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Variance-reduced first-order methods for stochastic optimization with deterministic constraints

We consider stochastic optimization problems with deterministic constraints. Existing methods typically focus on finding an approximate stochastic solution that ensures the expected constraint violations and optimality conditions meet a prescribed accuracy. However, such an approximate solution can possibly lead to significant constraint violations in practice. To address this issue, we propose variance-reduced first-order methods that treat the objective and constraints differently. Under suitable assumptions, our proposed methods achieve stronger approximate stochastic solutions with complexity guarantees, offering more reliable constraint satisfaction than existing approaches.