Karthik Abinav Sankararaman

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Contact

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Interests

Foundations and Applications of Artificial Intelligence: Robust Decision Making, Sequential Decision Problems (Online Matching, Multi-armed Bandits, SGD), Discrete and Continuous Optimization, Causality, Matching-based market design, Rideshare, Online Advertising.

Education

University of Maryland, College Park
PhD. in Computer Science — **September 2014 - July 2019**
M.S. in Computer Science — **December 2016**

Indian Institute of Technology, Madras — **August 2010 - July 2014**
B.Tech Honours in Computer Science and Engineering
Minor: Operations Research

Awards

- Best reviewer (top 400), NeurIPS 2019
- *Future Faculty Fellow*, University of Maryland, 2018
- *Dean's Fellowship*, University of Maryland, 2014, 2015
- *S.N. Bose Scholarship*, India, 2013
- *National Talent Search (NTSE)* Scholarship, India, 2010

Recent Work and Research Experience

Facebook, Menlo Park, USA — **September 2019 -**
Machine Learning Research Scientist

Microsoft Research New York City, USA — **June - September 2018**
Intern with Nicole Immorlica, Rob Schapire, Alex Slivkins

Indian Institute of Science, Bengaluru, India — **May - July 2017**
Research visit with Anand Louis, Navin Goyal

IBM Almaden Research Center, San Jose, USA — **May - August 2016**
Intern with Shivakumar Vaithyanathan, Prithviraj Sen

Adobe Inc., San Jose, USA — **May - August 2015**
Intern with Anil Kamath

Research/Teaching Assistant at UMD, College Park, USA — **August 2014 - July 2019**
Research Assistant with Aravind Srinivasan

Teaching Experience

Instructor, University of Maryland — **July 2019**
Online Lectures on Introduction to Mathematics of Online Learning
Responsibilities: Several hours of video lectures on introduction to the theory of online learning.

Instructor, University of Maryland — **January - May 2019**
CMSC250H - Discrete Structures (Honors) along with Prof. Bill Gasarch
Responsibilities: Designing the syllabus, homework, exams and grading policy. Weekly lecturing.

Teaching Assistant, University of Maryland — **August 2014 - December 2018**
CMSC250 - Discrete Structures (2 sems.), CMSC131- Intro to Programming (2 sems.), CMSC451/651- Advanced Algorithms (5 sems.)
Responsibilities: Guest Lectures, Conducting Discussion Sessions, Office Hours, Grading

Teaching Assistant, Indian Institute of Technology, Madras — **January - April 2014**
Paradigms of Programming
Responsibilities: Grading Programming Assignments

Publications

(α) indicates co-first author. (*) represents the other first author.

($\alpha\beta$) indicates (author) alphabetical ordering by last name.

1. ($\alpha\beta$) "Mix and Match: Markov Chains and Mixing Times for Matching in Rideshare" — Joint work with Mike Curry, John Dickerson, Aravind Srinivasan, Yuhao Wan, Pan Xu
   - *The 15th Conference on Web and Internet Economics (WINE), 2019*
2. ($\alpha\beta$) "Adversarial Bandits with Knapsacks" — Joint work with Nicole Immorlica, Robert Schapire, Alex Slivkins
   - *The 60th IEEE Symposium on Foundations of Computer Science (FOCS), 2019*
   - *INFORMS workshop on Market Design (with EC 2019)*
3. (α) "Stability of Linear Structural Equation Model of Causal Inference" — Joint work with Navin Goyal, Anand Louis
   - *The 35th Conference on Uncertainty in Artificial Intelligence (UAI), 2019*
   - *NeurIPS Workshop on Causality, 2018*
4. ($\alpha\beta$) "Online Resource Allocation with Matching Constraints" — Joint work with John Dickerson, Kanthi Sarpatwar, Aravind Srinivasan, Kun-Lung Wu, Pan Xu
   - *The 18th Conference on Autonomous Agents and Multiagent Systems (AAMAS), 2019*
5. "A Unified Approach to Online Matching with Conflict-Aware Constraints" — Joint work with Hao Cheng, John Dickerson, Yexuan Shi, Aravind Srinivasan, Yongxin Tong, Leonidas Tsepenekas, Pan Xu
   - *The 33rd AAAI Conference on Artificial Intelligence (AAAI), 2019*
6. ($\alpha\beta$) "Balancing Relevance and Diversity in Online Matching via Submodularity" — Joint work with John Dickerson, Aravind Srinivasan, Pan Xu
   - *The 33rd AAAI Conference on Artificial Intelligence (AAAI), 2019*
7. ($\alpha\beta$) "Assigning Workers to Tasks in Crowdsourcing Platforms: Two-Sided Online Matching" — Joint work with John Dickerson, Aravind Srinivasan, Pan Xu
   - *The 17th Conference on Autonomous Agents and Multiagent Systems (AAMAS), 2018*
   [Under review Operations Research (OR)]
8. ($\alpha\beta$) "Combinatorial Semi-Bandits with Knapsacks" — Joint work with Alexandrs Slivkins
   - *The 21st International Conference on Artificial Intelligence and Statistics (AIStats), 2018* — ***(Invited for Oral Presentation)***
9. ($\alpha\beta$) "Allocation Problems in Ride-Sharing Platforms: Online Matching with Offline Reusable Resources" — Joint work with John Dickerson, Aravind Srinivasan, Pan Xu
   - *The 32th AAAI Conference on Artificial Intelligence (AAAI), 2018* — ***(Invited for Oral Presentation)***
   [Under review Transactions on Economics and Computation (TEAC)]
10. ($\alpha\beta$) "Algorithms to Approximate Column-Sparse Packing Problems" — Joint work with Brian Brubach, Aravind Srinivasan, Pan Xu
    - *The 29th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2018*
    - *Full version in ACM Transactions of Algorithms (TALG), 2019*
11. ($\alpha\beta$) "Attenuation-based Frameworks for Online Stochastic Matching with Timeouts" — Joint work with Brian Brubach, Aravind Srinivasan, Pan Xu
    - *The 16th Conference on Autonomous Agents and Multiagent Systems (AAMAS), 2017*
    - *Full version in Algorithmica, 2019*
12. ($\alpha\beta$) "Improved Algorithms for Online Stochastic Matching"— Joint work with Brian Brubach, Aravind Srinivasan, Pan Xu
    - *The 24th Annual European Symposium on Algorithms (ESA), 2016*
    [Under review Algorithmica]
13. "Ensuring Privacy in Location-Based Services: An Approach Based on Opacity Enforcement" — Joint work with Yi-Chin Wu, Stèphane Lafortune
    - *The 14th International Workshop of Discrete Event Systems (WODES), 2014*

Thesis

1. "Sequential Decision Making with Limited Resources"
   PhD Thesis, University of Maryland College Park, 2019

Manuscripts

1. (α) "The Impact of Neural Network Overparameterization on Gradient Confusion and Stochastic Gradient Descent" — Joint work with Soham De*, Zheng Xu, Ronny Huang, Tom Goldstein
   - *NeurIPS Workshop on Integration of Deep Learning Theory, 2018*
2. (α) "Robust Identifiability in Linear Structural Equation Models for Causal Inference" — Joint work with Navin Goyal, Anand Louis
   - *NeurIPS Workshop on Safety and Robustness in Decision Making, 2019*
   - *[Under review AIStats 2020]*
3. ($\alpha\beta$) "Further Improved Bounds for Stochastic Bipartite Matching with Patience Constraints" — Joint work with Brian Brubach, Fabrizio Grandoni, Aravind Srinivasan, Pan Xu
   Manuscript 2019
4. "Balancing the Tradeoff between Profit and Fairness in Rideshare Platforms during High-Demand Hours" — Joint work with Vedant Nanda, John Dickerson, Aravind Srinivasan, Pan Xu
   - *Manuscript 2019*

Voluntary Service

Conference (reviewer and program committee). EC ('18), NeurIPS ('18, '19), ICLR ('19, '20), AIStats ('19, '20), ICML ('19, '20), UAI ('19), SODA ('20), AAAI ('20), WWW ('20), AI for Social Impact @ AAAI-20, AI for social good @ NeurIPS-19
Journal (reviewer). Transactions on Algorithms, Networks, Optimization Letters, JAAMAS, Mathematics of Operations Research, Transactions of Signal Processing
Mentor in "New in ML" workshop: Mentoring new researchers on writing machine learning papers.
Membership. ACM SIGACT
Graduate Admissions Comittee (UMD). CS department, UMD, 2016, 2017, 2018
Graduate Executive Council (UMD). Secretary 2017
Capital Area Theory Seminar Organizer. 2016, 2017, 2018

Grants

FOCS 2016 Travel Award, UMD CS Travel Award (2017), SODA 2018 Travel Award, Goldhaber Travel Award (2018), ICSSA Travel Award (2018), AIStats 2018 Travel Grant, AAMAS 2019 Student Scholarship

Selected Talks

1. Online Matching Problems
   - IBM Almaden Center, Theory Group
   - IBM Almaden Center, Machine Learning Group
2. Algorithms to Approximate Column-Sparse Packing Problems
   - Symposium on Discrete Algorithms (SODA), 2018
   - Indian Institute of Technology, Madras
3. Combinatorial Semi-Bandits with Knapsacks
   - International Conference on Artificial Intelligence and Statistics (AISTATS), 2018
   - Indian Institute of Science, Bengaluru
   - Indian Institute of Technology, Madras
4. Adversarial Bandits with Knapsacks
   - Johns Hopkins Theory Seminar
   - Google Research, NYC
   - Indian Institute of Science, Bengaluru
   - INFORMS Workshop on Market Design, 2019

Programming

C++, Python, Java

References

References available on request.