

Homework #1

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RELEASE DATE: 09/19/2011

DUE DATE: 10/03/2011, BEFORE THE END OF CLASS

Unless granted by the instructor in advance, you must turn in a printed/written copy of your solutions (without the source code) for all problems. For problems marked with (), please follow the guidelines on the course website and upload your source code and predictions to designated places.*

Any form of cheating, lying, or plagiarism will not be tolerated. Students can get zero scores and/or fail the class and/or be kicked out of school and/or receive other punishments for those kinds of misconducts.

Discussions on course materials and homework solutions are encouraged. But you should write the final solutions alone and understand them fully. Books, notes, and Internet resources can be consulted, but not copied from.

Since everyone needs to write the final solutions alone, there is absolutely no need to lend your homework solutions and/or source codes to your classmates at any time. In order to maximize the level of fairness in this class, lending and borrowing homework solutions are both regarded as dishonest behaviors and will be punished according to the honesty policy.

You should write your solutions in English with the common math notations introduced in class or in the problems. We do not accept solutions written in any other languages.

1.1 Learning Exercises

- (1) (5%) Do Exercise 1.1(a) of LFD.
- (2) (5%) Do Exercise 1.1(b) of LFD.
- (3) (5%) Do Exercise 1.1(c) of LFD.
- (4) (5%) Do Exercise 1.1(d) of LFD.
- (5) (10%) Describe a task that interests you and can be solved by machine learning. State some *reasons* that can convince your TAs.

1.2 Learning versus Design

In the following exercises, you need to make your arguments *convincing* to get the points.

- (1) (5%) Do Exercise 1.5(a) of LFD.
- (2) (5%) Do Exercise 1.5(b) of LFD.
- (3) (5%) Do Exercise 1.5(c) of LFD.
- (4) (5%) Do Exercise 1.5(d) of LFD.
- (5) (5%) Do Exercise 1.5(e) of LFD.

1.3 Perceptron Learning Algorithm

- (1) (5%) Do Exercise 1.2(a) of LFD.
- (2) (5%) Do Exercise 1.2(b) of LFD.
- (3) (5%) Do Exercise 1.2(c) of LFD.

1.4 Proof of Perceptron Learning Algorithm

- (1) (10%) Do Problem 1.3(a) of LFD.
- (2) (5%) Do the first part (before “hence”) of Problem 1.3(b) of LFD.
- (3) (5%) Do the second part (after “hence”) of Problem 1.3(b) of LFD.
- (4) (10%) Do Problem 1.3(c) of LFD.
- (5) (10%) Do Problem 1.3(d) of LFD.
- (6) (10%) Do Problem 1.3(e) of LFD.

1.5 Experiments with Perceptron Learning Algorithm (*)

- (1) (10%) Do Problem 1.2(a) of LFD.
- (2) (10%) Do Problem 1.2(b) of LFD.
- (3) (10%) Do Problem 1.2(c) of LFD.
- (4) (10%) Do Problem 1.2(e) of LFD.
- (5) (10%) Do Problem 1.2(f) of LFD.
- (6) (10%) Do Problem 1.2(g) of LFD.
- (7) (20%) Run PLA on the following set for training:

http://www.csie.ntu.edu.tw/~htlin/course/ml11fall/data/hw1_train.dat

Then, use the hypothesis you get to predict the label of each example within the following test set:

http://www.csie.ntu.edu.tw/~htlin/course/ml11fall/data/hw1_test.dat

Submit your predictions to the designated place (to be announced on the course website)—*note that you can only submit **once***. The TAs will grade this problem by this one-chance submission.

1.6 More about Proof of Perceptron Learning Algorithm

- (1) (Bonus 10%) The proof in Homework 1.4 suggests that the radius R affects the convergence of PLA. So Dr. Learn plans to conduct the following procedure: scale down all \mathbf{x}_n linearly by a factor of 10, with the hope that the PLA algorithm would run 10 times faster. Will his plan work? Why or why not?