University of TEHRAN

Machine Learning

Problem Set 12

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Problem 1: Review part
Write your reviews for the whiteboard notes and the slides of the lectures of the past two weeks. Write down all formulas and explain in detail each step of the derivations, if applicable.

Problem 2: Exponential Loss and AdaBoost.M1
Show that AdaBoost.M1 is equivalent to forward stagewise additive modeling using the exponential loss function. Write down the detailed derivations.

Problem 3: Variance reduction of bagging
For B identically distributed random variables with positive pairwise correlation ρ, prove the variance of the average is $\rho\sigma^2 + \frac{1-\rho}{B}\sigma^2$. Discuss how this formula is related to the idea of random forests.

Problem 4: Programming: shallow neural networks
Implement a function or package for representation and learning of shallow neural networks for both classification and regression problems. The user of your program should be able to change parameters of the neural networks such as the number of hidden nodes and activation function. Compare your code with the built-in functions on three different datasets.

We encourage discussing the problems with other students, however, similarity between solutions is not allowed. (**Important**) Studying any online or previous solutions, no matter to what extent, is strictly forbidden and is considered as a violation of the academic honor code. Submit your solutions by Mordad 10, 1399.