

Programming Assignment 1

Issued: Friday 27th September, 2019

Due: Friday 11th October, 2019

1.1. (5 points) *Linear regression*. Consider the linear observation model

$$\mathbf{y} = X\mathbf{w} + \mathbf{c}$$

where the X is a 10000×10 matrix, and \mathbf{w}, \mathbf{c} are column vectors with length 10 and 10000. Use gradient descent to find the \mathbf{w} that minimizes the loss $\frac{1}{2}\|X\mathbf{w} - \mathbf{y}\|_2^2$. See details in the **linear_regression.py**.

1.2. (5 points) *Logistic regression*. The MNIST database contains 60000 training images and 10000 testing images. In this task, each image of the MNIST has been reshaped to a column vector of length $28 \times 28 = 784$. You need to calculate the gradient and update the weights to learn your model. See details in the **logistic_regression.py**.

Notice:

1. Use matrix operations other than loops for efficiency. If the running time exceeds 5 minutes, you will get point deductions.
2. You are ought to acquire at least 95% test accuracy in your logistic binary classifier.