Ayan Mukhopadhyay

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Google Scholar Profile

Research

I am broadly interested in probabilistic modeling, decision-making under uncertainty, multi-agent systems, and robust machine learning applied to societal problems. I primarily work in the domains of emergency response, transportation, health, and conservation in collaboration with government agencies and non-profit organizations. I am also exploring fairness and equity of decision-making in the context of smart cities.

Experience

1. Vanderbilt University, USA (2020-)
Research Scientist,
Department of Electrical Engineering and Computer Science
Received "Google AI Impact Scholar Award", 2021 *(one of 30 awardees worldwide)*

2. Stanford University, USA (2019-2020)
Post-Doctoral Research Fellow,
Stanford Intelligent Systems Lab
Advisor: Prof. Mykel Kochenderfer
Received "Center of Automotive Research Post-Doctoral Fellowship Award", 2019

Education

1. Vanderbilt University, USA (2014-2019)
Ph.D. (Computer Science)
(GPA : 3.98/4)
Advisor: Prof. Yevgeniy Vorobeychik
Thesis: "Robust Incident Prediction, Resource Allocation and Dynamic Dispatch"
Nominated for "Victor Lesser Distinguished Dissertation Award 2020" *(one of 7 nominations worldwide)*

2. West Bengal University of Technology, India (2007-2011)
B.Tech, Computer Science, 2011 (GPA : 8.91/10)

Honors and Awards

1. Google AI Impact Scholar Award, 2021.
2. One of the best papers of ICCPS 2021 (TCPS Special Issue Invite).
3. Nominated for IFAAMAS Victor Lesser Distinguished Dissertation Award, 2020.
4. Center of Automotive Research at Stanford Post-Doctoral Fellowship Award, 2019.
5. Best paper award, AI for Social Good Workshop (ICLR), 2019.
6. Russell G. Hamilton Graduate Leadership Development Institute Professional Development Award, Spring 2019.
7. Governer's Award for Academic Excellence, 2005.

Publications

Pre-prints

1. Patel, Shruti, et al., "Using Deep Learning to Count Monarch Butterflies in Dense Clusters, *Bio-ArXiv pre-print*.

Refereed Journals

1. **Ayan Mukhopadhyay**, Geoffrey Pettet, Sayyed Vazirizade, Di Lu, Said El Said, Alex Jaimes, Hiba Baroud, Yevgeniy Vorobeychik, Mykel Kochenderfer, Abhishek Dubey, "A Review of Emergency Incident Prediction, Resource Allocation and Dispatch Models", *The Elsevier Journal of Accident Analysis and Prevention, 2021 (to appear).*

2. Geoffrey Pettet, **Ayan Mukhopadhyay**, Mykel Kochenderfer, Abhishek Dubey, "Hierarchical Planning for Resource Allocation in Smart and Connected Communities, *ACM Transactions on Cyber-Physical Sytems, 2021 (to appear).*

Refereed Conferences

1. Singla, Samriddhi, **Ayan Mukhopadhyay**, Michael Wilbur, Tina Diao, Vinayak Gajjewar, Ahmed Eldawy, Mykel Kochenderfer, Ross Shachter, Abhishek Dubey, "*WildfireDB*: An Open-Source Dataset Connecting Wildfire Spread with Relevant Determinants", *Neural Information Processing Systems Track on Datasets and Benchmarks (NeurIPS 2021).*

2. Yasas Senarath, **Ayan Mukhopadhyay**, Sayyed Mohsen Vazirizade, Hemant Purohit, Saideep Nannapaneni, Abhishek Dubey, "Practitioner-Centric Approach for Early Incident Detection Using Crowdsourced Data for Emergency Services", *International Conference on Data Mining (ICDM 2021).*

3. Samriddhi Singla, Ahmed Eldawy, Tina Diao, **Ayan Mukhopadhyay**, Elia Scudiero, "The Raptor Join Operator for Processing Big Raster + Vector Data", *ACM International Conference on Advances in Geographic Information Systems (SIGSPATIAL 2021).*

4. Sayyed Mohsen Vazirizade, **Ayan Mukhopadhyay**, Geoffrey Pettet, Said El Said, Hiba Baroud, Abhishek Dubey, "Learning Incident Prediction Models Over Large Geographical Areas for Emergency Response Systems", *IEEE Conference on Smart Computing (SmartComp 2021).*

5. Michael Wilbur, **Ayan Mukhopadhyay**, Sayyed Vazirizade, Philip Pugliese, Aron Laszka, Abhishek Dubey, "Energy and Emission Prediction for Mixed-Vehicle Transit Fleets Using Multi-Task and Inductive Transfer Learning", *European Conference on Machine Learning (ECML 2021).*

6. Geoffrey Pettet, **Ayan Mukhopadhyay**, Mykel Kochenderfer, Abhishek Dubey, "Hierarchical Planning for Resource Allocation in Emergency Response Systems", *ACM/IEEE Conference on Cyber-Physical Systems (ICCPS 2021).* [**One of the best papers**, TCPS Special Issue Invite]

7. Samriddhi Singla, Ahmed Eldawy, Tina Diao, **Ayan Mukhopadhyay**, Elia Scudiero, "Experimental Study of Big Raster and Vector Database Systems", *IEEE International Conference on Data Engineering (ICDE 2021).*

8. **Ayan Mukhopadhyay**, Kai Wang, Andrew Perrault, Mykel Kochenderfer, Milind Tambe, Yevgeniy Vorobeychik, "Robust Spatio-Temporal Incident Prediction", *Conference on Uncertainty in Artificial Intelligence (UAI 2020).*

9. Geoffrey Pettet, **Ayan Mukhopadhyay**, Mykel Kochenderfer, Yevgeniy Vorobeychik, Abhishek Dubey, "On Algorithmic Decision Procedures in Emergency Response Systems in Smart and Connected Communities", *Conference on Autonomous Agents and MultiAgent Systems (AAMAS 2020).*

10. **Ayan Mukhopadhyay**, Geoffrey Pettet, Chinmaya Samal, Abhishek Dubey, Yevgeniy Vorobeychik, "An Online Decision-Theoretic Framework for Responder Dispatch", *ACM/IEEE Conference on Cyber-Physical Systems (ICCPS 2019).*

11. **Ayan Mukhopadhyay**, Zilin Wang, Yevgeniy Vorobeychik, "A Decision Theoretic Framework for Emergency Responder Dispatch", *Conference on Autonomous Agents and MultiAgent Systems. (AAMAS 2018).*

12. **Ayan Mukhopadhyay**, "Incident Prediction and Response Optimization", *Conference on Autonomous Agents and MultiAgent Systems. (AAMAS 2018)* (Doctoral Consortium Paper).

13. **Ayan Mukhopadhyay**, Yevgeniy Vorobeychik, Abhishek Dubey, Gautam Biswas, "Prioritized Allocation of Emergency Responders based on a Continuous-Time Incident Prediction Model", *Conference on Autonomous Agents and MultiAgent Systems. (AAMAS 2017).*

14. **Ayan Mukhopadhyay**, Chao Zhang, Yevgeniy Vorobeychik, Milind Tambe, Kenneth Pence, Paul Speer, "Optimal Allocation of Police Patrol Resources Using a Continuous-Time Crime Model", *Conference on Decision and Game Theory for Security (GameSec 2016).*

15. Chao Zhang, Victor Bucarey, **Ayan Mukhopadhyay**, Arunesh Sinha, Yundi Qian, Yevgeniy Vorobeychik, Milind Tambe,"Using abstractions to solve opportunistic crime security games at scale.", *Conference on Autonomous Agents & Multiagent Systems (AAMAS 2016).*

16. Nandita Sen, Bhaskar Roy, Ankit Narsaria, **Ayan Mukhopadhyay**, Suman Tiwari, "Efficiency analysis of indian thermal power plants: A unit level cross-sectional perspective" *North American Power Symposium (NAPS, 2011)*

Refereed Workshops

1. Samriddhi Singla, Tina Diao, **Ayan Mukhopadhyay**, Ahmed Eldawy, Ross Shachter, Mykel Kochenderfer, "WildfireDB: A Spatio-Temporal Dataset Combining Wildfire Occurrence with Relevant Covariates", *NeurIPS-20 AI for Earth Sciences Workshop (AIES at NeurIPS 2020)* [**Spotlight Talk**].

2. **Mukhopadhyay, Ayan**, Geoffrey Pettet, Mykel Kochenderfer, Abhishek Dubey, "Designing Emergency Response Pipelines : Lessons and Challenges", *AAAI Fall Symposium Series on AI for Social Good 2020 (AAAI-FSS 2020).*

3. Tina Diao, Samriddhi Singla, **Ayan Mukhopadhyay**, Ahmed Eldawy, Ross Shachter, Mykel Kochenderfer, "A Pipeline for Emergency Response", *AAAI Fall Symposium Series on AI for Social Good 2020 (AAAI-FSS 2020).*

4. **Ayan Mukhopadhyay**, Yevgeniy Vorobeychik, "A Pipeline for Emergency Response", *The ICLR-19 Workshop on AI for Social Good (AISC at ICLR 2019)* [**Best Paper Award**].

5. **Ayan Mukhopadhyay**, Zilin Wang, Yevgeniy Vorobeychik, "Prioritized allocation of emergency responders based on a continuous-time incident prediction model", *The AAMAS-17 Workshop on Adversarial Reasoning in Multi-agent Systems (ADVERSE 2017).*

6. **Ayan Mukhopadhyay**, Chao Zhang, Yevgeniy Vorobeychik, Milind Tambe, Kenneth Pence, Paul Speer, "Optimal allocation of police patrol resources using a continuous-time crime model", *The AAAI 2017 Spring Symposium on AI for Social Good (AAAI-AISOC 2017).*

Patents

1. Dubey, Abhishek, et al., "Forecasting Energy Consumption in a Mixed Transit Fleet", USA Provisional Patent Application, 2021.
2. Mukhopadhyay, Ayan, et al., "A Security Device", Reference: E-2/2217/2013-KOL, Application: 616/KOL/2012. (Publication and Patent Pending)
3. Narsaria, Ankit et al., "Hybrid Car Power Transition Mechanism", *Official Journal Of The Patent Office, Government of India, Issue No. 31/2012.* (Patent Pending)

Software and Datasets

1. *StatResp*: An open-source tool for first-responders consisting of statistical methods for emergency response.
2. *WildfireDB*: An open-source database that connects wildfire occurrences with features extracted from satellite imagery and weather (17 million data points).

Funding

1. Research Grant (2021), co-Principal Investigator, "EdgeNet: An Online Edge Computing Based Generative Anomaly Detection and Prognostics Solution for Networked Equipment at Customer Premises" funded by **Cisco University Research Program Fund** for $100,000.
2. Research Gift (2021), Principal Investigator, "Data-driven Vaccine Demand Forecasting and Health Interventions in Nigeria" funded by **Google AI for Social Good** for $30,000 ($20,000 to the non-profit entity and $10,000 to PI).
3. Research Grant (2021), Principal Investigator, "Using Deep Learning for Counting Monarch Butterflies is Dense Clusters", funded by **Microsoft AI for Earth Program** for $15,000 in computation credits.

Professional Service

Peer-reviewed Conferences and Workshops

1. International Joint Conference on Artificial Intelligence (IJCAI, PC Member)
2. 2022 Doctoral Consortium on Computational Sustainability (CompSust 22, Program Chair)
3. Workshop on Data-Driven and Intelligent Cyber-Physical Systems for Smart Cities, 2022 (DI-CPS, ACM-IEEE CPS-IoT Week, Program Chair)
4. IEEE/WIC/ACM Conference on Web Intelligence and Intelligent Agent Technology, 2021 (WI-IAT, PC Member)
5. AAAI Conference on Artificial Intelligence, 2022 (AAAI, PC Member)
6. Workshop on Trustworthy Autonomous Systems Engineering, 2022 (AAAI, PC Member)
7. Conference on Autonomous Agents and Multi-Agent Systems, 2022 (AAMAS, PC Member)
8. Conference on Neural Information Processing Systems, 2021 (NeurIPS, Reviewer)
9. Workshop on Data-Driven and Intelligent Cyber-Physical Systems, 2021 (DI-CPS, CM-IEEE CPS-IoT Week, Program Chair)

10. AAAI Conference on Artificial Intelligence, 2021 (AAAI, PC Member)
11. Conference on Autonomous Agents and Multi-Agent Systems, 2021 (AAMAS, PC Member)
12. Workshop on AI for Social Good, 2020 (PC Member)
13. Bay Area Machine Learning Symposium, 2020 (BayLearn, Reviewer)
14. Conference on Autonomous Agents and Multi-Agent Systems, 2021 (AAMAS, PC Member)
15. Workshop on AI for Social Good, 2020 (AISG, PC Member)
16. Conference on Autonomous Agents and Multi-Agent Systems, 2018 (AAMAS, Organizing Committee Member)
17. Workshop on Optimization and Learning in Multiagent Systems, 2020 (AAMAS, PC Member)
18. Conference on Autonomous Agents and Multi-Agent Systems, 2019 (AAMAS, Reviewer)
19. Conference on Autonomous Agents and Multi-Agent Systems, 2017 (AAMAS, Reviewer)
20. International Joint Conference on Artificial Intelligence, 2018 (IJCAI, Reviewer)
21. AAAI Conference on Artificial Intelligence, 2018 (AAAI, Reviewer)
22. Conference on Decision and Game Theory, 2018 (GameSec, Reviewer)
23. Conference on Decision and Game Theory, 2017 (GameSec, Reviewer)
24. ACM Conference on Economics and Computation, 2018 (EC, Reviewer)

Peer-reviewed Journals

1. Artificial Intelligence Review (Reviewer)
2. IEEE Access (Reviewer)
3. IEEE Transactions on SMC: Systems (Reviewer)
4. Springer Machine Learning (Reviewer)
5. International Journal of Disaster Risk Reduction (Reviewer)
6. Journal of Ethics, Medicine and Public Health (Reviewer)

Invited Talks and Tutorials

1. "Multi-Agent Systems for Disaster Management", Oak Ridge National Laboratory (Invited Talk), 2021.
2. "Smart Emergency Response", IEEE Conference on Smart Computing, 2021 (SmartComp) (Tutorial) (Video)
3. "Multi-Agent Systems for Emergency Response", Los Alamos National Laboratory Seminar Series, 2021. (Invited Talk) (Slides).
4. Stanford University CS+Social Good Impact Lab Panel 2021. (Invited Panel).
5. "Smart Emergency Response", NSF Doctoral Consortium on Computational Sustainability, 2020 (CompSust-DC) (Tutorial) (Video).
6. "Robust Incident Forecasting and Response", University of Utah Data Science Seminar 2020. (Invited Talk) (Video).
7. "Robust Incident Forecasting for Animal Conservation", University of Cambridge Environmental Data Science AI4ER Seminar Series 2020 (Invited Talk) (Video).
8. "Transition to Research and Doctoral Programs", Stanford University CS and Social Good Impact Lab Panel 2020 (Invited Talk)
9. "Intelligent Emergency Response", Center of Automotive Research at Stanford Annual Symposium 2019 (Invited Talk)

Others

1. Member, Stanford Energy Systems Committee, 2020
2. Technical Mentor, Stanford CS+Social Good Impact Lab 2020.
3. Board Member, HelpMum (non-profit), Nigeria.

4. AI Mentor, Wildlife.ai (non-profit), New Zealand.

Teaching and Mentoring

Courses

1. Teaching Assistant, Artificial Intelligence (Under-Graduate/Graduate Level), Vanderbilt University, 2016. TA Evaluation : 4.2/5 (16% above dept. average)
2. Teaching Assistant, Machine Learning (Graduate Level), Vanderbilt University, 2017. TA Evaluation : 4.6/5 (21% above dept. average)
3. Guest Lecturer, AI and Society (Under-Graduate Level), Washington University in St. Louis, 2020.

Students Mentored

1. Shreyas Ramakrishna, Thesis Committee Member (PhD student, Vanderbilt University).
2. Tina Diao, Research Advisor, (PhD student, Stanford University)
3. Geoffrey Pettet, Research Advisor, (PhD student, Vanderbilt University)
4. Michael Wilbur, Research Advisor, (PhD student, Vanderbilt University)
5. Yihan Shao, Research Advisor, (Undergraduate Research Intern, University of Rochester)
6. Zilin Wang, Research Advisor, (Undergraduate Research Intern, Vanderbilt University)
7. Elom Dumenyo, Research Advisor, (Research Intern, Vanderbilt University)
8. Sidhart Krishnan, Research Advisor, (Research Intern, Stanford University)

References

1. Yevgeniy Vorobeychik (PhD Advisor)
   Associate Professor,
   School of Engg. and Applied Sciences,
   University of Washington at St. Louis
   yvorobeychik@wustl.edu

2. Abhishek Dubey,
   Asst. Professor,
   Electrical Engineering and Computer Science,
   Vanderbilt University
   abhishek.dubey@vanderbilt.edu

3. Mykel Kochenderfer (Post-Doc Advisor),
   Asst. Professor,
   Aeronautics and Aerospace Engineering/Computer Science,
   Stanford University
   mykel@stanford.edu