On variance reduction for stochastic smooth convex optimization with multiplicative noise

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© 2018, Springer-Verlag GmbH Germany, part of Springer Nature and Mathematical Optimization Society. We propose dynamic sampled stochastic approximation (SA) methods for stochastic optimization with a heavy-tailed distribution (with finite 2nd moment). The objective is the sum of a smooth convex function with a convex regularizer. Typically, it is assumed an oracle with an upper bound ? 2 on its variance (OUBV). Differently, we assume an oracle with multiplicative noise. This rarely addressed setup is more aggressive but realistic, where the variance may not be uniformly bounded. Our methods achieve optimal iteration complexity and (near) optimal oracle complexity. For the smooth convex class, we use an accelerated SA method a la FISTA which achieves, given tolerance ?> 0 , the optimal iteration complexity of O(?-12) with a near-optimal oracle complexity of O(?-2)[ln(?-12)]2. This improves upon Ghadimi and Lan (Math Program 156:59?99, 2016) where it is assumed an OUBV. For the strongly