

Assignment 2: March 17

Instructions: You are free to code in Python/Matlab/C/R. Discussion among the class participants is highly encouraged. But please make sure that you understand the algorithms and write your own code. Submit the code by 24th March.

Question 1 (Full information setting) Consider the problem of prediction with expert advice with $d = 10$. Assume that the losses assigned to each expert are generated according to independent Bernoulli distributions. The adversary/environment generates loss for experts 1 to 8 according to $\text{Ber}(.5)$ in each round. For the 9th expert, loss is generated according to $\text{Ber}(.5 - \Delta)$ in each round. The losses for the 10th expert are generated according to different Bernoulli random variable in each round— for the first $T/2$ rounds, they are generated according to $\text{Ber}(0.5 + \Delta)$ and the remaining $T/2$ rounds they are generated according to Bernoulli random variable $\text{Ber}(0.5 - 2\Delta)$. Generate (pseudo) regret vs T plots for each of the following algorithms for $\Delta = 0.1$ and $T = 10^6$. The averages should be taken over atleast 50 sample paths (more is better). Display the 95% confidence intervals for each plot. Select the best value for the learning rate η .

- Weighted Majority algorithm.
- Follow the Regularized Leader (FTRL) with linear loss functions and negative entropy as the regularizer. In round $t = 1, 2, \dots, T$, the linear function is $f_t(w) = w'v_t$, where $v_t \in \{0, 1\}^d$ is loss vector generated in round t . Set the weight parameter η appropriately to get best performance.

Question 2 (Bandit setting) Consider the problem of multi-armed bandit with $K = 10$ arms. Assume that the losses are generated as in Question 1. For each of the following algorithms generate (pseudo) regret vs T plots. The averages should be taken over atleast 50 sample paths (more is better). Display the 95% confidence interval for each plot. Select the best values for parameters, η, γ and β .

- EXP3,
- EXP3.P
- EXP-IX

Question 3 Comment on the performance of EXP, EXP3.P and EXP-IX. Which one performs better? Can you think of a your own method which performs better than any of the above methods. Give pseudo-code of your algorithm and compare its performance with others.