

KYOMIN JUNG

Division of Computer Science
Department of Electrical Engineering & Computer Science
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Education

Doctor of Philosophy
Department of Mathematics
Massachusetts Institute of Technology
Thesis : *Approximate Inference: Decomposition Methods with Applications to Networks*
Cambridge, MA, USA
Sep 2004 - June 2009

Bachelor of Science
Department of Mathematics
Seoul National University
Seoul, Korea
Mar 1996 - Aug 2003

Seoul Science High School for gifted students
Seoul, Korea
Mar 1993 - Feb 1996

Honors and Awards

- **2nd prize** in the 18th Korean College Mathematics Competition awarded by Korean Mathematical Society, 1999.
- **Gold medal** in the 36th **IMO**(International Mathematical Olympiad) in Toronto, Canada, 1995.
- **Gold prize** in the 7th **APMO**(Asian Pacific Mathematical Olympiad), 1995.
- **Gold prizes** in the 7th & 8th **KMO**(Korea Mathematical Olympiad) awarded by Korean Mathematical Society, 1994, 1995.
- Samsung Lee Kun Hee foundation scholarship for graduate study, Fall 2004 - Spring 2008.
- Korea Science and Engineering Foundation scholarship for undergraduate study, 1996 - 1999.

Research Experiences

- **Microsoft Research**, Cambridge, UK, *Research intern in the Machine Learning and Perception Group*, Jun-Aug 2008.
- Designed approximate inference algorithms for Markov Random Fields in application to image segmentation problems in computer vision. Submitted.
- **IBM T.J. Watson Research**, Yorktown, NY, USA, *Research intern in the System Analysis and Optimization Group*, Jun-Sep 2007.
- Designed a novel algorithm for estimating the stationary loss probabilities in stochastic loss networks with application to resource management, based on the structural property of the stationary distribution. Appeared in SIGMETRICS 2008.
- **Bell Laboratories**, Murray Hill, NJ, USA, *Research intern in the department of Mathematics of Networks and Systems*, Jul-Aug 2006.
- Proved stability of the max-weight routing and scheduling protocol for adversarial multicommodity dynamic queuing networks. Appeared in STOC 2007.

- **Samsung Advanced Institute of Technology**, Giheung, Korea, *Internship in the Communication and Network Lab*, Aug 2005.
 - Worked on privacy protection protocols in communication networks.
- **Microsoft Research**, Redmond, WA, USA, *Visiting scholar in the Theory Group*, Dec 2003 - Feb 2004.
 - Proved the phase transition of a random fitness function model of genetic compositions. Appeared in GECCO 2005, and Artificial Intelligence 172(2-3): 179-203, 2008.

Teaching Experiences

- Fall 2008, *Teaching Assistant for Linear Algebra*, MIT.
 - I prepared and taught weekly recitation sessions.
- Jan 2000, *Teaching Assistant for the Mathematical Winter School for Korean IMO team*, Jeonbuk Univ., Korea.
 - I prepared and taught daily problem solving sessions for two weeks.
- Aug 1999, *Teaching Assistant for the Mathematical Summer School for Korean IMO team*, Hanrim Univ., Korea.
- Jan 1997, *Teaching Assistant for the Mathematical Winter School for Korean IMO team*, KAIST, Korea.

Research Interests and Selected Projects

- **Algorithms for wireless network.**
 - We prove stability of the max-weight routing and scheduling algorithm for adversarial multicommodity dynamic queuing networks. Appeared in STOC 2007.
 - We propose algorithms for checking feasibility of arrival rate vectors for wireless networks. Appeared in INFOCOM 2008, INFOCOM 2009.
 - We design a linear iterative algorithm for computing average of numbers in a network, which achieves the fastest possible rate of convergence. To appear in IEEE Transactions on Information Theory.
 - We propose approximate max-weight routing and scheduling algorithms in a distributed manner for practical networks. Preliminary versions in ISIT 2007, ALLERTON 2007. Journal version submitted.
- **Statistical inference and learning algorithms.**
 - We present approximate inference algorithms for computing MAP and log-partition function for polynomially growing graphs, and planar graphs with bounded degree. Preliminary version in NIPS 2007. Journal version submitted.
 - We obtain an adaptive randomized algorithm for learning a fitness function of genetic compositions with almost optimal number of function evaluations. Preliminary version in COLT 2008. To appear in IEEE Transactions on Evolutionary Computation. We also establish the phase transition of a random fitness function model. Appeared in GECCO 2005, Artificial Intelligence 2008.
- **Algorithm for resource allocation.**
 - We design a novel algorithm for estimating the stationary loss probabilities in stochastic loss networks with application to resource allocation, based on the structural property of the stationary distribution. Preliminary version in SIGMETRICS 2008. Journal version submitted.

Publications

◦ Journal Publications

- Sung-Soon Choi, Kyomin Jung and Jeong Han Kim, *Phase Transition in a Random NK Landscape Model*, *Artificial Intelligence* 172(2-3): 179-203, 2008. - Preliminary version in ACM Genetic and Evolutionary Computation Conference (GECCO), Jun 2005, Washington DC, USA.
- Kyomin Jung, Devavrat Shah and Jinwoo Shin, *Minimizing the Rate of Convergence for Iterative Algorithms*, To appear in IEEE Transactions on Information Theory.
- Sung-Soon Choi, Kyomin Jung and Byung-Ro Moon, *Lower and Upper Bounds for Linkage Discovery*, To appear in IEEE Transactions on Evolutionary Computation.
- Kyomin Jung and Devavrat Shah, *Local Approximate Inference Algorithms*, Submitted.
- Kyomin Jung and Devavrat Shah, *Algorithmically Efficient Networks*, Submitted.
- Kyomin Jung, Yingdong Lu, Devavrat Shah, Mayank Sharma and Mark S. Squillante, *Revisiting Stochastic Loss Networks: Structures and Algorithms*, Submitted.
- Sung-Soon Choi, Kyomin Jung and Jeong Han Kim, *Almost Tight Upper Bound for Finding Fourier Coefficients of Bounded Pseudo-Boolean Functions*, Submitted.

◦ Refereed Conference Publications

- Ramakrishna Gummadi, Kyomin Jung, Devavrat Shah and Ramavarapu Sreenivas, *Computing Capacity Region of a Wireless Network*, IEEE International Conference on Computer Communications (INFOCOM), Apr 2009, Rio De Janeiro, Brazil.
- Arnab Bhattacharyya, Elena Grigorescu, Kyomin Jung, Sofya Raskhodnikova and David Woodruff, *Transitive-Closure Spanners*, ACM-SIAM Symposium on Discrete Algorithms (SODA), Jan 2009, New York, NY, USA.
- Sung-Soon Choi, Kyomin Jung and Jeong Han Kim, *Almost Tight Upper Bound for Finding Fourier Coefficients of Bounded Pseudo-Boolean Functions*, The Annual Conference on Learning Theory (COLT), Jul 2008, Helsinki, Finland.
- Kyomin Jung, Yingdong Lu, Devavrat Shah, Mayank Sharma and Mark S. Squillante, *Revisiting Stochastic Loss Networks: Structures and Algorithms*, ACM International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS), Jun 2008, Annapolis, MD, USA.
- Ramakrishna Gummadi, Kyomin Jung, Devavrat Shah and Ramavarapu Sreenivas, *Feasible Rate Allocation in Wireless Networks*, IEEE International Conference on Computer Communications (INFOCOM), Apr 2008, Phoenix, AZ, USA.
- Kyomin Jung and Devavrat Shah, *Local Algorithms for Approximate Inference in Minor-Excluded Graphs*, Annual Conference on Neural Information Processing Systems (NIPS), Dec 2007, Vancouver, Canada.
- Kyomin Jung and Devavrat Shah, *Low Delay Scheduling in Wireless Network*, IEEE International Symposium on Information Theory (ISIT), Jun 2007, Nice, France.
- Matthew Andrews, Kyomin Jung and Alexander Stolyar *Stability of the Max-Weight Routing and Scheduling Protocol in Dynamic Networks and at Critical Loads*, ACM Symposium on Theory of Computing (STOC), Jun 2007, San Diego, CA, USA.

◦ Invited Papers

- Kyomin Jung, Devavrat Shah and Jinwoo Shin, *Fast and Slim Lifted Markov Chains*, Invited paper to the ALLERTON Conference on Communication, Control and Computing, Sep 2007, Monticello IL, USA.
- Kyomin Jung and Devavrat Shah, *Local Approximate Inference Algorithms*, Invited paper to the ALLERTON Conference on Communication, Control and Computing, Sep 2007, Monticello IL, USA.
- Kyomin Jung and Devavrat Shah, *Fast Gossip via Non-reversible Random walk*, Invited paper to the IEEE Information Theory Workshop (ITW), Mar 2006, Punta del Este, Uruguay.
- Kyomin Jung and Devavrat Shah, *On Computationally Bounded Adversarial Capacity*, Invited paper to the Information Theory and Application Workshop (ITA), Feb 2006, San Diego, CA, USA.

Talks

◦ Invited Talks

- Jul 2009, KAIST-CUHK Joint workshop, “Computing the Capacity Region of a Wireless Network”.
- Jul 2009, ILVB workshop, Jeju Korea, “Approximate Inference: Decomposition Methods with Applications to Computer Vision”.
- May 2009, Bell Labs, Murray Hill, “Approximate Inference: Decomposition Methods with Applications to Networks”.
- Jan 2009, NIMS, “Learning Complex Networks : Structures and Algorithms”.
- Jan 2009, KAIST, “Learning Complex Networks : Structures and Algorithms”.
- Dec 2008, UConn, CSE Department Colloquia, “Approximate inference algorithms for pair-wise Markov Random Fields”.
- Oct 2008, INFORMS Annual Meeting, Washington DC, USA, “Message Passing Algorithms for Stochastic Loss Networks”.
- Aug 2008, Microsoft Research, Cambridge, Machine Learning and Perception Group, “Inference Algorithms for Markov Random Fields with Counting Constraint”.
- Jan 2008, KAIST, “Stability of the MaxWeight Routing and Scheduling Protocol in Adversarial Dynamic Networks.”
- Jan 2008, KAIST, “Approximate Inference Algorithms for Doubling Dimensional Graphs and Minor Excluded Graphs.”
- Aug 2007, IBM T.J. Watson Research, Mathematical Science Department, “Stability of the MaxWeight Routing and Scheduling Protocol in Dynamic Networks and at Critical Loads.”
- Aug 2007, Samsung Scholarship Foundation Summer Camp, “Theory and Application of the Belief Propagation Algorithm.”
- Jun 2007, IBM T.J. Watson Research, Mathematical Science Department, “Approximate Inference Algorithms for Doubling Dimensional Graphs and Minor Excluded Graphs.”

- May 2007, MIT, Algorithms and Complexity Seminar, “Approximation Algorithms for Doubling Dimensional Metric Spaces.”
 - Mar 2007, Microsoft Research, Redmond, Theory Group, “Approximate Inference Algorithms for Doubling Dimensional Graphs and Minor Excluded Graphs.”
 - Aug 2006, Bell Labs, Murray Hill, “Stability of the MaxWeight Routing and Scheduling Protocol in Adversarial Dynamic Networks.”
 - Aug 2005, Samsung Scholarship Foundation Summer Camp, “Pseudo-Random Generator.”
- **Conference Talks and Presentations**
- Jun 2008, SIGMETRICS, Annapolis, MD, USA, “Revisiting Stochastic Loss Networks: Structures and Algorithms.”
 - Dec 2007, NIPS, Vancouver, Canada, “Local Algorithms for Approximate Inference in Minor-Excluded Graphs.”
 - Jun 2007, ISIT, Nice, France, “Low Delay Scheduling in Wireless Network.”
 - Jun 2007, STOC, San Diego, CA, USA, “Stability of the Max-Weight Routing and Scheduling Protocol in Dynamic Networks and at Critical Loads.”
 - Jun 2005, GECCO, Washington DC, USA, “Phase Transition in a Random NK Landscape Model.”

Academic Services

- Reviewer, Discrete Applied Mathematics, Elsevier, 2009.
- Reviewer, IEEE International Symposium on Information Theory (ISIT), 2007.

Extracurricular Activities

- Volunteered to teach classes in the MIT Korean language class for foreigners organized by MIT KGSA(Korean Graduate Student Association), 2005 - 2009.
- **Military Service** as a *Sergeant in the 552nd Military Police Co.*, army, KATUSA, camp Hialeah, Busan, Korea, Feb 2000 - Apr 2002.
- Served as the representative of the department junior students, Seoul National University, Mathematics department, Spring 1998.
- Served as one of the representatives of the college students, Seoul National University, College of Natural Sciences, Fall 1996.
- *Co-founded a Math club “Mathema” and worked as an editor for the 1st and the 2nd release of the Math magazine “Art in Math.”*, Seoul National University, 1997 - 1999.
- *Worked as a member of singing club “Sonagi”*, Seoul National University, College of Natural Sciences, 1996 - 1999.

References

Dr. Matthew Andrews
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