Internship Proposal (Research): "Online Algorithms with Budget and Equity Contraints"

Keywords: Online Learning, Ad auctions, Fairness, Machine learning, Matching

Lab: Laboratoire d'Informatique de Grenoble (LIG), Grenoble, France (head: Noël De Palma)
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Background

Online platforms are omnipresent on the web: they are for instance used to place advertisements on webpages, to decide how to match drivers and customers in ride-sharing systems, or to decide which products to sell to which users. Such a system is two-sided, with users on one side and services (or products) on the other side. Users arrive sequentially to the platform and each time a user comes, he or she must be matched to a service or a set of services meeting her needs. Such problems are often solved by using bandit algorithms [4] when they are no constraints that couple the various users.

Goal of the internship

The goal of this internship will be to study online allocation problem where service providers have budget or equity constraints (for instance, they cannot discriminate on a gender basis). This creates a difficulty as it couples all decisions (for instance: *should I match a person of this gender now because it will give me more flexibility for my later decisions?*). A popular way to solve such a problem is to relax the constraints, which gives an upper bound on the best achievable performance. This relaxation often leads to primal-dual algorithms that enforce the constraints by using primal-dual approaches such a mirror descent [3, 5].

Let "REL" be the value of the upper bound given by relaxation, "OPT" the value of the optimal algorithms and "ALG" the value of our algorithm. One can often prove bounds (like competitive ratio or regret guarantees) between the value of the algorithm "ALG" and the value of the upper bound "REL", which automatically gives an upper bounds between OPT and ALG (since by construction, one has ALG $\leq$ OPT $\leq$ REL). Yet, such upper bounds are often loose because for many problems, OPT is much lower than REL. The objective of this projet is to use modern techniques developed in [2] to obtain better performing algorithms. A typical of use case of our method will be in the context of online auctions [1]. Other application are envisioned, more linked to restless bandits and stochastic optimization.

Contact For more information, please contact `kim-thang.nguyen@univ-grenoble-alpes.fr` and `nicolas.gast@inria.fr`.

Location The intern will be hosted in the POLARIS team. The POLARIS team is a joint team between Inria and LIG (Grenoble Computer Science Laboratory) and is located on Grenoble University main campus (`https://batiment.imag.fr/`).

References

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