Karthik Abinav Sankararaman

September 2021

Contact **Webpage:** http://karthikabinavs.xyz **Email:** karthikabinavs@gmail.com

Interests Artificial Intelligence Foundations, Applications and Systems: Robust and Sequential Decision Problems, Discrete and Continuous Optimization, Matching-based Market Design (Rideshare, Online Advertising), AI for societal impact, Large Scale Systems.

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*, NeurIPS 2019, ICML 2020
- *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 -**
Research Scientist
Expert in developing new algorithms and systems based on multi-armed bandits and reinforcement learning across many problem teams within the company. Highlights include the first multi-armed bandit-based system to have successfully deployed within the FB ads system with a significant revenue lift. Experience spans the full spectrum of being a scientist (pushing the state of the art in theory/algorithms) and engineer (building systems, deploying to production, leading teams).

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**

Adobe Inc., San Jose, USA — **May - August 2015**

Research Assistant at UMD, College Park, USA — **August 2014 - July 2019**

Teaching Experience

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

Programming C++, Python, SQL/Presto/Hive, PyTorch

PUBLICATIONS (HIGHLY PEER-REVIEWED) J: JOURNAL, C: CONFERENCE

1. "Bandits with Knapsacks beyond the Worst-Case" — Joint work with Alex Slivkins
   - *(C) The 35th Conference on Neural Information Processing (NeurIPS), 2021*
2. "Beyond $\log^2(T)$ Regret for Decentralized Bandits in Matching Markets" — Joint work with Soumya Basu, Abishek Sankararaman
   - *(C) The 38th International Conference on Machine Learning (ICML), 2021*
3. "Multi-armed Bandits with Cost Subsidy" — Joint work with Deeksha Sinha, Abbas Kazerouni and Vashist Avadhanula
   - *(C) The 24th International Conference on Artificial Intelligence and Statistics (AIStats), 2021*
4. "Dominate or Delete: Decentralized Competing Bandits with Uniform Valuation" — Joint work with Abishek Sankararaman and Soumya Basu
   - *(C) The 24th International Conference on Artificial Intelligence and Statistics (AIStats), 2021*
5. "Stochastic bandits for multi-platform budget optimization in online advertising" — Joint work with Vashist Avadhanula, Riccardo Colini-Baldeschi, Stefano Leonardi and Okke Schrijvers
   - *(C) The 30th Web Conference 2021 (formerly known as WWW)*
6. "Analyzing the effect of neural network architecture on training performance" — Joint work with Soham De*, Zheng Xu, Ronny Huang, Tom Goldstein
   - *(C) The 37th International Conference on Machine Learning (ICML), 2020*
   - *NeurIPS Workshop on Integration of Deep Learning Theory, 2018*
7. "Matching Algorithms for Blood Donation" — Joint work with Duncan McElfresh, Sergey Pupyrev, Christian Kroer, John Dickerson, Eric Sodomka, Zack Chauvin and Neil Dexter
   - *(C) The 21st ACM Conference on Economics and Computation (EC) 2020*
8. "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
   - *(C) The 34th AAAI Conference on Artificial Intelligence (AAAI), 2020*
   - *(C) Extended Abstract in the Third AAAI/ACM Conference on AI, Ethics and Society (AIES), 2020 (**Oral Presentation**)*
9. "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
   - *(C) The 15th Conference on Web and Internet Economics (WINE), 2019*
10. "Adversarial Bandits with Knapsacks" — Joint work with Nicole Immorlica, Robert Schapire, Alex Slivkins
    - *(C) The 60th IEEE Symposium on Foundations of Computer Science (FOCS), 2019*
    - *INFORMS workshop on Market Design (with EC 2019)*
    (J) [Under review Journal of the ACM (JACM): Accept subject to Major Revisions]
11. "Stability of Linear Structural Equation Model of Causal Inference" — Joint work with Navin Goyal, Anand Louis
    - *(C) The 35th Conference on Uncertainty in Artificial Intelligence (UAI), 2019*
    - *NeurIPS Workshop on Causality, 2018*
12. "Online Resource Allocation with Matching Constraints" — Joint work with John Dickerson, Kanthi Sarpatwar, Aravind Srinivasan, Kun-Lung Wu, Pan Xu
    - *(C) The 18th Conference on Autonomous Agents and Multiagent Systems (AAMAS), 2019*
13. "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
    - *(C) The 33rd AAAI Conference on Artificial Intelligence (AAAI), 2019*
14. "Balancing Relevance and Diversity in Online Matching via Submodularity" — Joint work with John Dickerson, Aravind Srinivasan, Pan Xu
    - *(C) The 33rd AAAI Conference on Artificial Intelligence (AAAI), 2019*
15. "Assigning Workers to Tasks in Crowdsourcing Platforms: Two-Sided Online Matching" — Joint work with John Dickerson, Aravind Srinivasan, Pan Xu
    - *(C) The 17th Conference on Autonomous Agents and Multiagent Systems (AAMAS), 2018*
16. "Combinatorial Semi-Bandits with Knapsacks" — Joint work with Alexandrs Slivkins
    - *(C) The 21st International Conference on Artificial Intelligence and Statistics (AIStats), 2018 — **(Invited for Oral Presentation)***

17. "Allocation Problems in Ride-Sharing Platforms: Online Matching with Offline Reusable Resources" — Joint work with John Dickerson, Aravind Srinivasan, Pan Xu
- *(C) The 32th AAAI Conference on Artificial Intelligence (AAAI), 2018* — ***(Invited for Oral Presentation)***
(J) Full version in Transactions on Economics and Computation (TEAC), 2020

18. "Algorithms to Approximate Column-Sparse Packing Problems" — Joint work with Brian Brubach, Aravind Srinivasan, Pan Xu
- *(C) The 29th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2018*
- *(J) Full version in ACM Transactions of Algorithms (TALG), 2019*

19. "Attenuation-based Frameworks for Online Stochastic Matching with Timeouts" — Joint work with Brian Brubach, Aravind Srinivasan, Pan Xu
- *(C) The 16th Conference on Autonomous Agents and Multiagent Systems (AAMAS), 2017*
- *(J) Full version in Algorithmica, 2019*

20. "Improved Algorithms for Online Stochastic Matching"— Joint work with Brian Brubach, Aravind Srinivasan, Pan Xu
- *(C) The 24th Annual European Symposium on Algorithms (ESA), 2016*
- *(J) Full version in Algorithmica 2020*

21. "Ensuring Privacy in Location-Based Services: An Approach Based on Opacity Enforcement" — Joint work with Yi-Chin Wu, Stèphane Lafortune
- *(C) 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 / Working Papers

1. "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*

2. "Improved Approximation Algorithms for Stochastic-Matching Problems" — Joint work with Marek Adamczyk, Brian Brubach, Fabrizio Grandoni, Aravind Srinivasan and Pan Xu
-[Under Review at Algorithmica]

Voluntary Service

Senior Program Committee IJCAI '21, AAMAS '22
Conference (reviewer and program committee). EC ('18, '20), NeurIPS ('18, '19, '20, '21), ICLR ('19, '20, '21, '22), AIStats ('19, '20, '21, '22), ICML ('19, '20, '21), UAI ('19, '20), SODA ('20, '22), AAAI ('20, '21, '22), WWW ('20), IJCAI ('20), COLT ('20, '21), AI for Social Impact @ AAAI ('20, '21), AI for social good @ NeurIPS-19, NeurIPS-19 Reproducibility Challenge, Global Challenges in EC @ EC '20
Journal (reviewer). Transactions on Algorithms, Networks, Optimization Letters, JAAMAS, Mathematics of Operations Research, Operations Research, Transactions of Signal Processing, Discrete Optimization, Artificial Intelligence, Nature-Scientific Reports, IEEE Transactions on Neural Networks and Learning Systems, Journal of Machine Learning Research (JMLR), Journal of Artificial Intelligence (JAIR)
Mentor in "New in ML" workshop: Mentoring new researchers on writing machine learning papers.
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 and Machine Learning Groups

2. Algorithms to Approximate Column-Sparse Packing Problems
- Symposium on Discrete Algorithms (SODA), 2018, New Orleans
- 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
   - Foundations of Computer Science (FOCS), 2019, Baltimore
5. Robust Identifiability in Linear Structural Equation of Causal Inference
   - 1-minute video presentation at Uncertainty in Artificial Intelligence (UAI), 2019
   - Virtual Reading Group hosted at National University of Singapore (NUS)
6. Multi-armed bandit problems in two-sided marketplaces
   - INFORMS annual event 2020