Geoffrey "Ava" Pettet

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Research Interests

My research interests include sequential decision making under uncertainty, cyber-physical systems, probabilistic modeling, robust machine learning, and explainable AI.

Research Experience

8/2022 - Present

Postdoctoral Scholar, Institute for Software Integrated Systems, Vanderbilt University.
- Member of ScopeLab Research Group – `https://scopelab.ai/`.
- Conduct research applying artificial intelligence to optimize cyber-physical systems.
- Mentor graduate students in their studies and careers.

6/2016 - 8/2022

Research Assistant, Institute for Software Integrated Systems, Vanderbilt University.
- Executed research efforts producing several publications accepted to selective conferences and journals (see publications).
- Mentored undergraduate interns.

5/2020 - 9/2020

Research Intern, Pacific Northwest National Laboratory, Richland, WA, USA.
- Developed charge scheduling algorithms for electric bus deployments that account for energy price fluctuations and grid stability.

4/2017 - 8/2017

Research Intern, Metro Government of Nashville, Information and Technology Department, Nashville, TN, USA.
- Coordinated research efforts for a distributed traffic sensing application, and led development on its software framework.

Other Experience

2014 - 2015

Software Development Intern, Institute for Software Integrated Systems, Nashville, TN, USA.
- 6/2014 - 8/2014: Conceptualized, designed, and prototyped hardware modules and their accompanying Android software for Google's Project Ara modular phone concept.
- 6/2015 - 8/2015: Designed and implemented assignments for Vanderbilt's online Android development course.

Education

6/2016 **PhD, Computer Science**, Vanderbilt University, Nashville, TN
- 8/2022
- Advisor: Dr. Abhishek Dubey - Assistant Professor, Computer Science and Computer Engineering, Department of Computer Science, Vanderbilt University.
- GPA: 4.0

8/2012 **BS, Computer Science**, Cum Laude, with Honors. Vanderbilt University, Nashville, TN
- 5/2016
- GPA: 3.97 (CS), 3.73 (Cumulative).

Awards and Honors

2021 One of the best papers of ICCPS 2021 – TCPS Special Issue.

Software

- StatResp: An open source toolset of statistical methods for emergency response that provides incident prediction, resource allocation, and dispatching tools for first-responders.

- Edge Traffic Analytics: A distributed framework for detecting vehicle and pedestrian flow through intersections using computer vision object detection and tracking.

Skills

- *Programming Languages*: (Proficient) Python, LaTeX. (Familiar) Java, C++, C, JavaScript
- *Frameworks and Tools*: Scikit-Learn, Git

Dissertation Title

Principled Algorithms for Real-time Sequential Decision Making for Large Scale Cyber-Physical Systems.

Teaching Experience

Fall 2022 **Invited Lecture**, Foundations of Hybrid and Embedded Systems, Vanderbilt University.
- Presented an introduction to Markov Decision Processes (MDP).
- Developed lecture materials that covered the definition of MDPs, important theory such as the Bellman equation, and introduced iterative MDP solution techniques.
- Connected MDPs to the course topics of embedded and cyber-physical systems (CPS), and discussed how I use MDPs in my research on sequential decision making for CPS.

Journal Publications

J1. Geoffrey Pettet, Ayan Mukhopadhyay, Mykel J. Kochenderfer, and Abhishek Dubey (Nov. 2021). "Hierarchical Planning for Dynamic Resource Allocation in Smart and Connected Communities". In: *ACM Trans. Cyber-Phys. Syst.* ISSN: 2378-962X.

J2. Ayan Mukhopadhyay, Geoffrey Pettet, Sayyed Mohsen Vazirizade, Di Lu, Alejandro Jaimes, Said El Said, Hiba Baroud, Yevgeniy Vorobeychik, Mykel Kochenderfer, and Abhishek Dubey (2022). "A Review of Incident Prediction, Resource Allocation, and Dispatch Models for Emergency Management". In: *Accident Analysis & Prevention* 165.C.

Refereed Conference Publications

C1. Michael Wilbur, Salah Kadir, Youngseo Kim, Geoffrey Pettet, Ayan Mukhopadhyay, Philip Pugliese, Samitha Samaranayake, Aron Laszka, and Abhishek Dubey (Apr. 2022). "An Online Approach to Solve the Dynamic Vehicle Routing Problem with Stochastic Trip Requests for Paratransit Services". In: *ACM/IEEE 13th International Conference on Cyber-Physical Systems (ICCPS)*. IEEE [**Acceptance Rate: 28** %].

C2. Geoffrey Pettet, Ayan Mukhopadhyay, Mykel Kochenderfer, and Abhishek Dubey (2021). "Hierarchical Planning for Resource Allocation in Emergency Response Systems". In: *Proceedings of the 12th ACM/IEEE International Conference on Cyber-Physical Systems, ICCPS 2021, Nashville, TN, USA* [**Acceptance Rate: 26** %].

C3. Sayyed Mohsen Vazirizade, Ayan Mukhopadhyay, Geoffrey Pettet, Said El Said, Hiba Baroud, and Abhishek Dubey (2021). "Learning Incident Prediction Models Over Large Geographical Areas for Emergency Response". In: *2021 IEEE International Conference on Smart Computing (SMARTCOMP)*, pp. 424–429 [**Acceptance Rate: 30** %].

C4. Geoffrey Pettet, Malini Ghosal, Shant Mahserejian, Sarah Davis, Siddharth Sridhar, Abhishek Dubey, and Michael Meyer (2020). "A Decision Support Framework for Grid-Aware Electric Bus Charge Scheduling". In: *2020 IEEE Power & Energy Society Innovative Smart Grid Technologies Conference (ISGT)*. IEEE [**Acceptance Rate Unknown**].

C5. Geoffrey Pettet, Ayan Mukhopadhyay, Mykel Kochenderfer, Yevgeniy Vorobeychik, and Abhishek Dubey (2020). "On Algorithmic Decision Procedures in Emergency Response Systems in Smart and Connected Communities". In: *Proceedings of the 19th Conference on Autonomous Agents and MultiAgent Systems, AAMAS 2020, Auckland, New Zealand* [**Acceptance Rate: 23** %].

C6. Ayan Mukhopadhyay, Geoffrey Pettet, Chinmaya Samal, Abhishek Dubey, and Yevgeniy Vorobeychik (2019). "An online decision-theoretic pipeline for responder dispatch". In: *Proceedings of the 10th ACM/IEEE International Conference on Cyber-Physical Systems, ICCPS 2019, Montreal, QC, Canada*, pp. 185–196 [**Acceptance Rate: 23** %].

C7. Geoffrey Pettet, Saideep Nannapaneni, Benjamin Stadnick, Abhishek Dubey, and Gautam Biswas (2017). "Incident analysis and prediction using clustering and Bayesian network". In: *2017 IEEE SmartWorld*, pp. 1–8 [**Acceptance Rate: 28** %].

Refereed Workshop Publications

W1.   Geoffrey Pettet, Ayan Mukhopadhyay, and Abhishek Dubey (2022). "Decision Making in Non-Stationary Environments with Policy-Augmented Monte Carlo Tree Search". In: *The 5th Multi-disciplinary Conference on Reinforcement Learning and Decision Making*, pp. 490–494.

W2.   Geoffrey Pettet, Hunter Baxter, Sayyed Mohsen Vazirizade, Hemant Purohit, Meiyi Ma, Ayan Mukhopadhyay, and Abhishek Dubey (2022). "Designing Decision Support Systems for Emergency Response: Challenges and Opportunities". In: *Workshop on Cyber Physical Systems for Emergency Response in conjunction with CPS-IOT Week 2022*.

W3.   Geoffrey Pettet, Saroj Sahoo, and Abhishek Dubey (2019). "Towards an Adaptive Multi-Modal Traffic Analytics Framework at the Edge". In: *IEEE International Conference on Pervasive Computing and Communications Workshops, PerCom Workshops 2019, Kyoto, Japan, March 11-15, 2019*, pp. 511–516.

W4.   Jose Paolo Talusan, Francis Tiausas, Keiichi Yasumoto, Michael Wilbur, Geoffrey Pettet, Abhishek Dubey, and Shameek Bhattacharjee (2019). "Smart Transportation Delay and Resiliency Testbed Based on Information Flow of Things Middleware". In: *IEEE International Conference on Smart Computing, SMARTCOMP 2019, Washington, DC, USA, June 12-15, 2019*, pp. 13–18.

W5.   Scott Eisele, Geoffrey Pettet, Abhishek Dubey, and Gabor Karsai (2017). "Towards an architecture for evaluating and analyzing decentralized Fog applications". In: *IEEE Fog World Congress, FWC 2017, Santa Clara, CA, USA, October 30 - Nov. 1, 2017*, pp. 1–6.

Posters and Demonstrations

D1.   Geoffrey Pettet, Ayan Mukhopadhyay, and Abhishek Dubey (2022). "Decision Making in Non-Stationary Environments with Policy-Augmented Monte Carlo Tree Search". In: *The 5th Multi-disciplinary Conference on Reinforcement Learning and Decision Making*, pp. 490–494.

D2.   Geoffrey Pettet, Ayan Mukhopadhyay, Chinmaya Samal, Abhishek Dubey, and Yevgeniy Vorobeychik (2019). "Incident management and analysis dashboard for fire departments: ICCPS demo". In: *Proceedings of the 10th ACM/IEEE International Conference on Cyber-Physical Systems, ICCPS 2019, Montreal, QC, Canada*, pp. 336–337.

Presentations

P1.   Geoffrey Pettet, Hunter Baxter, Sayyed Mohsen Vazirizade, Hemant Purohit, Meiyi Ma, Ayan Mukhopadhyay, and Abhishek Dubey (2022). "Designing Decision Support Systems for Emergency Response: Challenges and Opportunities". In: *Workshop on Cyber Physical Systems for Emergency Response in conjunction with CPS-IOT Week 2022*

P2.   Geoffrey Pettet, Ayan Mukhopadhyay, Mykel Kochenderfer, and Abhishek Dubey (2021). "Hierarchical Planning for Resource Allocation in Emergency Response Systems". In: *Proceedings of the 12th ACM/IEEE International Conference on Cyber-Physical Systems, ICCPS 2021, Nashville, TN, USA*.

P3. Geoffrey Pettet, Malini Ghosal, Shant Mahserejian, Sarah Davis, Siddharth Sridhar, Abhishek Dubey, and Michael Meyer (2020). "A Decision Support Framework for Grid-Aware Electric Bus Charge Scheduling". In: *2020 IEEE Power & Energy Society Innovative Smart Grid Technologies Conference (ISGT)*. IEEE.

P4. Geoffrey Pettet, Ayan Mukhopadhyay, Mykel Kochenderfer, Yevgeniy Vorobeychik, and Abhishek Dubey (2020). "On Algorithmic Decision Procedures in Emergency Response Systems in Smart and Connected Communities". In: *Proceedings of the 19th Conference on Autonomous Agents and MultiAgent Systems, AAMAS 2020, Auckland, New Zealand*.

P5. Geoffrey Pettet, Saroj Sahoo, and Abhishek Dubey (2019). "Towards an Adaptive Multi-Modal Traffic Analytics Framework at the Edge". In: *IEEE International Conference on Pervasive Computing and Communications Workshops, PerCom Workshops 2019, Kyoto, Japan, March 11-15, 2019*, pp. 511–516.

P6. Ayan Mukhopadhyay, Geoffrey Pettet, Chinmaya Samal, Abhishek Dubey, and Yevgeniy Vorobeychik (2019). "An online decision-theoretic pipeline for responder dispatch". In: *Proceedings of the 10th ACM/IEEE International Conference on Cyber-Physical Systems, ICCPS 2019, Montreal, QC, Canada*, pp. 185–196.

P7. Geoffrey Pettet, Saideep Nannapaneni, Benjamin Stadnick, Abhishek Dubey, and Gautam Biswas (2017). "Incident analysis and prediction using clustering and Bayesian network". In: *2017 IEEE SmartWorld*, pp. 1–8.