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December 9, 2024
Due: December 16, 2024 at 10:00 p.m.

Algorithms and Uncertainty

Winter Term 2024/25

Exercise Set 10

If you want to hand in your solutions for this problem set, please send them via email to rlehming@uni-bonn.de *by Monday evening. Of course, submitting solutions in groups is also possible.*

If you would like to present one of the solutions in class, please also send an email to rlehming@uni-bonn.de *stating* **which task** *you would like to present in* **which of the tutorials***. Deadline for the email is Monday, 10:00 pm. Please note that the tasks will be allocated on a first-come-first-serve basis, so sending this email earlier than Monday evening is highly recommended.*

Exercise 1: (4 Points)

We consider a generalization of the algorithm *Weighted Majority* for classifiers with k different classes. (The case covered in the lecture, binary classification, is $k = 2$.) In each step, the algorithm chooses a class, which is recommended by the largest number of classifiers (so the class has a plurality).

Show that this algorithm makes at most $(k + k\eta) \min m_i + k \ln n/\eta$ errors, where m_i is the number of errors of classifier i.

Bonus: Tighten this bound to $(2 + 2\eta) \min m_i + 2 \ln n/\eta$.

Exercise 2: (4 Points)

Consider the modified update rule for Multiplicative Weights that sets $w_i^{(t+1)} = w_i^{(t)} \cdot (1 - \ell_i^{(t)} \eta)$. Show that Theorem 18.3 still holds.