Linear & Logistic Regression from Scratch

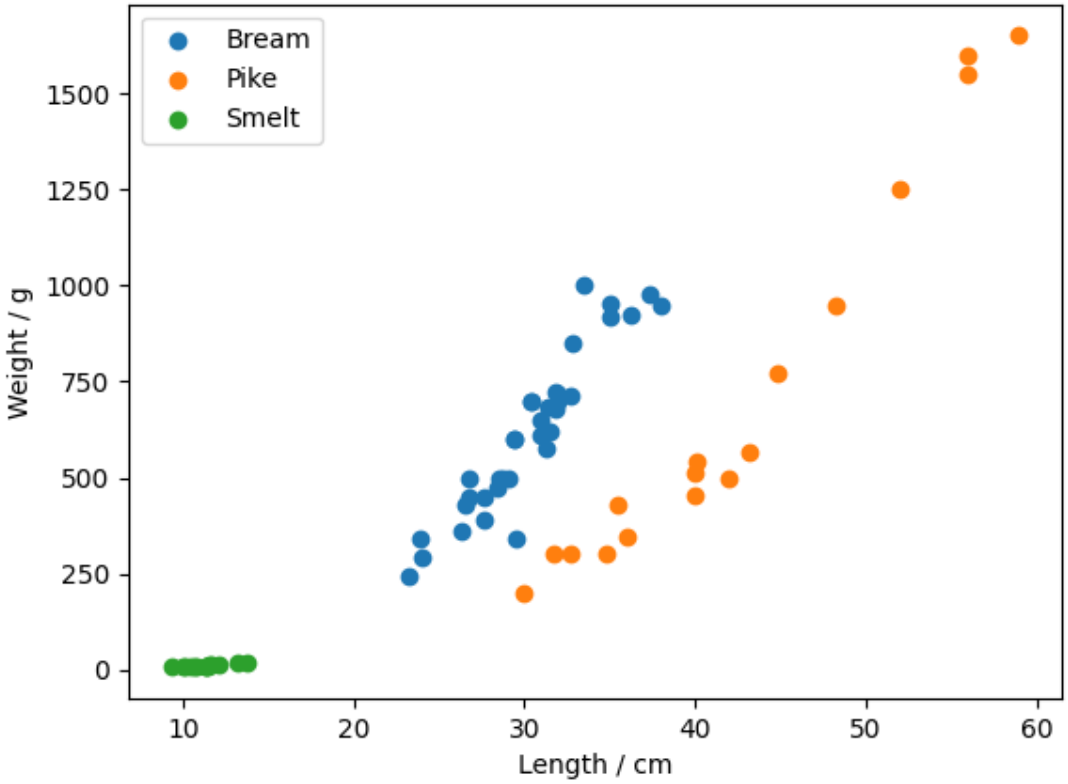
Construct linear and logistic regressors from scratch.

Learning Objectives

- Loss functions
- Gradient descent
- Learning rate
- Scaling data

Visualising the Data

A fish market dataset was used to test the regressors in two dimensions.

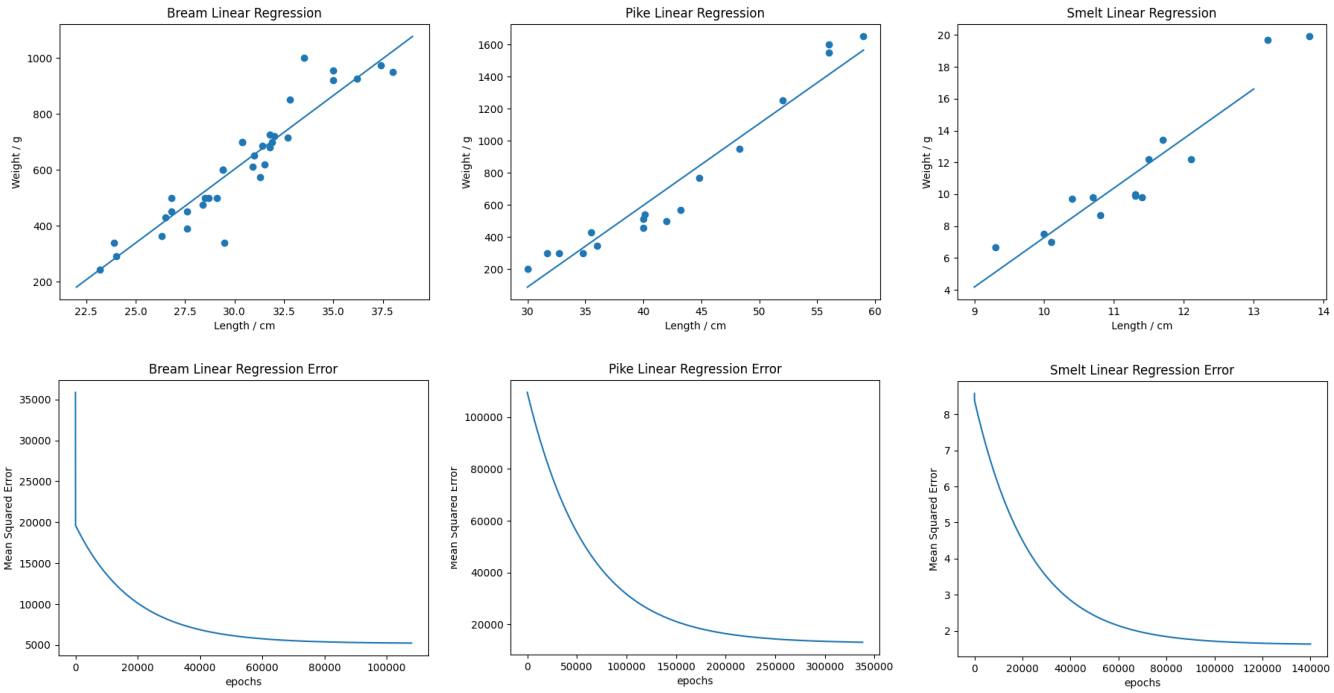


Each fish species could be identified by its length and weight.

Linear Regression

A linear regressor was constructed using a Mean Squared Error loss function and optimised using gradient descent. A learning rate of 0.001 was chosen. The model was considered to be converged when the relative difference in Mean Squared Error between subsequent epochs was less than 1e-7.

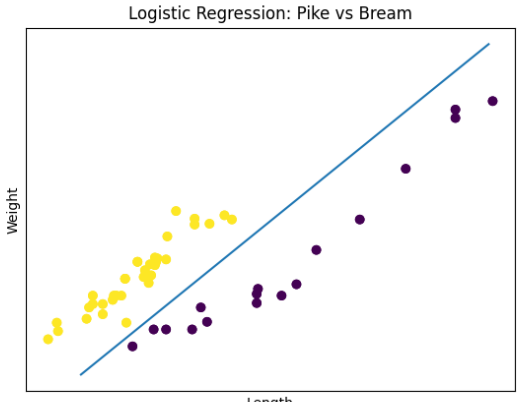
Each fish species required ~100,000 epochs to converge.

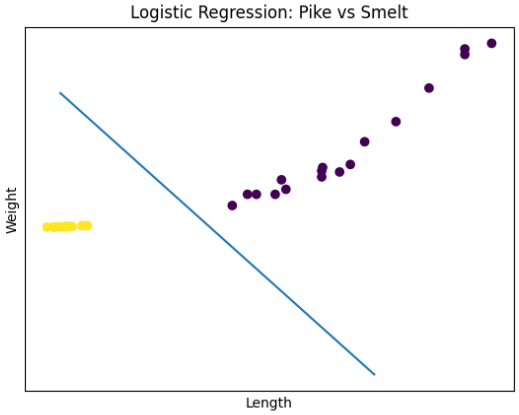


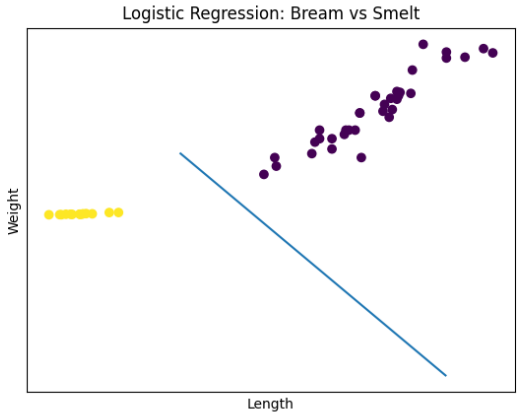
A Linear Scaler was used to scale down the parameter space. Linear regression on the scaled data converged within ~20,000 epochs. The learning rate could also be increased to 0.1 without causing divergence, reducing the time for convergence to ~200 epochs. It is clear that scaling down the parameter space affords a significant decrease in training time.

Logistic Regression

A logistic regressor was constructed using the Sigmoid of the Mean Square Error as the loss function, and was optimised using gradient descent. A learning rate of 0.1 was chosen. Logistic regressors were optimised for each fish pair. Using random test / train splitting, the models achieved perfect accuracy on the test data when only optimised for the training data.







A data point could be correctly classified into one of the three species by having each binary classifier vote on the classification. However, this approach would become infeasible as the number of classes increases.