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THE CHINESE UNIVERSITY OF HONG KONG
Department of Information Engineering

Seminar

Polar Codes for Multiple Access Channels

by
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Time : 2:00pm-3:00pm
Venue : Room 833, Ho Sin Hang Engineering Building
The Chinese University of Hong Kong

Abstract
Achieving the fundamental capacity limits of communication channels with low complexity coding schemes has been a major challenge for over 60 years. Recently, a revolutionary coding construction, called Polar coding, has been shown to provably achieve the ``symmetric capacity'' of binary-input, memoryless single-user channels. The underlying principle of the technique is to convert repeated uses of a given single-user channel to single uses of a set of extremal channels, whereby almost every channel in the set is either almost perfect, or almost useless. The latter phenomenon is referred to as polarization.

Whereas a number of practical coding constructions (e.g. Turbo codes and Low Density Parity Check codes) can empirically approach the capacity of single-user communication channels, there is still an absence of good practical coding schemes for multi-user communication channels. In this talk, we extend the polar coding method to two-user multiple-access communication channels. We have shown that if the two users use the channel combining and splitting construction, the resulting multiple-access channels will polarize to one of five possible extremals, on each of which uncoded transmission is optimal. Our coding technique can achieve some of the optimal transmission rate pairs obtained with uniformly distributed inputs. The encoding and decoding complexity of the code is O(n log n) with n being the block length, and the block error probability is roughly O(2^{-\sqrt{n}}). Our coding construction is the first low-complexity coding scheme which has been proved to achieve capacity in multi-user communication networks.

Joint work with Eren Sasoglu and Emre Telatar.

Biography
Edmund Yeh received his B.S. in Electrical Engineering with Distinction from Stanford University in 1994, his M.Phil in Engineering from the University of Cambridge in 1995, and his Ph.D. in Electrical Engineering and Computer Science from MIT in 2001. Since 2001, he has been on the faculty at Yale University, where he is currently an Associate Professor of Electrical Engineering, Computer Science, and Statistics.

Dr. Yeh is a recipient of the U.S. Army Research Office Young Investigator Program Award. He was invited to the National Science Foundation Future Internet Architecture Summit in 2009. He serves as the general co-chair for the Workshop on Spatial Stochastic Models for Wireless Networks (SpaSWiN) 2010, and the guest editor of the Special Issue on Wireless Networks for Internet Mathematics. He has served on the technical program committees for many conferences and workshops, including IEEE Infocom, IEEE Globecom, and WiOpt. Dr. Yeh was awarded one of ten Winston Churchill Scholarships for overseas study at Churchill College, University of Cambridge, in 1994. He received the U.S. National Science Foundation and Office of Naval Research Fellowships for graduate study. He received the Barry M. Goldwater Scholarship from the United States Congress, as well as the Frederick E. Terman Award and President's Award for Academic Excellence from Stanford University. He is a member of Phi Beta Kappa, Tau Beta Pi, and IEEE.

**** ALL ARE WELCOME ****

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