The University of New South Wales

Faculty of Engineering

School of Electrical Engineering & Telecom

Invited Talk

Coalition and Correlated Game Theoretical Approaches for Cognitive Radio Networks

Zhu Han

Assistant Professor

University of Houston, USA

Date: 20 April 2010, Tuesday
Time: 3:00 p.m. – 4:00 p.m.
Venue: G3, Electrical Engineering Building

Abstract

Game theoretical techniques have recently become prevalent in many wireless communication and networking researches. With the emergence of cooperation as a new communication paradigm, and the need for self-organizing, decentralized, and autonomic networks, it has become imperative to seek suitable game theoretical tools that allow analyzing and studying the behavior and interactions of the nodes in future communication networks. In this context, this talk introduces the concepts of coalition game theory and correlated equilibrium, and their potential applications in communication and wireless networks. Specifically, we study the following two examples. First, collaborative spectrum sensing among secondary users (SUs) in cognitive networks is shown to yield a significant performance improvement. We model distributed collaboration strategies as a non-transferable coalitional game, and propose a distributed algorithm for coalition formation through simple merge and split rules. Through the proposed algorithm, SUs can autonomously collaborate and self-organize into disjoint independent coalitions, while maximizing their detection probability taking into account the cooperation costs (in terms of false alarm). Second, one of the major design challenges for cognitive radios is to coordinate and cooperate in accessing the spectrum opportunistically among multiple distributive users with only local information. We propose a game theoretical approach with a new solution concept, the correlated equilibrium, which is better compared to the noncooperative Nash equilibrium in terms of spectrum utilization efficiency and fairness among the distributive users. To achieve this correlated equilibrium, we construct an adaptive algorithm based on no-regret learning that guarantees convergence. From the simulation results, the optimal correlated equilibria achieve better fairness and performance gain, compared to the Nash equilibria. Finally, some other approaches, such as mechanism design for relay section, physical layer security, etc., are briefly discussed.

Biography

Zhu Han received the B.S. degree in electronic engineering from Tsinghua University, in 1997, and the M.S. and Ph.D. degrees in electrical engineering from the University of Maryland, College Park, in 1999 and 2003, respectively. From 2000 to 2002, he was a R&D Engineer of JDSU, Germantown, Maryland. From 2006 to 2008, he was an Assistant Professor in Electrical and Computer Engineering Department at Boise State University, Idaho. Since fall semester 2008, he has been with Electrical and Computer Engineering Department at the University of Houston, where he is now an Assistant Professor. In June-August 2006, he was a visiting scholar in Princeton University. In May-August 2007, he was a visiting professor in Stanford University. In summer 2008, he was a visiting professor in UNIK of University of Oslo, Norway and Supelec, Paris, France. In summer 2009, he was a visiting professor in University of Illinois at Urbana-Champaign. His research interests include wireless networking, signal processing, and security. He received NSF Career Award 2010.

*** * * * *** **ALL ARE WELCOME** *** * * * *** **For ENQUIRIES: Dr. Wei Zhang (Ph: 9385 4033)**