

## 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,  $\varepsilon$  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  $y = \theta_0 + \theta_1 x + \theta_2 x^2 + \dots + \theta_M x^M$ .
- (4) Try different  $\alpha$  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  $\alpha$  value, and your graph.

### 2. EXERCISE SUBMISSION

- You can hand me your printed report after the lectures or during the exercise sessions
- Deadline: April 18th
- Note: Do not forget to include your names in the report!