NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

SEMINAR ANNOUNCEMENT

An Exact Spectrum Formula for the Maximum Size of Finite Length Block Codes

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Venue: MAS Executive Classroom 2 #03-07,
School of Physical and Mathematical Sciences

Abstract

An exact information spectrum-type formula for the maximum size of finite length block codes subject to a minimum pairwise distance constraint is presented. This formula can be applied to codes for a broad class of distance measures. As revealed by the formula, the largest code size is fully characterized by the information spectrum of the distance between two independent and identically distributed (i.i.d.) random codewords drawn from an optimal distribution. A new family of lower bounds to the maximal code size is thus established, and the well-known Gilbert-Varshamov (GV) lower bound is a special case of this family.

By duality, an explicit expression for the largest minimum distance of finite length block codes of a fixed code size is also obtained. Under an arbitrary uniformly bounded symmetric distance measure, the asymptotic largest code rate (in the block length n) attainable for a sequence of $(n,M,n\delta)$-codes is given exactly by the maximum large deviation rate function of the normalized distance between two i.i.d. random codewords. The exact information spectrum-type formula also yields bounds on the second-order terms in the asymptotic expansion of the optimum finite length rate for block codes with a fixed normalized minimum distance.

This is joint work with Ling-Hua Chang (National Chiao Tung University, Taiwan), Carol Wang (NUS), Po-Ning Chen (NCTU, Taiwan), and Yunghsiang S. Han (Dongguan University of Technology, China). It can be found on arXiv:1706.04709.

Speaker Biography

Vincent Tan is an Assistant Professor in the Department of Electrical and Computer Engineering (ECE) and the Department of Mathematics at the National University of Singapore (NUS). He received the B.A. and M.Eng. degrees in Electrical and Information Sciences from Cambridge University in 2005. He received the Ph.D. degree in Electrical Engineering and Computer Science (EECS) from the Massachusetts Institute of Technology in 2011. He was a postdoctoral researcher in the Department of ECE at the University of Wisconsin-Madison in 2011 and following that, a scientist at the Institute for Infocomm Research (I2R), A*STAR, Singapore from 2012 to 2013. His research interests include machine learning, statistical signal processing, and information theory.

Host: Dr Kiah Han Mao
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