



香港中文大學
The Chinese University of Hong Kong

Institute of Theoretical Computer Science and Communications

ITCSC Seminar

Expected communication cost of distributed quantum tasks and quantum Huffman coding

By

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11:00 am – 12:00 nn

Room 121, 1/F, Ho Sin Hang Engineering Building, CUHK

Abstract:

A central question in classical information theory is that of source compression, which is the task where Alice receives a sample from a known probability distribution and needs to transmit it to the receiver Bob with small error. This problem has a one-shot solution due to Huffman, in which the messages are of variable length and the expected length of the messages matches the asymptotic and i.i.d. compression rate of the Shannon entropy of the source. In this work, we consider a quantum extension of above task, where Alice receives a sample from a known probability distribution and needs to transmit a part of a pure quantum state (that is associated to the sample) to Bob. We allow entanglement assistance in the protocol, so that the communication is possible through classical messages, for example using quantum teleportation. The classical messages can have a variable length and the goal is to minimize their expected length. We provide a characterization of the expected communication cost of this task, by giving a lower bound that is near optimal up to some additive factors.

A special case of above task, and the quantum analogue of the source compression problem, is when Alice needs to transmit the whole of her pure quantum state. Here we show that there is no one-shot interactive scheme which matches the asymptotic and i.i.d. compression rate of the von Neumann entropy of the average quantum state. This is a relatively rare case in quantum information theory where the cost of a quantum task is significantly different from its classical analogue. Further, we also exhibit similar results for the fully quantum task of quantum state redistribution, employing some different techniques. We show implications for the one-shot version of the problem of quantum channel simulation.

Joint work with Ankit Garg, Aram Harrow, Penghui Yao. arXiv:1605.04601

Biography:

Anurag Anshu is a final year PhD Student at the Centre for Quantum Technologies, National University of Singapore. His research interests include quantum communication complexity, quantum Shannon theory and hamiltonian complexity

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