Department of Systems Engineering and Engineering Management

Seminar Series

Analysis of non-reversible Markov chains

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Date	28 December 2017 (Thursday)
Time	2:30pm - 3:30pm
Venue	P7303, 7/F, Yeung Kin Man Academic Building

Abstract

The analysis of non-reversible Markov chains is of great theoretical and applied interest. In this talk, we outline two original approaches to analyze such chains.

In the first approach, we develop an in-depth analysis of non-reversible Markov chains on denumerable state space from a similarity orbit perspective. In particular, we study the class of Markov chains whose transition kernel is in the similarity orbit of a normal transition kernel, such as the one of birth-death chains or reversible Markov chains. We start by identifying a set of sufficient conditions for a Markov chain to belong to the similarity orbit of a birth-death one. As by-products, we obtain a spectral representation in terms of non-self-adjoint resolutions of identity in the sense of Dunford '54 and offer a detailed analysis on the convergence rate, separation cutoff and L^2-cutoff of this class of non-reversible Markov chains. To illustrate the power of this framework, we investigate three particular similarity orbits of reversible Markov kernels, that we call the permutation, pure birth and random walk orbit, and analyze various possibly non-reversible variants of classical birth-death processes in these orbits. This approach is based on joint work with Pierre Patie.

In the second approach, we study two types of Metropolis-Hastings (MH) reversiblizations for non-reversible Markov chains with transition kernel P. While the first type is the classical Metropolised version of P, we introduce a new self-adjoint kernel which captures the opposite transition effect of the first type, that we call the

second MH kernel. Compared with reversiblizations proposed in Fill '91 and Paulin '15, this approach has four attractive features: a version of Weyl's inequality for bounding the spectral gap of P, a comparison theorem between P and two MH kernels, a new pseudo-spectral gap based on the two MH kernels for bounding the total variation distance to stationarity, and finally a possibly tighter variance bound.

About the Speaker

Michael Choi graduated with a Ph.D. in Operations Research from Cornell University in the summer of 2017, advised by Prof. Pierre Patie. He received his B.Sc. in Actuarial Science from The University of Hong Kong in 2013 and his M.Sc. in Operations Research from Cornell University in 2016. He is currently a Research Fellow in the Department of Mathematics and Statistics at Hang Seng Management College. His research lies in the area of stochastic modelling, applied probability and their applications to operations research, statistics, actuarial science and financial mathematics.

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All are Welcome!

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