Distributed source coding: Theory, Algorithms and Applications

by

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Abstract
Distributed source coding (DSC) refers to separate encoding of correlated sources with joint decoding. Driven by a host of emerging applications (e.g., distributed sensor networks and Wyner-Ziv video coding), DSC has assumed renewed interest in recent years. Although the theoretical result given by the Slepian-Wolf theorem has been known for more than 30 years, practical approaches to DSC did not appear until 1999. Since then, DSC has become a very active area of research.

In this seminar, we focus in a fundamental component of DSC: Wyner-Ziv coding. After reviewing the theory behind DSC, we present the Slepian-Wolf coded quantization (SWCQ) paradigm combination of Slepian-Wolf coding and quantization or the practical implementation of Wyner-Ziv coding. The efficiency of SWCQ lies mainly in the actual design of Slepian-Wolf coding. While Wyner suggested that syndrome-based channel coding could be used to implement Slepian-Wolf coding, efficient code design method, such as density evolution, may not be used to design the capacity-achieving low-density parity-check (LDPC) code for this problem. We show that density evolution can be applied in this problem provided that a certain symmetry condition is satisfied by the hypothetical channel between the source and the side information. This symmetry condition can then guide us in the design of the quantizer. We conclude this seminar with a few potential applications relating to DSC including distributed sensor networks, digital watermarking, and telemedicine.

Biography
Samuel Cheng received the B.S. degree in Electrical and Electronic Engineering from the University of Hong Kong in 1995, and the M.Phil. degree in Physics and the M.S. degree in Electrical Engineering from Hong Kong University of Science and Technology and the University of Hawaii, Honolulu, in 1997 and 2000, respectively. He received the Ph.D. degree in Electrical Engineering from Texas A&M University in 2004. He worked in Microsoft Asia, China, and Panasonic Technologies Company, New Jersey, in the areas of texture compression and digital watermarking during the summers of 2000 and 2001. Currently, he is a Senior Research Engineer with Advanced Digital Imaging Research based near Houston, Texas. His research interests include distributed source coding, and biomedical image processing and transmission.

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