Hamilton Institute

In Search of Optimality: Network Coding for Wireless Networks

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Abstract:
Network coding has gained significant interest from the research community since the first paper by Alshwede et al., in 2000. Network coding techniques can significantly increase the overall throughput of wireless networks by taking advantage of their broadcast nature. We focus on network coding for wireless networks; specifically we investigate the Index Coding problem.

In wireless networks, each transmitted packet is broadcasted within a certain region and can be overheard by the nearby users. When a user needs to transmit packets, it employs the Index Coding that uses the knowledge of what the user's neighbors have heard previously (side information) in order to reduce the number of transmissions. The objective is to satisfy the demands of all the users with the minimum number of transmissions. With the Index Coding, each transmitted packet can be a combination of the original packets. The Index Coding problem has been proven to be NP-hard, and NP-hard to approximate.

Noting that the Index Coding problem is not only NP-hard but NP-hard to approximate, we look at it from a novel perspective and define the Complementary Index Coding problem; where the objective is to maximize the number of transmissions that are saved by employing the Index Coding compared to the solution that does not involve coding. We prove that the Complementary Index Coding problem can be approximated in several cases of practical importance. We investigate both the multiple unicast and multiple multicast scenarios for the Complementary Index Coding problem for computational complexity, and provide polynomial time approximation algorithms.

Biography:
Mohammad Asad Rehman Chaudhry received his Ph.D. in Electrical and Computer Engineering from Texas A&M University in December 2011. His research interests include algorithmic and information-theoretic aspects of networking, network coding and its applications, design of fault tolerant and reliable systems, algorithm design, and combinatorial optimization. Some of his honors include receiving a Presidential Talent Scholarship, a Fulbright Fellowship, Texas A&M University's Class Start Award in Academics, Texas A&M University ECE Merit Fellowship, Fellowship for M.Sc. in Engineering. Chaudhry was also on the State University of New York's Dean's Honor List.

Venue: Seminar Room, Hamilton Institute, Rye Hall, NUI Maynooth

Time: 2.00pm - 3.00pm

Travel directions are available at www.hamilton.ie

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