Continuous and/or Combinatorial Optimization

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Continuous Optimization

- Constraint set $\mathcal{Q} \subset \mathbb{R}^d$
- Query $x_1 \in \mathcal{Q}$, observe $f(x_1) + \xi_1$, with noise ξ_1
- No Hessian, no gradient, just noisy function evaluation
- Query $x_2 \in \mathcal{Q}$, observe $f(x_2) + \xi_2$

$$\text{Minimize } f(\bar{x}_K) - f(x^*)$$

- With adversarial noise... ξ_k not iid, depends on x...
  $f_k(x) = f(x) + \xi_k(x)$ convex.

$$\text{Minimize } \frac{1}{T}\sum_{k=1}^{T} f_k(x_k) - \min_{x^* \in \mathcal{Q}} \frac{1}{T}\sum_{k=1}^{T} f_k(x^\star)$$

Optimal rates is $\mathrm{poly}(d)\sqrt{T}$...

What is the polynome ?

Any (more or less efficient) algorithm ?

Combinatorial Optimization

- Constraint set $\mathcal{Q} \subset \{0, 1\}^d$
- Ex. subset of size m
- Query $x_1 \in \mathcal{Q}$, observe $f_1(x_1)$
- Query $x_2 \in \mathcal{Q}$, observe $f_2(x_2)$

Minimize $\frac{1}{T}\sum_{k=1}^{T} f_k(x_k) - \min_{x^* \in \mathcal{Q}} \frac{1}{T}\sum_{k=1}^{T} f_k(x^\star)$

Optimal rates is $\mathrm{poly}(m, d)\sqrt{T}$...

What is the polynome ?

Any (more or less efficient) algorithm ?