**Machine Learning** **Universität Hamburg**
Spring 2023 Sören Laue

# Exercise Sheet 1

## Exercise 1

How do you interpret the weights $w$ and offset $b$ in a least squares regression analysis?

## Exercise 2

We have seen in class that the gradient of the least squares regression function is

$$\nabla L = X^\top (Xw - y)$$

Verify the correctness of this gradient using standard calculus from high school, i.e., no matrix calculus.

## Exercise 3

Prove that the system of linear equations for least squares regression always has a solution. How many solutions can it have? Please list all cases that can happen.

## Exercise 4

Implement least squares regression in Python and run it on a multi-dimensional dataset. Run it also on a one-dimensional dataset and visualize the result. Please use NumPy for solving this exercise. Other Python libraries like scikit-learn or scipy are disallowed here.

Remember: It is always advisable to visualize results when running ML experiments.

Please turn in your solutions by Friday, April 14th.