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THE CHINESE UNIVERSITY OF HONG KONG

Department of Information Engineering

Seminar

Inequalities Revisited

by

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Date : 25 July 2025 (Friday)
Time : 11:00am – 12:00pm
Venue : Rm 801, Ho Sin-hang Engineering Building, CUHK

Abstract

In the past over two decades, very fruitful results have been obtained in information theory in the study of the Shannon entropy. This study has led to the discovery of a new class of constraints on the Shannon entropy called non-Shannon-type inequalities. Intimate connections between the Shannon entropy and different branches of mathematics including group theory, combinatorics, Kolmogorov complexity, probability, matrix theory, etc, have been established. All these discoveries were based on a formality introduced for constraints on the Shannon entropy, which suggested the possible existence of constraints that were not previously known. We assert that the same formality can be applied to inequalities beyond information theory. To illustrate the ideas, we revisit through the lens of this formality three fundamental inequalities in mathematics: the AM-GM inequality in algebra, Markov's inequality in probability theory, and the Cauchy-Scharwz inequality for inner product spaces. Applications of this formality have the potential of leading to the discovery of new inequalities and constraints in different branches of mathematics.

Biography

Raymond W. Yeung is a Choh-Ming Li Professor of Information Engineering at The Chinese University of Hong Kong (CUHK). He received his B.S., M.Eng., and Ph.D. degrees from Cornell University in Electrical Engineering. Before joining CUHK in 1991, he was a Member of Technical Staff at AT&T Bell Laboratories. He has been serving as Co-Director of the Institute of Network Coding at CUHK since 2010. He is the author of the books A First Course in Information Theory (Kluwer Academic/Plenum Publishers, 2002) and Information Theory and Network Coding (Springer 2008), which have been adopted by over 100 institutions around the world. In spring 2014, he gave the first MOOC in the world on information theory that has reached over 60,000 students to date.

He is a recipient of the 2005 IEEE Information Theory Society Paper Award, the Friedrich Wilhelm Bessel Research Award from the Alexander von Humboldt Foundation in 2007, the 2016 IEEE Eric E. Sumner Award, the 2018 ACM SIGMOBILE Test-of-Time Paper Award, the 2021 IEEE Richard W. Hamming Medal, and the 2022 Claude E. Shannon Award. He is a Fellow of the IEEE, Hong Kong Academy of Engineering Sciences, Hong Kong Institution of Engineers, and the US National Academy of Inventors.

**** ALL ARE WELCOME ****

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