THE MONTHLY OPT-IN

AI4OPT Monthly Newsletter

Table of Contents

FROM THE DIRECTOR

AI4OPT is dedicated to addressing challenges related to energy systems, supply chains, resilience and sustainability, and circuit design and control. Working on these challenges often generates novel ideas and methodologies that have broad applicability beyond a specific use case. For example, AI4OPT researchers have developed "optimization proxies," the idea of replacing optimization problems with machine-learning models. Initially successful in power systems, optimization proxies are now being used to optimize logistic systems and assess supply chain risk. As a renowned leader in the field of AI and optimization research, AI4OPT publishes methodological contributions in top AI conferences, including NeurIPS, ICML, and AAAI, in esteemed optimization journals such as Operations Research, Mathematical Programming, and SIAM Journal on Optimization, and in leading journals in the application domains Through these publications, AI4OPT shares their latest research findings and innovations, all of which can be easily accessed on the Institute's new Google Scholar page.

This newsletter features a member spotlight on George Lan, who leads the “Decision Making under Uncertainty” research thrust. Prof. Lan both pushes the methodological frontiers in topics such as risk averse distributed optimization and convex multistage stochastic optimization, but also contributes to applications in food production and computer chip manufacturing. The student spotlight highlights Hanyu Zhang, who is using the latest technology in time series prediction to predict future solar and wind production, which is important for power systems that rely significantly on renewables.

- **Pascal Van Hentenryck**

MEMBER RESEARCH SPOTLIGHT

GET TO KNOW OUR MEMBERS

Guanghui (George) Lan spearheads the AI4OPT methodology thrust: Decision Making under Uncertainty. He is also an A. Russell Chandler III Professor of Industrial and Systems Engineering at Georgia Tech. His research focuses on designing efficient algorithms for optimization problems in data analytics, machine learning, and reinforcement learning. Lan serves as an associate editor for three leading journals in the area of optimization. He is also an associate director for the Center of Machine Learning at Georgia Tech.

AI4OPT Decision Making under Uncertainty

By George Lan

My work in the decision making under uncertainty methodology thrust includes a wide range of applications, such as sustainability, energy and manufacturing. Our primary goal is to make optimal decisions over a long period, even when the future is unknown. Collaborating with other AI4OPT thrusts is crucial to designing better process control systems that lead to the production of reliable renewable products. Currently, I am involved in three exciting projects that aim to advance the field of decision making under uncertainty.

Our first project focuses on developing stochastic optimization models and algorithms to solve stochastic problems over an infinite horizon. This involves developing algorithms that can handle a wide range of time horizons. Our team has developed a hierarchical multi-stage stochastic valuation model and algorithms to address these challenges, which is a significant advancement in our ability to tackle complex problems.

The second project involves developing distributionally robust Bayesian optimization (DRBO). The goal is to create a new approach to address uncertainty in decision making, which is a common challenge in many applications. This approach involves considering the worst-case scenario while also considering the probability distribution of possible outcomes.

The third project is uncertainty quantification for multi-stage optimization. This project involves developing techniques to quantify uncertainty in multi-stage decision-making problems. The challenge lies in the fact that the uncertainty can evolve over time, and the impact of the uncertainty may change as the decision-making process unfolds.

Along with these projects, we explore the advantages of converting waste into a valuable resource in our work on "Sustainability: Waste to Treasure." The process offers several advantages over conventional waste disposal methods, including land conservation, pollution reduction, and renewable energy production. However, the process faces challenges in feedstock supply and composition, as well as complex and non-linear process dynamics.

In addition, my work with Intel focuses on the chip fabrication process flow, which involves the entire process from bare silicon wafer to fab (wafer processing) to e-test/sort to package assembly to component test to ship to customer.

With limitless applications for decision making under uncertainty, I am excited to continue this work and explore new solutions to long-standing problems. By having continuous collaborating with partners, we can broaden the range of our applications and help more industries benefit from this methodology.

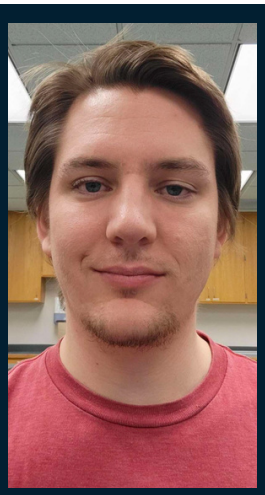
DEVELOPMENTS & ACCOMPLISHMENTS

WE TAKE PRIDE IN OUR WORK AND ACHIEVEMENTS

AI4OPT and the AI institute for Intelligent Cyberinfrastructure with Computational Learning in the Environment (ICICLE) have joined forces to optimize food logistics for the USDA-LFPA program's Tribal Elder Food Box initiative, which is operated by Feeding America in Wisconsin for the summer of 2023.

Two students from Victor Valley College (VVC) and their professor Michael Butros, who is a participant in the AI4OPT Faculty Training Program, will conduct research this summer with AI4OPT at Georgia Tech. Ruben Vegas and Brian Huie will be working alongside **Dan Molzahn**, a co-leading member of AI4OPT and an assistant professor in the School of Electrical and Computer Engineering, who specializes in electric power systems.

Ruben Vegas



Brian Huie

AI4OPT members recently published a report on the second CCC-INFORMS workshop on AI and OR, which they organized in Summer 2022. The report emphasizes the need for trustworthy AI and OR technology and discusses the importance of developing frameworks for evaluating their trustworthiness. To read, click **here**.

AI4OPT is excited to announce the upcoming visit of its external advisory board on May 10, 2023. This marks the first time the board will convene to provide guidance and direction for the institute's future initiatives in-person.

STUDENT HIGHLIGHTS

GET TO KNOW OUR STUDENTS

Meet **Hanyu Zhang**, a third-year Ph.D. student in machine learning at Georgia Tech. She is a member of the Energy System team and Supply Chain team at AI4OPT. Hanyu completed a Bachelor's degree in Mathematics at Oberlin College and a Master's degree in Operations Research at Georgia Tech.

Q: What is your research focus and how do you contribute to AI4OPT?

My research focuses on probabilistic time series forecasting and space-time scenario generation. I am interested in using these techniques to predict renewable energy production for power grids. Working with the Energy System and Supply Chain teams at AI4OPT has been a great opportunity to collaborate with others who share my passion for using AI to solve important challenges in the energy industry.

Q: What sparked your interest in AI and optimization or field of study?

During my undergraduate studies, my fascination with AI and optimization was ignited through playing a game called Cities: Skylines, which simulated the operation of a city and allowed me to plan my own power and transit systems. This experience led me to work on projects with the Beijing Subway, where I became interested in using time series forecasting to solve real-world transit problems related to ridership.

The complexity of high-dimensional time series and spatial-temporal correlations inherent in both transit and power systems presents an ongoing challenge and an area of great interest to me. I find this work both rewarding and challenging, and I remain committed to using my skills to tackle important challenges in these fields.

Q: What would you say is unique about your field of study?

I believe what sets my work apart is that it involves solving real-world problems with large-scale and complex data. Renewable energy is becoming increasingly important for power grids, and accurately forecasting its production is crucial for ensuring a sustainable and reliable energy system. My research focuses on probabilistic time series forecasting and uncertainty quantification for renewable energy production, which can help operators make more informed decisions about balancing supply and demand.

Q: What do you like to do for fun or to relax when you're not studying or conducting research?

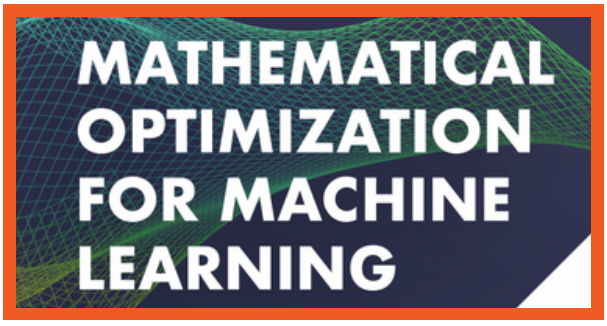
When I am not studying or conducting research, I like to unwind by playing video games on my self-built gaming PC. I also enjoy gardening and taking care of plants, particularly by growing ones from grocery store produce such as avocados, mangoes, and grapefruits. Additionally, watching cat videos on TikTok is always a great way for me to de-stress!

NEWS & PUBLICATIONS

CURATED COVERAGE OF OUR RESEARCH AND EVENT APPEARANCES

The **Spring 2023 AI4OPT Seminar Series** concludes. We would like to extend our thanks to all those who participated. We express our appreciation to our dedicated presenters and series coordinators, as well as those who participated in-person and virtually. The engagement has truly made this series a resounding success and we look forward to returning in the fall.

The **Pascal United** event, covered topics such as constraint programming, differential privacy, power systems, transportation, and supply chain management over two days. The concluding dinner, sponsored by the Seth Bonder Foundation, brought together partners, collaborators, researchers, and scientists passionate about the work of AI4OPT.



AI4OPT Director, Pascal Van Hentenryck is one of the external organizers of the workshop titled "**Exploring Synergies: Machine Learning Meets Physics & Optimization,**" took place April 26-28, 2023, at the Zuse Institute Berlin.

Publications

AI4OPT is contributing to methodological advances in AI and Optimization to enable impact in the end use cases of the Institute. Some examples include:

- Guanghui Lan and Zhe Zhang. Optimal Methods for Risk Averse Distributed Optimization. SIAM Journal on Optimization, page forthcoming, 2023. arXiv:2203.05117
- Michael Laskin, Hao Liu, Xue Bin Peng, Denis Yarats, Aravind Rajeswaran, and Pieter Abbeel. Unsupervised Reinforcement Learning with Contrastive Intrinsic Control. In Neural Information Processing Systems Conference, pages 34478–34491, 2022. NeurIPS Proceedings
- Wenbo Chen, Mathieu Tanneau, and Pascal Van Hentenryck. End-to-End Feasible Optimization Proxies for Large-Scale Economic Dispatch, 2023. arXiv:2304.11726

The latest AI4OPT publications are now available on Google Scholar.

MARK YOUR CALENDAR!

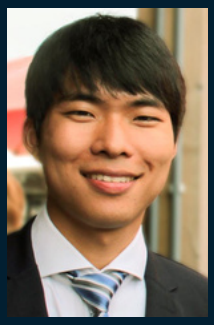
AI4OPT EVENT

Seminar on Exact Mixed-Integer Programming for Multi-Area Reserve Sizing

Date: May 18, 2023

Time: noon-1 p.m.

Location: 9th floor Atrium in Coda Building (756 W Peachtree St NW, Atlanta, GA 30308)



Speaker: **Jehum Cho,** a Ph.D. candidate at the Center for Operations Research and Econometrics (CORE), UCLouvain, under the supervision of **Anthony Papavasiliou**.

Cho's interests include electricity market design, renewable energy integration in power systems, distributed optimization, and stochastic programming.

LEARN MORE

CONFERENCE

AI4OPT will be attending the Institute of Industrial and Systems Engineers (IISE) Annual Conference & Expo Fri. May 19 - Mon, May 22 at the Hyatt Regency in New Orleans, LA.

Our members will showcase AI for engineering during the largest industrial and systems engineering event of the year and talk about our work in application to power systems and transportation.

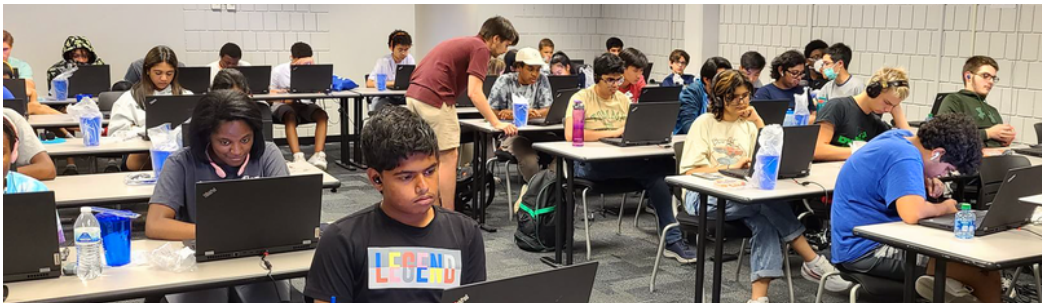
For more information, click **here**.

OUTREACH & EDUCATION

SHAPING THE FUTURE WITH STUDENT OPPORTUNITIES

The Seth Bonder Camp

We are excited to announce that the Seth Bonder Camp in Computational and Data Science for Engineering will be returning for the summer of 2023, both in an online format and on-campus at Georgia Tech. We look forward to welcoming a new cohort of enthusiastic high school students who are eager to learn about computational and data science in the context of industrial engineering and operations research. Whether you are a beginner or have some experience, we invite you to join us for a stimulating and practical experience that will help you better understand the exciting careers and opportunities in this field. To learn more, click on **Seth Bonder Camp**.



AI Communications Student Assistant (Hybrid/Mostly Remote)

AI4OPT Communications Director, Breon Martin is seeking a talented student assistant to help us showcase the exciting world of AI research happening right here at Georgia Tech. As an AI communications student assistant, you'll work with the NSF AI Institutes: AI4OPT, AI-ALOE, and AI-CARING. Your primary responsibilities will include crafting compelling stories, curating social media, and more.

- **Flexible hours**: 10 to 20 hours per week (works around class schedule)
- **Pay range**: $15
- **Start date**: ASAP

Find background information, **here**. Email a resume and samples of your work to **breon.martin@gatech.edu**.

CONNECT WITH US

Our objective is to enhance community engagement by leveraging cutting-edge AI and optimization technologies to tackle some of society's most pressing issues, including energy, logistics and supply chains, resilience, sustainability, circuit design, and control.

To stay up-to-date on our ongoing projects, research, and community events, we encourage you to subscribe and follow us. If interested in media relations or learning more about AI4OPT's research, education, and partnership initiatives, please don't hesitate to get in touch with us via email or phone. To learn more, click **here**.

Email, subscribe, and follow @AI4OPT to learn more!

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