DATA.ML.100 Introduction to Pattern Recognition and Machine Learning
TAU Computing Sciences
Exercise 1 *Fitting a line*

Be prepared for the exercise sessions (watch the demo lecture). You may ask TAs to help if you cannot make your program to work, but don't expect them to show you how to start from the scratch.

1. **Fitting 2D linear model to $N > 2$ training points** (30 points)

   (a) During the lectures we started to derive solutions for the parameters a and b of the linear model $y = ax + b$ and when there are N training data samples $\{(x_1, y_1), (x_2, y_2), \ldots, (x_N, y_N)\}$.

   You should finish the derivation before testing it. Do not google, but allow yourself to do the math.

   (b) Implement a Python function *my_linfit(x,y)* that computes and returns a and b. Use your own derivations in the function - no matter how "ugly" they are - to convince yourself about your super powers.

   (c) Write a Python program that asks user to give N points with a mouse (left click: add point, right click: stop collecting) and then plots the points and a fitted linear model. Usage:

   ```
   (dataml100)$ python fit_line.py
   ```

   You may start with this snippet:

   ```python
   # Linear solver
   def my_linfit(x,y):
       a = 0
       b = 0
       return a,b

   # Main
   import matplotlib.pyplot as plt
   import numpy as np

   x = np.random.uniform(-2,5,10)
   y = np.random.uniform(0,3,10)
   a,b = my_linfit(x,y)
   plt.plot(x,y,'kx')
   xp = np.arange(-2,5,0.1)
   plt.plot(xp,a*xp+b,'r-')
   print(f"My fit: a={b} and b={b}")
   plt.show()
   ```