Beibei Wang

Contact

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Summary of Qualifications

- Authored 30+ technical papers in top IEEE transactions/conferences on wireless communications.
- Familiar with game theoretical optimization in wireless networking and resource allocation, and co-authored one book on cognitive radio networking and security (published in 2010 by Cambridge University Press).
- 5+ years of R&D experience in cognitive and cooperative communications and networking.

Education

- **Ph.D., Electrical Engineering**, Aug. 2009
  University of Maryland, College Park, Maryland, USA. GPA: 3.9/4.0.
  - Major: Communications and Signal Processing
  - Advisor: Prof. K. J. Ray Liu
  - Thesis: Dynamic Spectrum Allocation and Sharing in Cognitive Cooperative Networks
  - **Winner of the Dean's Doctoral Research Award**

- **M.S., Electrical Engineering**, May 2008
  University of Maryland, College Park, Maryland, USA. GPA: 3.9/4.0.

- **B.S., Electrical Engineering**, Jul. 2004
  University of Science and Technology of China (USTC), Hefei, China
  GPA: 3.96/4.0 (ranked 1st among 165 students in the EE Dept.)

Honors and Awards

- **Dean's Doctoral Research Award**, 2009
  (2nd place among all Ph.D. candidates in the A. James Clark School of Engineering)
- NSF Student Travel Grant for attending IEEE DySPAN'07, Apr. 2007
- **University of Maryland Future Faculty Fellowship**, Jan. 2007 - May 2009
  (20 selected among graduate students in the A. James Clark School of Engineering)
- University of Maryland Jacob K. Goldhaber Award, Nov. 2006
- University of Maryland Graduate School Fellowship, Aug. 2004 – May 2006
- **Guo Moruo Scholarship**, 2003
  (**Highest honor at USTC, awarded to the top 1 student among all graduates**)
- **Microsoft Scholarship**, 2001 (award to the **top 1** student in the EE Dept. at USTC)
- First-Class Excellent Student Scholarship, USTC, 2000 and 2003
- Guanghua Education Scholarship, USTC, 2002

Research Grants and Proposals

- Played a major leading role in writing proposals (with PI K. J. Ray Liu) of the following funded projects
  - Optimal Distributed Dynamic Spectrum Access: A Game Theoretical Framework , Laboratory for Telecommunications Sciences, US Department of Defense, $378,000, 2007 - 2010.
  - Secure Dynamic Spectrum Access and Robust Spectrum Sensing for Cognitive Radio Networks, Laboratory for Telecommunications Sciences, US Department of Defense, funded, 2010-2013.
- Participated in writing grant proposals and technical reports for federal agencies and industrial companies.

Research Experience

- **Corporate Research and Development, Qualcomm Inc**, San Diego, California, USA
  Senior Systems Engineer, Oct. 2010 – present
  Investigated imbalance over heterogeneous network deployment in HSPA.

- **University of Maryland**, College Park, Maryland, USA
  Postdoctoral Research Associate, Sep. 2009 – Sep. 2010
  Investigated various security issues in cognitive radio networks and designed effective defense mechanisms against malicious attacks on dynamic spectrum access.

  Project Leader, Aug. 2006 - present
  Lead several projects, including "Optimal Distributed Dynamic Spectrum Access: A Game Theoretical Framework" and "Secure Dynamic Spectrum Access and Robust Spectrum Sensing for Cognitive Radio Networks" funded by DoD, and "RF-Time Reversal Architecture" funded by DARPA.

  Research Assistant, Aug. 2004 - Aug. 2009
  Designed efficient spectrum allocation and sharing schemes for cognitive radio networks, cooperative networks, and multimedia communications.

- **NTT DoCoMo Communications Laboratories USA**, Palo Alto, California USA
  Research Intern, Jun. 2007 - Aug. 2007
  Designed dynamic frequency planning schemes to combat inter-operator interference and improve spectral efficiency in 3G cellular systems.

- **Applied Electromagnetics Lab**, University of Science and Technology of China, Hefei China
  Undergraduate Research Assistant, Feb. 2002 - Aug. 2004
  Actively participated in designing numerical algorithms to analyze waveguide characteristics.

Teaching and Mentoring Experience

- University of Maryland, College Park, Maryland, USA
  Mentor, Feb. 2007 – Sep. 2010
  Co-supervise Ph.D. students working on the following projects:
  - Robust spectrum allocation for cognitive radio networks (Yongle Wu)
  - Optimal resource allocation for multimedia communications (Yan Chen)
  - Time-reversal based wireless communication (Feng Han and Yu-Han Yang)
- University of Maryland, College Park, Maryland, USA
  Instructor, Feb. 2008 – May 2008
  Co-taught (one-third workload) and undergraduate engineering probability course (ENEE 324). Shared responsibility for lectures, office hours, exams, homework assignments, and grades.

Publications

Book

B1. K. J. Ray Liu and Beibei Wang, "Cognitive Radio Networking and Security: A Game Theoretical View," Cambridge University Press, 2010.

Journal Articles

J1. Beibei Wang, Z. Han, and K. J. Ray Liu, "Distributed Relay Selection and Power Control for Multiuser Cooperative Communication Networks Using Stackelberg Game," *IEEE Trans. Mob. Comput.*, vol. 8, no. 7, pp. 975-990, Jul. 2009.

J2. Beibei Wang, Zhu Ji, K. J. Ray Liu, and T. Charles Clancy, "Primary-Prioritized Markov Approach for Dynamic Spectrum Allocation," *IEEE Trans. Wireless Commun.*, vol. 8, no. 4, pp. 1854-1865, Apr. 2009.

J3. Beibei Wang, Yongle Wu, Zhu Ji, K. J. Ray Liu, and T. Charles Clancy, "Game Theoretical Mechanism Design Methods: Suppressing Cheating in Cognitive Radio Networks," *IEEE Signal Process Mag.*, vol. 25, no. 6, pp. 74-84, Nov. 2008.

J4. Yongle Wu, Beibei Wang, K. J. Ray Liu, and T. Charles Clancy, "Repeated Open Spectrum Sharing Game with Cheat-Proof Strategies," *IEEE Trans. Wireless Commun.*, vol. 8, no. 4, pp. 1922-1933, Apr. 2009.

J5. Yan Chen, Beibei Wang, and K. J. Ray Liu, "Multi-User Rate Allocation Games for Multimedia Communications," *IEEE Trans. Multimedia*, vol. 11, no. 6, pp. 1170-1181, Oct. 2009.

J6. Yongle Wu, Beibei Wang, K. J. Ray Liu, and T. Charles Clancy, "A Scalable Collusion-Resistant Multi-Winner Cognitive Spectrum Auction Game," *IEEE Trans. Commun.*, vol. 57, no. 12, pp. 3805-3816, Dec. 2009.

J7. Beibei Wang, K. J. Ray Liu, and T. Charles Clancy, "Evolutionary Cooperative Spectrum Sensing Game: How to Collaborate?" *IEEE Trans. Commun.*, vol. 58, no. 3, pp. 890-900, Mar. 2010.

J8. Yan Chen, Yongle Wu, Beibei Wang, and K. J. Ray Liu, "Spectrum Auction Games For Multimedia Streaming Over Cognitive Radio Networks," to appear, *IEEE Trans. Commun.*.

J9. Beibei Wang and K. J. Ray Liu, "Advances in Cognitive Radio Networks: A Survey," to appear, *IEEE J. Sel. Top. Sign. Proces.*.

J10. Beibei Wang, Yongle Wu, and K. J. Ray Liu, "Game Theory for Cognitive Radio Networks: An Overview," to appear, *Computer Networks (Elsevier) Journal*.

J11. Yan Chen, Beibei Wang, W. Sabrina Lin, Yongle Wu, and K. J. Ray Liu, "Cooperative Peer-to-Peer Streaming: An Evolutionary Game-Theoretic Approach," to appear, *IEEE Trans. Circuits Syst. Video Technol.*.

J12. Beibei Wang, Yongle Wu, and K. J. Ray Liu, "An Anti-Jamming Stochastic Game for Cognitive Radio Networks," to appear, *IEEE J. Sel. Areas Commun.*.

J13. Yongle Wu, Beibei Wang, K. J. Ray Liu, and T. Charles Clancy, "Anti-Jamming Games in Multi-Channel Cognitive Radio Networks," submitted to *IEEE Trans. Commun.*.

J14. Beibei Wang, Yongle Wu, Feng Han, Yu-Han Yang, and K. J. Ray Liu, "Green Wireless Communications: A Time-Reversal Paradigm," submitted to *IEEE J. Sel. Areas Commun.*.

Conference Papers

C1. Beibei Wang, Zhu Han, and K. J. Ray Liu, "Stackelberg Game for Distributed Resource Allocation over Multiuser Cooperative Communication Networks," in *Proc. IEEE Globecom*, San Francisco, Nov. 2006.

C2. Beibei Wang, Zhu Han, and K. J. Ray Liu, "Distributed Relay Selection and Power Control for Multiuser Cooperative Communication Networks Using Buyer/Seller Game," in *Proc. IEEE INFOCOM*, pp. 544-552, Anchorage, May 2007.

C3. Beibei Wang, Zhu Ji, and K. J. Ray Liu, "Primary-Prioritized Markov Approach for Dynamic Spectrum Access," in *Proc. IEEE DySPAN*, pp. 507-515, Dublin, Ireland, Apr. 2007.

C4. T. Charles Clancy, Zhu Ji, Beibei Wang, and K. J. Ray Liu, "Planning Approach to Dynamic Spectrum Access in Cognitive Radio Networks," in *IEEE Globecom*, Washington DC, Nov. 2007 (invited paper).

C5. Beibei Wang, Zhu Ji, and K. J. Ray Liu, "Self-Learning Repeated Game Framework for Distributed

Primary-Prioritized Dynamic Spectrum Access," in *Proc. IEEE SECON*, pp. 631-638, San Diego, Jun. 2007.

C6. Beibei Wang, Chia-Chin Chong, Fujio Watanabe, and K. J. Ray Liu, "Dynamic Frequency-Intelligent Reserve-and-Switch Technique (D-FIRST) to Combat Inter-Operator Interference," in *Proc. IEEE ICC*, pp. 4003-4008, Beijing, May 2008.

C7. Yongle Wu, Beibei Wang, and K. J. Ray Liu, "Repeated Spectrum Sharing Game with Self-Enforcing Truth-Telling Mechanism," in *Proc. IEEE ICC*, pp. 3583-3587, Beijing, May 2008.

C8. Yongle Wu, Beibei Wang, K. J. Ray Liu, and T. Charles Clancy, "A Multi-Winner Cognitive Spectrum Auction Framework with Collusion-Resistant Mechanisms," in *Proc. IEEE DySPAN*, Chicago, Oct. 2008.

C9. Beibei Wang, K. J. Ray Liu, and T. Charles Clancy, "Evolutionary Game Framework for Behavior Dynamics in Cooperative Spectrum Sensing," in *Proc. IEEE Globecom*, New Orleans, Nov. 2008.

C10. Yongle Wu, Beibei Wang, K. J. Ray Liu, and T. Charles Clancy, "Collusion-Resistant Multi-Winner Spectrum Auction for Cognitive Radio Networks," in *Proc. IEEE Globecom*, New Orleans, Nov. 2008.

C11. Beibei Wang, Zhu Han, and K. J. Ray Liu, "Peer-to-Peer File Sharing Game Using Correlated Equilibrium," in *CISS*, Baltimore, MD, Mar. 2009.

C12. Yan Chen, Beibei Wang, and K. J. Ray Liu, "A Game-Theoretic Framework for Multi-User Multimedia Rate Allocation," in *Proc. IEEE ICASSP*, Taipei, Taiwan, Apr. 2009.

C13. Yongle Wu, Beibei Wang, and K. J. Ray Liu, "Optimal Power Allocation Strategy Against Jamming Attacks Using the Colonel Blotto Game," in *Proc. IEEE Globecom*, Honolulu, Hawaii, Nov. 2009.

C14. Yan Chen, Yongle Wu, Beibei Wang, and K. J. Ray Liu, "An Auction-Based Framework for Multimedia Streaming Over Cognitive Radio Networks," in *Proc. IEEE ICASSP*, Dallas, Mar. 2010.

C15. Yan Chen, Beibei Wang, Wan-Yi Lin, Yongle Wu, and K. J. Ray Liu, "Evolutionary Games for Cooperative P2P Video Streaming," in *Proc. IEEE ICIP*, Hong Kong, Sep. 2010.

C16. Yongle Wu, Beibei Wang, and K. J. Ray Liu, "Optimal Defense Against Jamming Attacks in Cognitive Radio Networks using the Markov Decision Process Approach," in *IEEE Globecom*, Miami, FL, Dec. 2010.

Patent Application

Beibei Wang, Chia-Chin Chong, and Fujio Watanabe, "A Dynamic On-Off Spectrum Access Scheme to Enhance Spectrum Efficiency," filed Aug. 2007.

Invited Talks

- "Dynamic spectrum allocation over cognitive radio networks," Dept. of Electrical and Computer Engineering, University of Utah, Apr. 2009.
- "Dynamic spectrum allocation and sharing over cognitive radio networks," Electrical and Computer Engineering Graduate Student Association seminar series, University of Maryland, May 2009.

Research Projects

- **Efficient Spectrum Allocation and Sharing** – developed game theoretic and stochastic modeling based spectrum sharing schemes to enhance spectrum efficiency when users strategically compete for spectrum resources in a dynamic environment, including
  - introducing evolutionary game modeling to study cooperation evolution in spectrum sensing and developing a learning algorithm based on replicator dynamics to approach the optimal collaboration with local throughput observation.
  - designing spectrum access coordination for interference management using Markov chain modeling and developing a self-learning algorithm to obtain the optimal access probability.
  - introducing a punishment-based repeated spectrum sharing game to enhance user cooperation with truth-telling mechanisms to motivate users to reveal true private information.

- designing a multi-winner cognitive spectrum auction scheme with collusion-resistant mechanisms and low-complexity implementations.
- **Secure Dynamic Spectrum** – investigated various malicious attacks, quantified their damage, and designed effective defense strategies, including
  - developing effective channel hopping scheme based on stochastic game modeling for anti-jamming defense with a minimax-Q learning algorithm to maximize the long-term throughput.
  - deriving optimal power allocation strategies against jamming attacks using Colonel Blotto game modeling.
- **Relay Selection and Power Allocation for Cooperative Communications** – introduced a Stackelberg (buyer/seller) game over cooperative networks to jointly optimize source and relay ndoes' utilities and developed a distributed implementation based on standard function.
- **Resource Allocation for Multimedia Communications** – proposed game theoretic approaches to efficiently allocate rate/spectrum resources for multimedia communications, including
  - introducing a noncooperative game for efficient and fair rate allocation and developing a distributed cheat-proof implementation using alternative ascending clock auction.
  - designing a cheat-proof spectrum auction scheme to maximize social welfare for multimedia streaming over cognitive radio networks.
  - designing a cooperative peer-to-peer video streaming system based on evolutionary game theory with a distributed implementation using replicator dynamics.
  - introducing a peer-to-peer file sharing game based on correlated equilibrium and no-regret learning to jointly optimize users' strategies and achieve high bandwidth efficiency.

Professional Activity

- Student Member, Institute of Electrical and Electronics Engineers (IEEE)
- Reviewer for:
  - Journals: *IEEE J. Sel. Areas Commun., IEEE Trans. Mob. Comput., IEEE Trans. Wireless Commun., IEEE Signal Process Mag., IEEE J. Sel. Top. Sign. Proces., IEEE Commun. Lett., IEEE Signal Process Lett., EURASIP Journal on Wireless Communications and Networking, EURASIP Journal on Advances in Signal Processing.*
  - IEEE Conferences: ICC, WCNC, PIMRC, VTC, ICASSP, DySPAN, CCNC.
- Technical Committee Member for:
  - IEEE Wireless Communications and Networking Conference, 2011
  - IEEE Wireless and Optical Communications Conference, 2011

Skills and Background

- Computer Skills: Matlab, C, C++, Mathematica
- Network protocols: IEEE 802.11, IEEE 802.22, IEEE 802.15

Personal

Female, Citizen of China, DOB: March 14, 1983

References

Available upon request