AIFT Seminar

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Relative Optimization and Time-Nonhomogeneous Markov Chains

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Units 1101-1102 & 1121-1123,
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Join by SIP: 95203973648@zoomcrc.com

Abstract

Many real-world systems are time-dependent and can be modeled as time-nonhomogeneous Markov chains (TNHMCs), in which the state spaces, transition probabilities, and reward functions depend on time. Notions such as stationarity, ergodicity, periodicity, connectivity, recurrent and transient states, which are crucial to the analysis of time-homogeneous Markov chains (THMCs), no longer apply. In addition, the long-run average criterion suffers from the so-called under-selectivity, which roughly means that it does not depend on the rewards received in any finite period. Dynamic programming may not be very suitable to address such optimization problems, and new notions and a different optimization approach are needed.

In this talk, we show that "confluencity" captures the essentials of analysis of such systems. Confluencity refers to the property that two independent sample paths of a TNHMC starting from two different initial states will eventually meet together. With confluencity, the states in a TNHMC can be classified into different classes of confluent states and branching states, and the optimization conditions for the long-run average, bias, Nth-bias, and Blackwell optimality for single class and multi-class TNHMCs can be derived. In the analysis, the relative optimization approach is applied; the approach simply compares the performance measures of a system under any two policies. The under-selectivity is reflected in the conditions. The optimization of time-homogeneous systems becomes a special case.

Biography

Xiren Cao obtained a PhD degree from Harvard University in 1984. He is now a Professor Emeritus of the Hong Kong University of Science and Technology. He was a consulting engineer at Digital Equipment Corporation, U.S.A, a research fellow at Harvard University, and a reader, professor, and chair professor at the Hong Kong University of Science and Technology, and chair professor at Shanghai Jiaotong University. He owns three patents in data- and tele- communications and has published five books and numerous papers in the areas of performance optimization, discrete event dynamic systems, stochastic learning and stochastic control, and financial engineering. He is Fellow of IEEE and IFAC.

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