THE CHINESE UNIVERSITY OF HONG KONG
Institute of Network Coding
and
Department of Information Engineering
Seminar

Matroidal Entropy Functions: A Quartet of Theories of Information, Matroid, Design, and Coding
by
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Date : 20 April 2023 (Thursday)
Time : 11:00am to 12:00pm
Venue : Room 801, Ho Sin Hang Engineering Building, CUHK

Abstract

A matroidal entropy function is an entropy function in the form $\log v \cdot \mathbf{r}_M$, where v is an integer exceeding one and $\mathbf{r}_M$ is the rank function of a matroid M. For a matroid M, the characterization of matroidal entropy function induced by M is to determine its probabilistic-characteristic set χ_M, i.e., the set of integers v such that $\log v \cdot \mathbf{r}_M$ is entropic. To characterize matroidal entropy functions, we introduce variable strength orthogonal arrays(VOA), which can be considered as special cases of classic combinatorial structure orthogonal arrays(OA). We prove that whether $\log v \cdot \mathbf{r}_M$ is entropic depends on whether a VOA(M, v) is constructible. Leveraging the correspondences between matroidal entropy functions and VOAs, we characterize the matroidal entropy functions induced by matroids obtained from matroid operations such as deletion, contraction, minor, serize and parallel connection and 2-sum. Utilizing these results, we characterize two classes of matroidal entropy functions, i.e., those induced by regular matroids and matroids with the same p-characteristic set as uniform matroid $U_{2,4}$. As the support of characterizing random vector of a matroidal entropy function, i.e., the set of rows of the corresponding VOA is equivalent to the code book of an almost affine code, they can be applied to solve coding problems in secret sharing, network coding, index coding and locally repairable code.

Biography

Qi Chen received his PhD degree at Information Engineering Department, The Chinese University of Hong Kong in 2014. From 2014 to 2017, He was a post-doctoral fellow at Institute of Network Coding and Information Engineering Department, The Chinese University of Hong Kong . From Sept. 2015 to Jan. 2016, he was also a postdoc at ECE department, Drexel University. In 2018, he joined State Key Laboratory of Integrated Services Networks and School of Telecommunication Engineering, Xidian University, Xi'an, China, where he is now an associate professor. His research interests include information theory and related areas, in particular, the characterization of the entropy region.

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