2024-Bernasconi-1

Beyond Primal-Dual Methods in Bandits with Stochastic and Adversarial Constraints

- **Date**: 2024-05-25
- Link
- **Authors:**
  - Bernasconi, Martino
  - Castiglioni, Matteo
  - Celli, Andrea
  - Fusco, Federico
- **Cites:**
- **Cited by:**
- **Keywords:** #bandits-with-knapsacks #bandits
- **Collections:**
- **Status:** #in-progress

0. Abstract

- Problem description:
  - Generalization of the bandits with knapsacks (BwK) problem where an arbitrary set of long-term constraints must be satisfied by the learner.
- **Goal** - design a best-of-both-worlds algorithm that performs optimally under stochastic and adversarial constraints.
- **Problem** - previous works use primal-dual methods.
  - Prior work assumptions:
    - Slater's condition.
    - Knowledge of a lower bound on Slater's parameter, in the adversarial case.
    - Requires weak adaptivity on the primal and dual regret minimizers.
- **Solution** - estimate the constraints with an UCB-like approach.
  - Two main components:
    1. Regret minimizer working on moving strategy sets.
    2. An estimate of the feasible set as an optimistic weighted empirical mean of previous samples.
- **Key challenge** - designing adaptive weights suitable for both stochastic and adversarial constraints.
- **Results**
  - First algorithm to yield logarithmic bounds in the number of constraints for stochastic and adversarial constraints, "best-of-both-worlds."
  - In stochastic settings, yields $\tilde{O}(\sqrt{T})$ regret without Slater's condition.