Xingran Chen

467C, 3401 Walnut Street, Philadelphia, PA, 19104
https://sites.google.com/seas.upenn.edu/xingranc
xingranc@seas.upenn.edu
+1-2672446516, +86-17830420372

Research Fields

Research Interests: Internet of Things (IoT) with emphasis on Information Freshness, Resources Allocation and Security.
Methodologies: Information and Coding Theory, Optimization, Machine Learning, Game Theory, and Control Theory.

Education

Ph.D. in **Information and Decision Systems** 2018 - present
University of Pennsylvania Philadelphia, PA
`Department of Electrical and Systems Engineering` GPA: 3.94/4.0
Advisor: Shirin Saeedi Bidokhti

M.A. in **Applied Mathematics and Computational Science** 2016 - 2018
University of Pennsylvania Philadelphia, PA
`Applied Mathematics and Computational Science Program` GPA: 4.0/4.0
Master Thesis Advisor: Saswati Sarkar

M.S. in **Operations Research** 2015 - 2016
Central South University Changsha, China
`School of Mathematics and Statistics` Transfer to Upenn
Advisor: Zhong Wan

B.S. in **Statistics** 2011 - 2015
Central South University Changsha, China
`School of Mathematics and Statistics` 90.41/100

Research Experience

Age of Information in Random Access Channels

University of Pennsylvania Philadelphia, PA, USA
`Graduate Researcher` 05/2019 - 10/2019
Advisor: Shirin Saeedi Bidokhti, Hamed Hassani

- An analytic expression for AoI under stationary randomized policies was provided.
- Proved that the age performance of a (stabilized) slotted ALOHA algorithm is approximately optimal in large number of sources when the sum arrival rate θ is below the infamous critical point $\frac{1}{e}$.
- Proposed two age-based thinning methods (adaptive and stationary) in which transmitters discard packets in order to reach an effective (sum) arrival rate. Proved that our proposed thinning mechanism can reduce age to $1/2C$ for any random access technologies which can achieve the throughput C.

Age of Information of Broadcast Channels

University of Pennsylvania Philadelphia, PA, USA
`Graduate Researcher` 09/2018 - 04/2019
Advisor: Shirin Saeedi Bidokhti

- Randomized policies were devised, and explicit conditions were found for symmetric dependent channels under which coded randomized policies strictly outperform the corresponding uncoded policies.
- Deterministic policies with or without other constraints (throughput, transmitting cost and sampling cost) were devised. Coded deterministic policies strictly outperforms uncoded ones when channel erasure is larger than a threshold, otherwise coded and uncoded deterministic policies reach the same EWSAoI.

Non-asymptotic Coded Slotted Aloha

University of Pennsylvania Philadelphia, PA, USA
`Graduate Researcher` 02/2018 - 06/2018
Advisor: Hamed Hassani, Shirin Saeedi Bidokhti

- Coded Slotted Aloha (CSA) was considered and its performance was analyzed in the non-asymptotic regime where the frame length and the number of users are finite.
- A density evolution framework was provided to describe the dynamics of decoding, and fundamentally limits were found on the maximum channel load (the number of active users per time slot) that allows reliable communication.
- Scaling laws were established, describing the non-asymptotic relation between the probability error, number of users, and the channel load.

Resources Allocation in Wireless Networks

University of Pennsylvania Philadelphia, PA, USA
`Graduate Researcher` 04/2017 - 05/2018
Advisor: Saswati Sarkar

- Investigated the incentives of mobile networks (MNOs) for acquiring additional spectrum to offer mobile virtual network operators (MVNOs) and thereby inviting competition for a common pool of end users (EUs).
- Considered a sequential framework and a hybrid of a sequential and a bargaining frameworks in a base case (one MNO and one MVNO) and two generalizations ((i) one MNO, one MVNO and an outside option, (ii) two MNOs and one MVNO).
- The optimal strategies were characterized analytically and numerically: (i) cooperation between MNO and MVNO can enhance the payoffs of both, while increased competition due to the presence of additional MNOs is beneficial to EUs but reduces the payoffs of the service providers; (ii) whether and by how much the different entities benefit due to the cooperation in spectrum acquisition decision is evaluated.

Online-Offline Supply Chain Management

Central South University Changsha, China
`Graduate Researcher` 09/2015 - 02/2016
Advisor: Zhong Wan

- Optimal strategies for Online-Offline retailing under BOPS (buy-on-line, pick-up-in-store) mode were proposed by constructing a *Stochastic* Nash equilibrium model.

Publications

Thesis

1. **X. Chen**. Competition and cooperation between service providers. Master's thesis, University of Pennsylvania, 2018

Preprints

1. **X. Chen**, M. H. Lotfi, and S. Sarkar. The interplay of competition and cooperation among service providers (part I). *IEEE Transactions on Network Science and Engineering*, under revision. [arXiv: 1905.13423]
2. **X. Chen**, M. H. Lotfi, and S. Sarkar. The interplay of competition and cooperation among service providers (part II). *IEEE Transactions on Network Science and Engineering*, under revision. [arXiv: 1906.01187]
3. **X. Chen**, H. Hassani, K. Gatsis, and S. Saeedi Bidokhti. Age of information in random access channels with stochastic arrivals. In *SIGMETRICS*, under review
4. **X. Chen** and S. Saeedi Bidokhti. Benefits of coding on age of information in broadcast networks. under submission. [arXiv: 1904.10077]
5. M. Fereydounian, **X. Chen**, H. Hassani, and S. Saeedi Bidokhti. Non-asymptotic coded slotted ALOHA. under submission. https://www.seas.upenn.edu/ mferey/ms.pdf

Journal Articles

1. **X. Chen**, Y. Liu, and Z. Wan. Optimal decision making for online and offline retailers under BOPS mode. *ANZIAM Journal*, 58:187–208, 2016

Conference Papers

1. **X. Chen** and S. Saeedi Bidokhti. Benefits of coding on age of information in broadcast networks. In *2019 IEEE Information Theory Workshop*, to appear, 2019
2. M. Fereydounian, **X. Chen**, H. Hassani, and S. Saeedi Bidokhti. Non-asymptotic coded slotted ALOHA. In *2019 IEEE International Symposium on Information Theory (ISIT)*, to appear, 2019

Conference Talks, Invited Talks & Conference Posters

Conference Talks

1. "Non-asymptotic coded slotted aloha", *2019 IEEE International Symposium on Information Theory (ISIT)*, Paris, France, 07/2019.
2. "Optimal Decision Making for Online and Offline Retailers under BOPS Mode", *The 6th International Conference on Optimization and Control with Applications*, Changsha, China, 12/2015.

Invited Talks

1. "Benefits of coding on age of information in broadcast networks", Southwest University, Chongqing, China, 08/2019.

Conference Posters

1. "Benefits of coding on age of information in broadcast networks", *2019 IEEE Information Theory Workshop*, Visby, Sweden, 08/2019.
2. "Benefits of coding on age of information in broadcast networks", *2019 IEEE International Symposium on Information Theory (ISIT)*, Paris, France, 07/2019.
3. "Benefits of coding on age of information in broadcast networks", *2019 North American School of Information Theory (NASIT)*, Boston, USA, 07/2019.

Awards and Achievements

Awards in graduate (Ph.D.)

The Dean's Fellowship (University of Pennsylvania) 2018 - present
Ganster Engineering Fellowship (University of Pennsylvania) 09/2018

Awards in graduate (M.S./M.A.)

National Scholarship of China (Top 1% in China) 12/2016
First Prize of the 12th Graduate Students' Mathematical Modeling Contest in China (Top 1%) 11/2015

Awards in undergraduate (Selected)

Student Representative at the 2015 Graduation Ceremony of Central South University 06/2015
Outstanding Graduates of Hu'nan Province (Top 1% in Hu'nan Province) 05/2015
Meritorious Winner of Mathematical Contest In Modeling (MCM) 04/2015
National Scholarship of China (Top 1% in China) 12/2014

Paper Review

Reviewer for Journals

- ANZIAM Journal
- Journal of Industrial and Management Optimization (JIMO)

Reviewer for Conferences

- The Joint Optimization Conferences 2017 (JOC 2017)

Selected Courses

- **Mathematics:** Complex Analysis, Real Analysis, Functional Analysis, Topology, Advanced Algebra, Advanced Probability, Stochastic Process.
- **Engineering Mathematics:** Machine Learning, Convex Optimization, Linear Systems, Information Theory, Finite Element Analysis.
- **Statistics:** Mathematical Statistics, Regression Analysis, Multivariable Statistical Analysis, Time Series Analysis, Sampling Survey.
- **Economics & Finance:** Macro Micro Economics, Econometrics, Monetary Finance, Financial Management.