

Python and Maths Basics

Exercise 1 : Converting between model function space and the loss landscape

Consider the loss $l_2(c, y(\mathbf{x}))$ as defined in the homework sheet for the point $(4, 6)$.

- (a) Intuitively explain why $l_2 = 0$ holds for a set of more than one instance of model parameters.
- (b) Show through calculations that $l_2 = 0$ is a straight line in the loss landscape.
- (c) To what structure does this correspond in the function space? Plot and try to show your conjecture using calculations.

Exercise 2 : Advanced model functions

What if we want to fit a parabola instead of a straight line?

- (a) Define the model function.
- (b) How can we find (\mathbf{x}, c) , given the points to fit through (e.g., $(4, 6)$, $(-1, -3)$, $(5, 10)$)?
- (c) Vaguely describe the loss landscape.

Exercise 3 : Gradient descent and loss functions

Consider the general case, but you might want to check back on the loss landscape plot in the homework exercise.

- (a) In which direction does the gradient point?
- (b) In which direction does the negative gradient point?
- (c) Why does that help in the context of a loss landscape?

Exercise 4 : Limits of LMS

- (a) What happens to the loss landscape in further iterations of the LMS algorithm?
- (b) Why is that a problem?
- (c) What could be the solution?