Hamilton Institute

Game Theory and Cognitive Networks:
Application to Distributed Spectrum Sharing

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Abstract:
In a cognitive network, radios adapt their parameters of operation to achieve end-to-end or network objectives such as spectral or energy efficiency, reliability, or throughput maximization. Opportunistic use of licensed spectrum and dynamic spectrum sharing are some of the important applications of cognitive networks. Game theory has been employed to analyze cooperation and coexistence in cognitive networks. In this presentation, we will discuss concepts in cognitive networking and the role of cooperative and non-cooperative game theory.

We will then introduce a game-theoretic model to analyze a wireless network in which nodes seek to agree on a fair and efficient allocation of spectrum. In high interference environments, the utility space of this game is non-convex, making certain optimal frequency channel allocations unachievable with pure strategies. As the number of available channels increases, the utility space approaches convexity, thereby making optimal allocations achievable with pure strategies. By comparing and analyzing three bargaining solutions, we determine that the Nash Bargaining Solution achieves the best tradeoff between fairness and efficiency. Finally, we discuss a distributed algorithm for spectrum sharing that achieves allocations reasonably close to the Nash Bargaining Solution.

Bio: Luiz A. DaSilva joined Trinity College Dublin in May 2009, where he holds the Stokes Professorship in Telecommunications. At CTVR, he is continuing his work on cognitive networks and resource management in wireless networks. Prof DaSilva has also been a faculty member at Virginia Tech's Bradley Department of Electrical and Computer Engineering since 1998. He received his Ph.D. in Electrical Engineering from the University of Kansas and previously worked for IBM for six years. He has published over seventy refereed papers in journals and major conferences in the communications and computer areas. He co-authored two books on wireless networks and is an associate editor of IEEE Communications Letters and of Computer Networks. Prof DaSilva is a Senior Member of IEEE and a member of the ASEE and of ACM. In 2006, he was named a College of Engineering Faculty Fellow at Virginia Tech.

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

Time: 2.00pm - 3.00pm (followed by tea/coffee)

Travel directions are available at www.hamilton.ie

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