWR as focus models

- Retained comparative study

- Developed two web applications
 - One for education
  - One for model visualization

2. Coding

- Dev setup
- SWE principals

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2.1 Coding - Dev setup

- Fixed python version via pyenv (python 3.11)
- Dependencies loaded via pip into a virtual env of the `venv` module of the standard lib
- Code formatting with `black`
- Linting with `pylint`
- Reviews of pushed code
- Usage of github issue tracker

2.2 SWE principals -- Separation of concerns
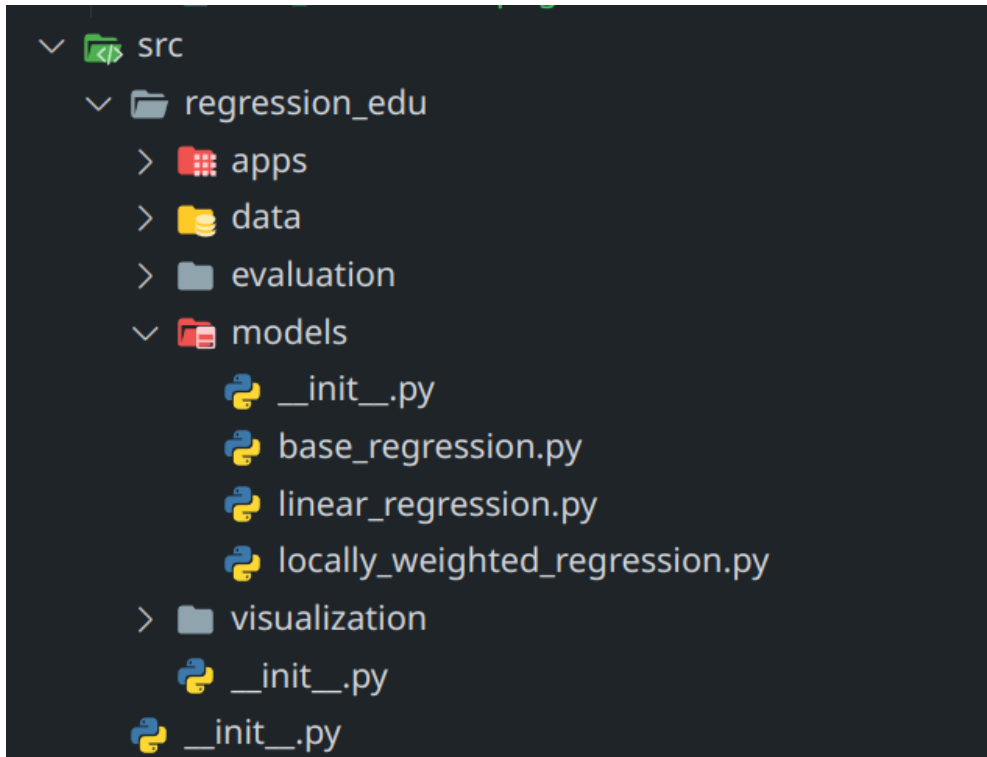
2.3 SWE principals -- Inheritance

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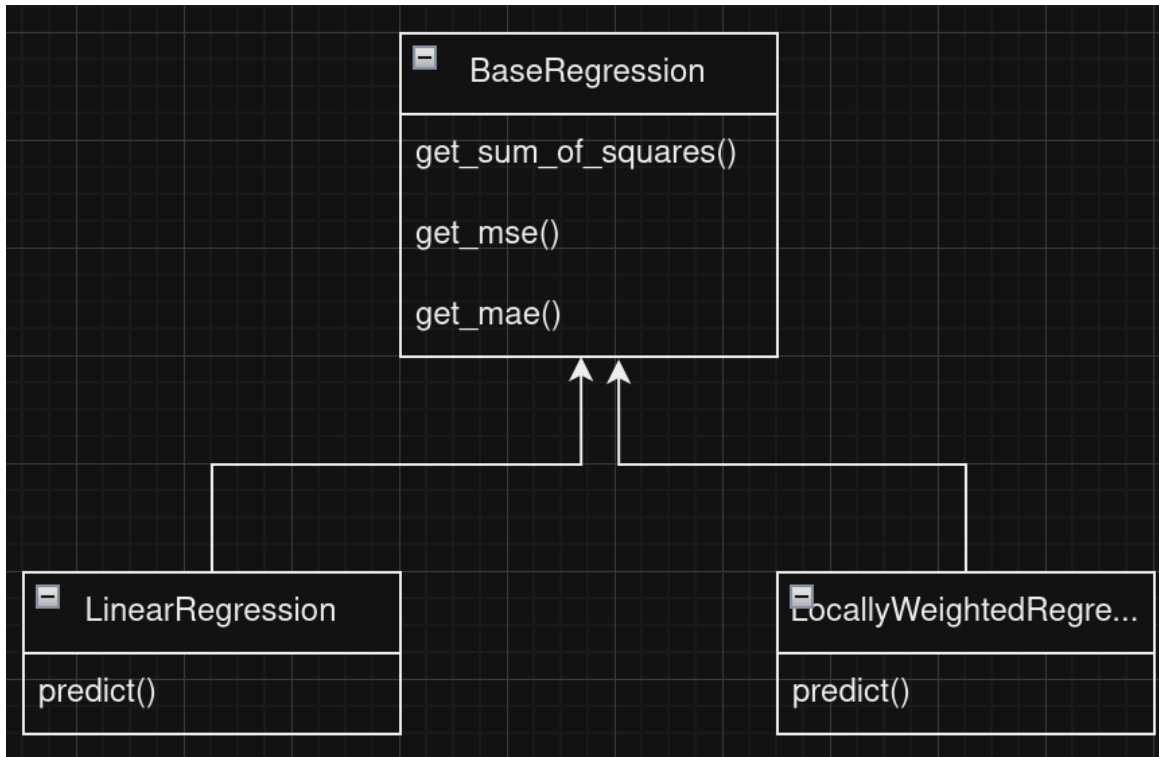
3. Locally Weighted Regression (LWR) in Detail

3.1 LWR in Detail

1. Divide intersections

2. For each section, calculate the weighted regression with weight
$$w_i(x) = e^{-\frac{(centre_i - x)^2}{2\tau^2}}$$

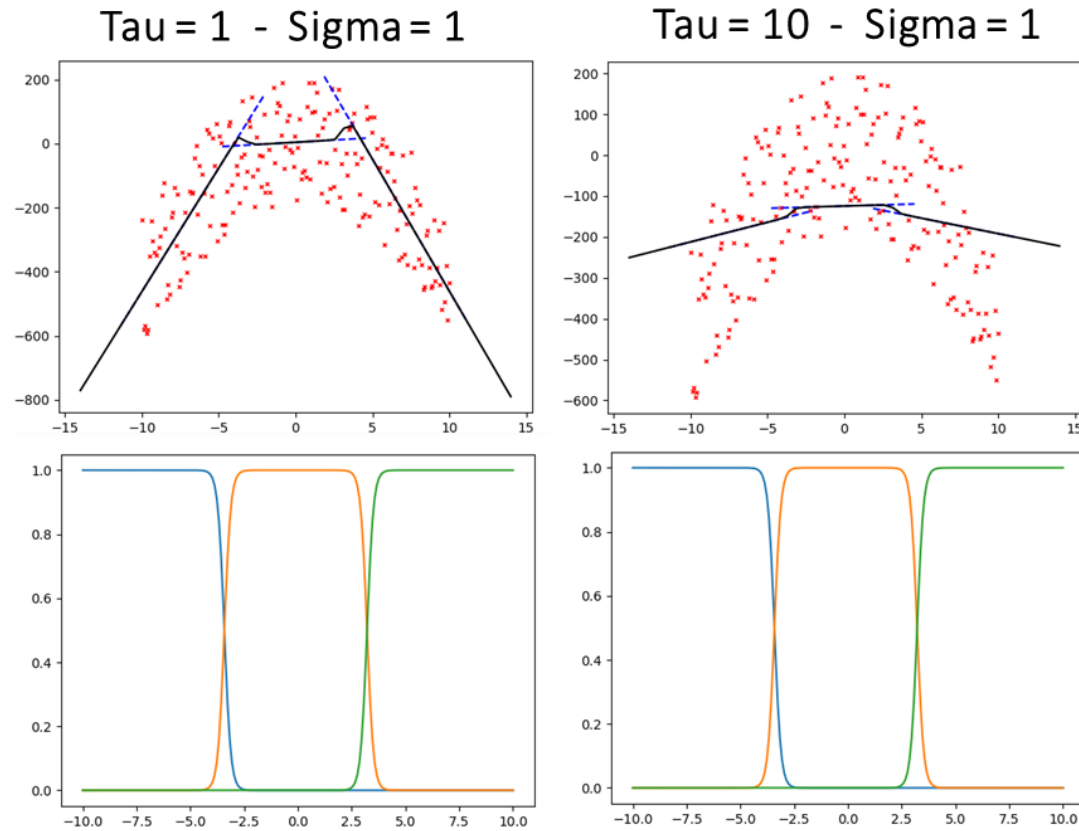3. Smoothen the function with $gauss_{centre}(x) = e^{-\frac{(centre - x)^2}{2\sigma^2}}$ and normalising it by dividing through $\Sigma_{centre} \, gauss_{centre}(x)$
$$f(x) = \frac{1}{\Sigma_i \, gauss_i(x)} \Sigma_i gauss_i(x) \cdot f_i(x)$$

Hyperparameters:

- *amount sections*

- *tau*

- *sigma*

3. LWR in Detail - Influence of Tau

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3. LWR in Detail - Influence of Sigma

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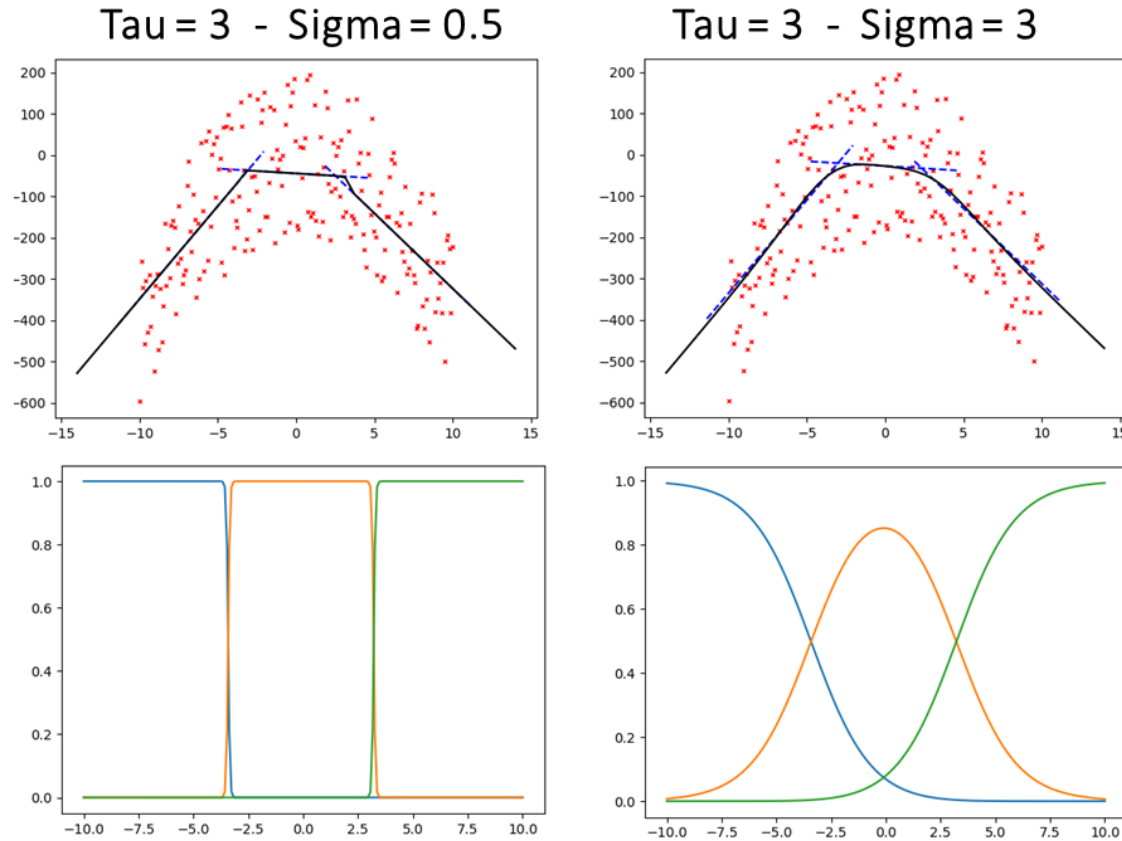
4. Runtime Performance - Setup
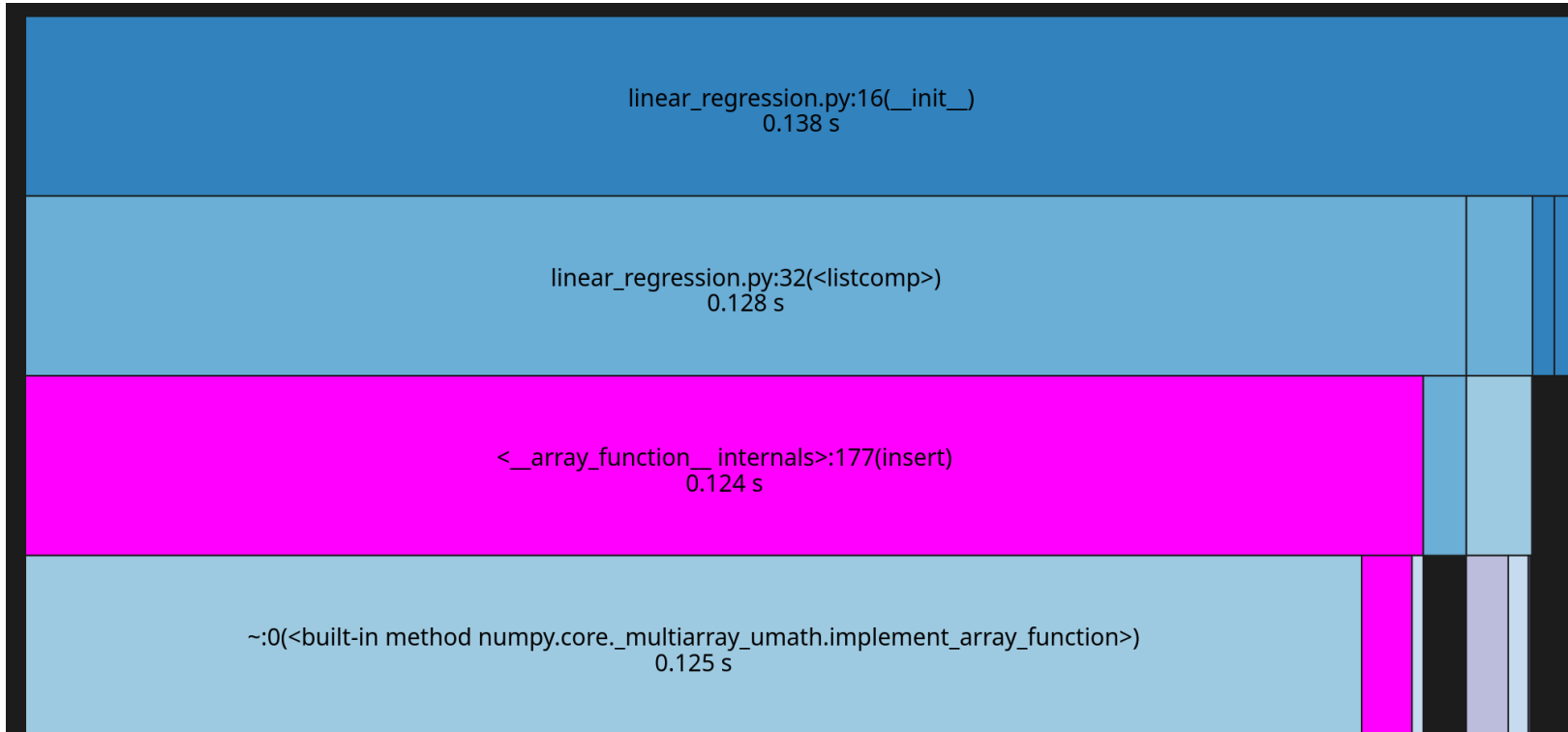
Time Complexity:

- 50 iterations
- Data:
  - 50 data points
  - 2 independent variables
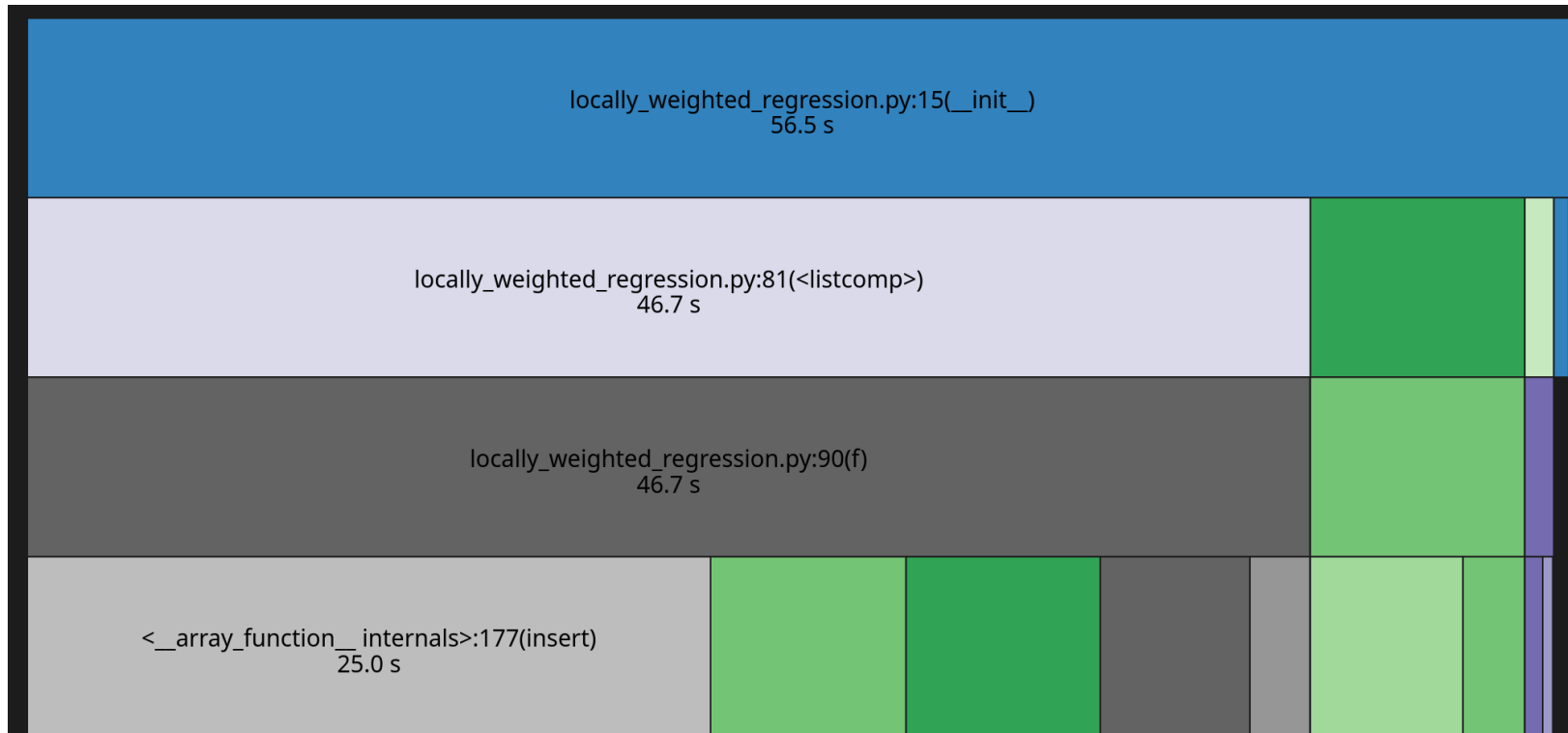
4. Runtime Performance - Results

	Runtime in seconds
LinearRegression	0.138
skearn.linear_model	0.060
LocallyWeightedRegression	56.500
localreg	2.170

4.1 LinearRegression

flame graph generated with `snakeviz`

4.2 LocallyWeightedRegression

flame graph generated with `snakeviz`

5. Live Demo

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