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香港中文大學
The Chinese University of Hong Kong

Institute of Theoretical Computer Science and Communications

Joint CSE-ITCSC Seminar

Spectral analysis of matrix scaling and operator scaling

By

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2:30 pm – 3:30 pm

Room 804, 8/F*, William MW Mong Engineering Building, *CUHK

Abstract:
We present a spectral analysis of a continuous scaling algorithm for matrix scaling and operator scaling. The main result is that if the input matrix or input operator has a spectral gap, then a natural gradient flow has linear convergence. This implies that a simple gradient descent algorithm also has linear convergence under the same assumption. The spectral gap condition for operator scaling is closely related to the notion of quantum expander studied in quantum information theory.

The spectral analysis also provides bounds on some important quantities of the scaling problems, such as the condition number of the scaling solution and the capacity of the matrix and operator. These results can be used in various applications of the scaling problems, including matrix scaling on expander graphs, permanent lower bounds on random matrices, the Paulsen problem on random frames, and Brascamp-Lieb constants on random operators. In some applications, the inputs of interest satisfy the spectral condition and we prove significantly stronger bounds than the worst case bound.

Joint work with Tsz Chiu Kwok and Akshay Ramachandran.

Biography:

Lap Chi is currently an associate professor in the School of Computer Science at University of Waterloo. He was a visiting researcher in the Simons Institute at UC Berkeley from Aug 2014 to June 2015. Before joining University of Waterloo, he was a faculty member in CSE CUHK and the coach of the ACM-ICPC programming team from 2007 to 2014. He was a visiting researcher of Microsoft Research New England during Jan-Jun 2009.

Lap Chi grew up in Hong Kong and received his B.Sc. degree from CSE CUHK. He received his M.Sc. and Ph.D. degrees from the University of Toronto. During his graduate study, he worked in the Theory Group of Microsoft Research in Redmond for three summers, and in the Egrevary Research Group on Combinatorial Optimization (EGRES) in Budapest for two winters.

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