DEPARTMENT OF APPLIED MATHEMATICS
應 用 數 學 系

# The Hong Kong Polytechnic University
# Department of Applied Mathematics

# Seminar

## SPIDER: Near-Optimal Non-Convex Optimization via Stochastic Path Integrated Differential Estimator


**by**

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## Abstract

In this paper, we propose a new technique named Stochastic Path-Integrated Differential EstimatoR (SPIDER), which can be used to track many deterministic quantities of interest with significantly reduced computational cost. We apply SPIDER to two tasks, namely the stochastic first-order and zeroth-order methods. For stochastic first-order method, combining SPIDER with normalized gradient descent, we propose two new algorithms, namely SPIDER-SFO and SPIDER-SFO+, that solve non-convex stochastic optimization problems using stochastic gradients only. We provide sharp error-bound results on their convergence rates. In special, we prove that the SPIDER-SFO and SPIDER-SFO+ algorithms achieve a gradient computation cost of $O(\min(n^{1/2} \epsilon^{-2}, \epsilon^{-3} )$ for finding an $\epsilon$-approximate first-order and $(\epsilon, O(\epsilon^{0.5}))$-approximate second-order stationary point, respectively. In addition, by modifying the recent lower result of Carmon, Duchi, Hinder and Sidford (2017+) we prove that SPIDER-SFO nearly matches the algorithmic lower bound for finding approximate first-order stationary points under the gradient Lipschitz assumption in the finite-sum setting. For stochastic zeroth-order method, our proposed SPIDER-SZO algorithm has a gradient cost of $O(d \epsilon^{-3})$ which outperforms all existing results. This is joint work with Cong Fang, Zhouchen Lin and Tong Zhang.


**Date : 5 September, 2018 (Wednesday)**
**Time : 11:00a.m. – 12:00noon**
**Venue : TU801, The Hong Kong Polytechnic University**

*** * * ALL ARE WELCOME * * ***