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Online Learning with Sublinear Best-Action Queries

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0. Abstract

- **Key Idea** - allow an online learning agent to perform *best-action queries* that reveal beforehand the best action at a given time step.
- Limit the agent to k many best-action queries over the time span T.
- Performance bounds:
  - Full feedback model - feedback is given at all timesteps:<
    - Optimal regret is bounded by $\Theta\Big(\min\{\sqrt{T},\, T/k\}\Big)$
  - Partial feedback model - feedback is only given at timesteps where the agent performs a best-action query:
    - Optimal regret is bounded by $\Theta\Big(\min\{T/\sqrt{T},\, T^2/k^2\}\Big)$
- **Result** - a significant multiplicative advantage in the regret rate can be achieved with a relatively modest number of best-action queries.