EXERCISE 1

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1. Stochastic Gradient Descent

(1) Implement in your favorite programming language the Stochastic Gradient Descent algorithm.

(2) Generate 100 artificial data points (x_i, y_i) where each x_i is randomly generated from the interval $[0, 1]$ and $y_i = \sin(2\pi x_i) + \varepsilon$. Here, ε is a random noise value in the interval $[-0.1, 0.1]$.

(3) Make your initial learning rate constant $\alpha = 0.005$, and train a polynomial model using your artificially created data. A polynomial model has the form $y = \theta_0 + \theta_1 x + \theta_2 x^2 + \ldots + \theta_M x^M$.

(4) Try different α values to speed up the learning process.

(5) Once you have found the best model, plot a graph containing the data points, the sine function, and the learned function.

(6) Prepare a report containing your final model, your final α value, and your graph.

2. Exercise Submission

- Send your report to `cetina@informatik.uni-hamburg.de` with the email title string: MLEX1 Lastname1-Lastname2-Lastname3
- Deadline: A day before your next exercise session.
- Note: Do not forget to include your names in the report!