

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.

Experience

1. Vanderbilt University, USA (2020-)
Research Scientist,
Institute for Software Integrated Systems, School of Engineering
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. Best Presentation Award, Google AI for Social Good Workshop 2022.
2. Google AI Impact Scholar Award, 2021.
3. One of the best papers of ICCPS 2021 (TCPS Special Issue Invite).
4. Nominated for IFAAMAS Victor Lesser Distinguished Dissertation Award, 2020.
5. Center of Automotive Research at Stanford Post-Doctoral Fellowship Award by Stanford University, 2019.
6. Best paper award, AI for Social Good Workshop (ICLR), 2019.
7. Russell G. Hamilton Graduate Leadership Development Institute Professional Development Award, Spring 2019.
8. AAMAS Student Scholarship, Conference on Autonomous Agents and Multiagent Systems, 2018.
9. AAMAS Student Scholarship, Conference on Autonomous Agents and Multiagent Systems, 2017.

10. GameSec Student Travel Grant, Conference on Game Theory and Security, 2016.
11. Governor's Award for Academic Excellence, 2005.

Publications

Books

1. Ayan Mukhopadhyay and Yevgeniy Vorobeychik, "Artificial Intelligence and Society", Edited Volume, Association for Computing Machinery Press (ACM Book Series), 2023 (to appear).

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*, 2022.
2. Geoffrey Pettet, **Ayan Mukhopadhyay**, Mykel Kochenderfer, Abhishek Dubey, "[Hierarchical Planning for Resource Allocation in Smart and Connected Communities](#)", *ACM Transactions on Cyber-Physical Systems*, 2022.

Refereed Conferences

1. Scott Eisele, Michael Wilbur, Taha Eghtesad, Kevin Silvergold, Fred Eisele, **Ayan Mukhopadhyay**, Aron Laszka, Abhishek Dubey, "Decentralized Computation Market for Stream Processing Applications", *IEEE International Conference on Cloud Engineering (IC2E 2022)*.
2. Vineet Nair, Kritika Prakash, Michael Wilbur, Aparna Taneja, Corrine Namblard, Oyindamola Adeyemo, Abhishek Dubey, Abiodun Adereni, Milind Tambe, **Ayan Mukhopadhyay**, "[ADVISED: AI-Driven Vaccination Intervention Optimiser for Increasing Vaccine Uptake in Nigeria](#)", *International Joint Conference on Artificial Intelligence (IJCAI 2022)*. **(Acceptance rate: 15%)**
3. Amutheezan Sivagnanam, Salah Kadir, **Ayan Mukhopadhyay**, Philip Pugliese, Abhishek Dubey, Samitha Samaranyake, Aron Laszka, "[Offline Vehicle Routing Problem with Online Bookings: A Novel Problem Formulation with Applications to Paratransit](#)", *International Joint Conference on Artificial Intelligence (IJCAI 2022)*. **(Acceptance rate: 15%)**
4. Geoffrey Pettet, Ayan Mukhopadhyay, Abhishek Dubey, "[Decision Making in Non-Stationary Environments with Policy-Augmented Monte Carlo Tree Search](#)", Multidisciplinary Conference on Reinforcement Learning and Decision Making, 2022. **(Acceptance rate: unknown)**
5. Michael Wilbur, Salah Uddin Kadir, Youngseo Kim, Geoff Pettet, **Ayan Mukhopadhyay**, Philip Pugliese, Samitha Samaranyake, Aron Laszka, Abhishek Dubey, "[An Online Approach to Solve the Dynamic Vehicle Routing Problem with Stochastic Trip Requests for Paratransit Services](#)", *International Conference on Cyber-Physical Systems (ICCPs 2022)*. **(Acceptance rate: 26%)**
6. Singla, Samridhi, **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)*. **(Acceptance rate: 35%)**
7. 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)*. **(Acceptance rate: 20%)**

8. 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)*. (**Acceptance rate: 20%**)
9. 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)*. (**Acceptance rate: 30%**)
10. 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)*. (**Acceptance rate: 25%**)
11. 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] (**Acceptance rate: 28%**)
12. 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)*. (**Acceptance rate: 19%**)
13. **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)*. (**Acceptance rate: 27%**)
14. 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)*. (**Acceptance rate: 23%**)
15. **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)*. (**Acceptance rate: 23%**)
16. Geoffrey Pettet, **Ayan Mukhopadhyay**, Chinmaya Samal, Abhishek Dubey, Yevgeniy Vorobeychik, “[Incident Management and Analysis Dashboard for Fire Departments: ICCPS Demo](#), *ACM/IEEE Conference on Cyber-Physical Systems (ICCPS 2019)* (**Acceptance rate: 23%**)
17. **Ayan Mukhopadhyay**, Zilin Wang, Yevgeniy Vorobeychik, “[A Decision Theoretic Framework for Emergency Responder Dispatch](#)”, *Conference on Autonomous Agents and MultiAgent Systems. (AAMAS 2018)*. (**Acceptance rate: 25%**)
18. **Ayan Mukhopadhyay**, “[Incident Prediction and Response Optimization](#)”, *Conference on Autonomous Agents and MultiAgent Systems. (AAMAS 2018)* (Doctoral Consortium Paper). (**Acceptance rate unknown**)
19. **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)*. (**Acceptance rate: 27%**)
20. **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)*. (**Acceptance rate: 45%**)

21. 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)*. (**Acceptance rate: 25%**)
22. 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)* (**Acceptance rate unknown**)
23. Bhaskar Karmaker, Ankit Narsaria, **Ayan Mukhopadhyay**, Suman Tiwari, “Comparative Performance of Asymmetric DEA as a Bankruptcy Predictor: An Empirical Evidence from Indian Context”, *International Conference on Data Envelopment Analysis (DEA 2011)* (**Acceptance rate unknown**)

Refereed Workshops

1. Ayan Mukhopadhyay and Abiodun Adereni, “Data-driven Vaccine Demand Forecasting and Health Interventions in Nigeria”, *Google AI for Social Good Workshop 2022* [**Best Presentation Award**]
2. Geoffrey Pettet, Hunter Baxter, Sayyed Mohsen Vazirizade, Hemant Purohit, Meiyi Ma, Ayan Mukhopadhyay, Abhishek Dubey, Designing Decision Support Systems for Emergency Response: Challenges and Opportunities, Workshop on Cyber Physical Systems for Emergency Response (CPS-IOT Week 2022).
3. Juan Martinez, Ayan Mukhopadhyay, Afiya Ayman, Michael Wilbur, Philip Pugliese, Dan Freudberg, Aron Laszka, Abhishek Dubey, Predicting Public Transportation Load to Estimate the Probability of Social Distancing Violations, *Workshop on AI for Urban Mobility at the 35th AAAI Conference on Artificial Intelligence (AAAI-AIUM 2021)*.
4. 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**].
5. **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)*.
6. 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)*.
7. **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**].
8. **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)*.
9. **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)*.

Pre-prints and Working Papers

1. Shruti Patel, et al., “[Using Deep Learning to Count Monarch Butterflies in Dense Clusters](#), *Bio-ArXiv pre-print*.
2. Carlos Martinez, Ayan Mukhopadhyay, Samitha Samaranayake, Abhishek Dubey, “*Understanding Fairness in Public Transit.*”

Media Coverage

1. I was interviewed by the [INFORMS Resoundingly Human podcast](#) to talk about our work on using Artificial Intelligence for designing health interventions.
2. [Bella Naija](#), based in Lagos, Nigeria, covered our work with HelpMum to increase vaccination uptake in Nigeria by using Artificial Intelligence.
3. [TechNext Nigeria](#) covered the acceptance of our paper at the International Joint Conference on Artificial Intelligence, the first AI-driven vaccination uptake framework to be deployed in Nigeria.
4. [Metro Lab Innovation of the Month](#) covered our work on using Artificial Intelligence to lower emergency response times.
5. [Financial Times](#) covered our project while discussing how IoT devices can shape the future of smart cities.
6. [Spectrum News](#) covered our work on building *WildfireDB*.
7. [UCR News](#) discussed how our work on extracting heterogeneous data pertaining to wildfires can help firefighters.
8. [Patch](#) discussed how *WildfireDB*, the first comprehensive database that links wildfire occurrence with relevant covariates extracted from satellite data, can be used to model the spread of wildfires.

Funding

1. Research Grant (2022), co-Principal Investigator, “AI-Engine for Adaptive Sensor Fusion For Traffic Monitoring Systems” funded by **Tennessee Department of Transportation** for \$150,000.
2. 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.
3. 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).
4. Research Grant (2021), Principal Investigator, “Using Deep Learning for Counting Monarch Butterflies in Dense Clusters”, funded by **Microsoft AI for Earth Program** for \$15,000 in computation credits.

Professional Service

Peer-reviewed Journals

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

Peer-reviewed Conferences and Workshops

1. Reviewer, Conference on Neural Information Processing Systems, 2021 (NeurIPS)
2. Session Chair, Conference on Autonomous Agents and Multiagent Systems, 2022 (AAMAS)
3. Session Chair, Going beyond efficiency: exploring equity in decision-making for transit, INFORMS Annual Meeting, 2022.
4. Program Chair, Workshop on Social Media for Emergency Response, 2022 (SOMMER, AAAI Conference on Web and Social Media ICWSM)
5. PC Member, International Joint Conference on Artificial Intelligence (IJCAI)
6. Chair, 2022 Doctoral Consortium on Computational Sustainability (CompSust 22)
7. Program Chair, Workshop on Data-Driven and Intelligent Cyber-Physical Systems for Smart Cities, 2022 (DI-CPS, ACM-IEEE CPS-IoT Week)
8. PC Member, IEEE/WIC/ACM Conference on Web Intelligence and Intelligent Agent Technology, 2021 (WI-IAT)
9. PC Member, AAAI Conference on Artificial Intelligence, 2022 (AAAI)
10. PC Member, Workshop on Trustworthy Autonomous Systems Engineering, 2022 (AAAI)
11. PC Member Conference on Autonomous Agents and Multi-Agent Systems, 2022 (AAMAS)
12. Reviewer, Conference on Neural Information Processing Systems, 2021 (NeurIPS)
13. Program Chair, Workshop on Data-Driven and Intelligent Cyber-Physical Systems, 2021 (DI-CPS, CM-IEEE CPS-IoT Week)
14. PC Member AAAI Conference on Artificial Intelligence, 2021 (AAAI)
15. PC Member Conference on Autonomous Agents and Multi-Agent Systems, 2021 (AAMAS)
16. PC Member, Workshop on AI for Social Good, 2020
17. Reviewer, Bay Area Machine Learning Symposium, 2020 (BayLearn)
18. Conference on Autonomous Agents and Multi-Agent Systems, 2021 (AAMAS, PC Member)
19. Organizing Committee, Conference on Autonomous Agents and Multi-Agent Systems, 2018 (AAMAS)
20. PC Member, Workshop on Optimization and Learning in Multiagent Systems, 2020 (AAMAS)
21. Reviewer, Conference on Autonomous Agents and Multi-Agent Systems, 2019 (AAMAS)
22. Reviewer, Conference on Autonomous Agents and Multi-Agent Systems, 2017 (AAMAS)
23. Reviewer, International Joint Conference on Artificial Intelligence, 2018 (IJCAI)
24. Reviewer, AAAI Conference on Artificial Intelligence, 2018 (AAAI)
25. Reviewer, Conference on Decision and Game Theory, 2018 (GameSec)
26. Reviewer, Conference on Decision and Game Theory, 2017 (GameSec)
27. Reviewer, ACM Conference on Economics and Computation, 2018 (EC)

Proposal Reviewing

1. National Science Foundation Panel on Cyber-Physical Systems, 2022.

Invited Talks, Panels, and Tutorials

1. “Multi-agent systems for Emergency Response”, Workshop on Social Media for Emergency Response at the AAAI Conference on Web and Social Media (Invited Talk), 2022.
2. “Applying Cyber-Physical Infrastructure to Improving Transportation Services and Enhancing Mobility”, Invited Talk and Panelist at NSF-sponsored CREEATTE Workshop (Connecting Rural and Urban Environments for Equitable Access to Transportation, Telecommunications and Energy), 2022.
3. “Multi-Agent Systems for Disaster Management”, Oak Ridge National Laboratory (Invited Talk), 2021.
4. “Smart Emergency Response”, IEEE Conference on Smart Computing, 2021 (SmartComp) (Tutorial) ([Video](#))
5. “Multi-Agent Systems for Emergency Response”, Los Alamos National Laboratory Seminar Series, 2021. (Invited Talk) ([Slides](#)).
6. Stanford University CS+Social Good Impact Lab Panel 2021. (Invited Panel).

7. “Smart Emergency Response”, NSF Doctoral Consortium on Computational Sustainability, 2020 (CompSust-DC) (Tutorial) ([Video](#)).
8. “Robust Incident Forecasting and Response”, University of Utah Data Science Seminar 2020. (Invited Talk) ([Video](#)).
9. “Robust Incident Forecasting for Animal Conservation”, University of Cambridge Environmental Data Science AI4ER Seminar Series 2020 (Invited Talk) ([Video](#)).
10. “Transition to Research and Doctoral Programs”, Stanford University CS and Social Good Impact Lab Panel 2020 (Invited Talk)
11. “Intelligent Emergency Response”, Center of Automotive Research at Stanford Annual Symposium 2019 (Invited Talk)

Other Service

1. Member, Stanford Energy Systems Committee, Stanford University, 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.

References

1. Yevgeniy Vorobeychik (PhD Advisor)
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2. Abhishek Dubey,
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3. Mykel Kochenderfer (Post-Doc Advisor),
Associate Professor,
Aeronautics and Aerospace Engineering/Computer Science,
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