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Online Unrelated-Machine Load Balancing and Generalized Flow with Recourse

I this talk, we discuss the online unrelated-machine load balancing problem with recourse, where the algorithm is allowed to re-assign prior jobs. We give a $(2+\epsilon)$-competitive algorithm for the problem with $O_\epsilon(\log n)$-amortized recourse per job. This is the first $O(1)$-competitive algorithm for the problem with reasonable recourse, and the competitive ratio nearly matches the long-standing best-known offline approximation guarantee.

We also present an $O(\log\log n/\log\log\log n)$-competitive algorithm for the problem with $O(1)$-amortized recourse, improving upon the previous best $O(\log\log n)$-competitive ratio of Gupta et al., which works only for the special case of the restricted assignment model. The algorithm is based on our recent $O(\log\log m/\log\log\log m)$-online rounding algorithm for the problem without recourse.

Both algorithms are based on producing a fractional solution online first. To do so, we introduce and study the online algorithm for the generalized network flow problem (also known as network flow problem with gains) with recourse. We give an online algorithm for the problem with amortized recourse of $O(1/\epsilon)$ and capacity-violation of 1+epsilon. The $(1+\epsilon)$-factor improves upon the corresponding $(2+\epsilon)$-factor of Gupta et al., which only works for the ordinary network flow problem.

The talk is based on two papers: [Krishnaswany-Li-Suriyanarayana,2022] and [Li-Xian,2021].