EVALUATION

ONLINE LEARNING

LINKS WITH OPTIMIZATION AND GAMES

UNIVERSITÉ PARIS–SACLAY

ADAGRAD ON THE SIMPLEX AND APPLICATION TO GAMES

Let $d \geqslant 1$ and consider the simplex $\mathcal{X} = \Delta_d$.

1) Derive regret bounds for AdaGrad-Norm and AdaGrad-Diagonal in the special case of the simplex.

2) Let $m, n \geqslant 1$ be integers and $A \in \mathbb{R}^{m \times n}$. In the context of solving the two-player zero-sum game given by A, derive guarantees for AdaGrad-Norm and AdaGrad-Diagonal.

3) Implement AdaGrad-Norm on the simplex with the help of the following snippet which computes the Euclidean projection onto the simplex.

4) In the context of solving two-player zero-sum games, perform numerical experiments to compare the performance of AdaGrad-Norm with RM, RM+ and the exponential weights algorithm. Also include optimistic variants of all algorithms.

5) BONUS. — Rewrite the above Python function mathematically and prove that it indeed computes the Euclidean projection onto the simplex.

6) Bonus. — Also implement AdaGrad-Diagonal and add it to the numerical experiments.