
Machine Learning B

2024-2025

Home Assignment 5

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The deadline for this assignment is **27 May 2025, 17:00**. You must submit your *individual* solution electronically via the Absalon home page.

A solution consists of:

- A PDF file with detailed answers to the questions, which may include graphs and tables if needed. Do *not* include your full source code in the PDF file, only selected lines if you are asked to do so.
- A .zip file with all your solution source code with comments about the major steps involved in each question (see below). Source code must be submitted in the original file format, not as PDF. The programming language of the course is Python.
- **IMPORTANT: Do NOT zip the PDF file**, since zipped files cannot be opened in *SpeedGrader*. Zipped PDF submissions will not be graded.
- Your PDF report should be self-sufficient. I.e., it should be possible to grade it without opening the .zip file. We do not guarantee opening the .zip file when grading.
- Your code should be structured such that there is one main file (or one main file per question) that we can run to reproduce all the results presented in your report. This main file can, if you like, call other files with functions, classes, etc.
- Handwritten solutions will not be accepted. Please use the provided latex template to write your report.

1 [Optional] Occam's kl-razor vs. PAC-Bayes-kl (0 points) [Yevgeny]

Solve Exercise 3.7 in Yevgeny's lecture notes.

2 PAC-Bayesian Aggregation (70 points) [Yevgeny]

Solve Exercise 3.8 in Yevgeny's lecture notes.

A small clarification - the exercise asks you to "document carefully what you". What it means is to

- Include key equations you are using for calculating various quantities. For example, the equations for ρ -updates and for calculating the bounds.
- Snippets of the key parts of the code (but, please, do not dump the whole code into the report).

Careful documentation will give the TAs ground to award partial points even if the final graphs go wrong.

3 VC Dimension (30 points) [Amartya]

1. Solve Q1 of Exercise 3.4 in Yevgeny's lecture notes.
2. Solve Q2 of Exercise 3.4 in Yevgeny's lecture notes.
3. Solve Q3 of Exercise 3.4 in Yevgeny's lecture notes.
4. Solve Q4 of Exercise 3.4 in Yevgeny's lecture notes.
5. Solve Q5 of Exercise 3.6 in Yevgeny's lecture notes.

4 [Optional] Regularization by relative entropy and the Gibbs distribution [Yevgeny]

Solve Exercise 5.11 in Yevgeny's lecture notes.