

Exercises Week 6

Machine Learning/Advanced Machine Learning
IT University of Copenhagen

Fall 2019

Exercise W8.1 (Theoretical)

- (a) Problem 17.13.2 from Alpaydin [2014].
- (b) Problem 17.13.4 from Alpaydin [2014].

Exercise W8.2 (Programming)

This problem is classification of two classes using ensemble averaging.

First, generate the data by drawing 1000 random numbers from two dimensional isotropic normal distributions, that form the ground truth class conditional distributions, respectively, with the parameters

$$\mu_1 = (0, 0), \mathbf{C}_1 = \mathbf{I}, \quad (\text{W8.1})$$

and

$$\mu_2 = (2, 0), \mathbf{C}_2 = 4\mathbf{I}. \quad (\text{W8.2})$$

Divide the data into training and test sets with 500 points each.

Let us look at the classification problem. Assume that the two classes are equiprobable, the costs for misclassifications are zero, and costs for correct classifications are zero. It can be shown that the optimal, Bayes classifier would achieve 81.51% classification score for this set up.

(a) Train a MLP network with one hidden layer and two hidden neurons using TensorFlow using the training data generated. Use the learning rate, $\eta = 0.1$ and momentum constant $\alpha = 0.5$. This trained MLP network is the Expert 1.

(b) Train nine more experts as in (a) with the only difference of using different initialisation for the network weights. These experts are the Experts 2-9.

(c) Construct a committee machine by ensemble averaging. Compute the classification results on the test set by the individual experts and compare to the result you will obtain the committee machine. What can you conclude from the results?

Exercise W8.3 (Theoretical)

Problem 18.9.1 from Alpaydin [2014]

Exercise W8.4 (Programming)

Problem 18.9.2 from Alpaydin [2014]

References

E. Alpaydin. *Introduction to Machine Learning*. The MIT Press., third edition edition, 2014.