Introduction to Machine Learning
2022

Exercise 6: final

Due date: See course's site

The purpose of this exercise is to implement a neural network, and train it on the MNIST dataset. Follow the following steps:

1. Implement a feed-forward fully-connected neural network for the MNIST dataset (40%).
   We have all the necessary knowledge to implement this neural network. But, in case you feel insecure and you want reassurance, you can use the materials in this book. The book contains a detailed exaplanation on how to implement a neural network for the MNIST dataset. In fact it even contains the code which you can find here. Do not copy the code, but rather write your own version of the neural network implementation for the MNIST dataset.

2. Train your neural network on the MNIST dataset, and test your results (35%).

3. Optimize the networks parameters, including the architecture, in order to achieve best results (25%). Keep a log of all your history attempts in a presentable manner.

Comments and guidelines:

1. For the cost of 10 points you can do the exercise with a partner, and submit it together.

2. Documented your solution well, and clearly.

3. Your solution must include a class named *NeuralNetwork* that contains (among others) the methods *fit(X,y)*, *predict(X)*, and *score(X,y)*. Here X is a matrix containing all or a part of the MNIST dataset, and y is a vector with the corresponding labels. Following is a description of these methods:

   - *fit(X,y)* - Trains a neural network on X, y.
   - *predict(X)* - Computes the output of the trained network on the examples in X.
   - *score(X,y)* - Computes the average number of examples in X that the trained network classifies incorrectly.

4. Make sure it is easy for us to run your solution and test it.