Machine Learning (Spring 2020) **(Due: 16.04.2020 23:55)**

Assignment 4

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Course Policy: Read all the instructions below carefully before you start working on the assignment, and before you make a submission.

- The homework assignments are for practice purpose. The grade from your homework will not affect your final grade of the course.
- Please submit your answer sheet, either by a scanned copy or a typeset PDF file, to Moodle before the deadline.
- No late submission is accepted.
- You can do this assignment in groups of 2. Please submit no more than one submission per group.

Problem 1: Support Vector Machine (5 points)

(a) Show that, irrespective of the dimensionality of the data space, a data set consisting of just two data points, one from each class, is sufficient to determine the location of the maximum-margin hyperplane.

Problem 2: Random Forest (5 points)

(a) Show that as the number of the bootstrap samples B gets large, the out-of-bag error for a random forest approaches its N-fold cross validation error estimate, and that in the limit, the identity is exact.

Problem 3: Artificial Neural Network (5 points)

(a) Consider a convolutional network, in which multiple weights are constrained to have the same value. Discuss how the standard backpropagation algorithm must be modified in order to ensure that such constraints are satisfied when evaluating the derivatives of an error function with respect to the adjustable parameters in the network.