Forward-backward-forward algorithms for stochastic variational inequalities: Variance Reduction, Accelerated Rates and Applications

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Abstract

Variational inequalities provide a general mathematical framework for studying many important problems in sciences and engineering. They include complementarity systems, systems of equations, saddle-point problems and many equilibrium problems. The stochastic variational inequality problem has received a lot of attention recently in data science, in particular in generative models and supervised learning. The solution of stochastic variational inequalities relies on stochastic approximation algorithms whose convergence guarantees usually rely on uniform bounds on the noise and global monotonicity properties of the operator. Both assumptions are rather restrictive in applications. We develop a new stochastic algorithm for solving pseudo-monotone stochastic variational inequalities. Our method builds on Tseng's forward-backward-forward algorithm, which is known in the deterministic literature to be a valuable alternative to Korpelevich's extragradient method when solving variational inequalities over a convex and closed set governed by pseudo-monotone, Lipschitz continuous operators. The main computational advantage of Tseng's algorithm is that it relies only on a single projection step and two independent queries of a stochastic oracle. Our algorithm incorporates a mini-batch sampling mechanism and leads to almost sure (a.s.) convergence to an optimal solution. To the best of our knowledge, this is the first stochastic look-ahead algorithm achieving this by using only a single projection at each iteration.

This talk is based on the paper Bot, R. I., Mertikopoulos, P., Staudigl, M., & Vuong, P. T. (2019). Forward-backward-forward methods with variance reduction for stochastic variational inequalities. arXiv preprint arXiv:1902.03355.