



## MATH-IMS Joint Applied Mathematics Colloquium Series The Chinese University of Hong Kong

*This MATH-IMS Joint Colloquium Series is organized by Center for Mathematical Artificial Intelligence (CMAI), under Department of Mathematics and Institute of Mathematical Sciences (IMS) at The Chinese University of Hong Kong. The colloquium series focuses on mathematics and applications of artificial intelligence, big data and related topics.*

**Date:** May 14, 2021 (Friday)

**Time:** 16:00-17:00 (Hong Kong Time)

**Zoom Link:** <https://cuhk.zoom.us/j/92775210812>

### On the Convergence of Stochastic Gradient Descent with Bandwidth-based Step Size

*Speaker: Professor Yuan Ya-xiang*

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**Abstract:** We investigate the stochastic gradient descent (SGD) method where the step size lies within a banded region instead of being given by a fixed formula. The optimal convergence rate under mild conditions and large initial step size is proved. Our analysis provides comparable theoretical error bounds for SGD associated with a variety of step sizes. In addition, the convergence rates for some existing step size strategies, e.g., triangular policy and cosine-wave, can be revealed by our analytical framework under the boundary constraints. The bandwidth-based step size provides efficient and flexible step size selection in optimization. We also propose a  $1/t$  up-down policy and give several non-monotonic step sizes. Numerical experiments demonstrate the efficiency and significant potential of the bandwidth-based step-size in many applications.

This is a joint work with Xiaoyu Wang.

**Bio:** Professor Ya-xiang Yuan is a professor at the Academy of Mathematics and Systems Science, Chinese Academy of Sciences. He graduated from Xiangtan University in 1982 and obtained his Ph.D. from University of Cambridge in 1986. Prof. Yuan mainly works on numerical methods for nonlinear optimization. He has made outstanding contributions to trust region algorithms, quasi-Newton methods, nonlinear conjugate gradient methods and subspace methods. He was the president of Chinese Mathematical Society (2016-2019), the president of the OR Society of China (2004-2012). Currently he is the president of International Council for Industrial and Applied Mathematics. He is an academician of CAS, Fellow of SIAM, Fellow of AMS, Corresponding Member of Brazilian Academy of Science and Fellow of TWAS.