THE MONTHLY OPT-IN

Table of Contents

*click page number/text to view

Scan/click QR code for all newsletters:

As we enter 2024, there's no denying that AI has had and will continue to have a profound impact on society. AI4OPT contributes to this shift by developing AI tools for significant engineering challenges, like constructing resilient and sustainable supply chains and enabling zero-emission power grids. But none of this technology can be deployed unless it is guaranteed to be safe and reliable. The concept of trustworthy AI has rightfully gained public attention and was the primary focus of President Biden's executive order to manage AI risks.

In this newsletter, Director Pascal Van Hentenryck explains how AI4OPT prioritizes trustworthiness. A spotlight is also cast on student Guancheng "Ivan" Qiu, who is developing methods to certify the quality of AI solutions. For those more visually inclined I also recommend the video on trustworthy AI that the Institute recently produced.

Effectively managing AI is worthwhile because numerous opportunities remain unexplored. This was evident at the AI4OPT TechFest, where industry professionals shared ideas about AI and optimization. There's also clear interest from the government too, as AI4OPT recently hosted US House Representative Rich McCormick and members of his staff to discuss AI possibilities. The Institute also met with the Belgian Agoria delegation and Consul General Gerebtzoff to talk about this topic. At all these events, the excitement about the future is palpable, which makes me believe we are in for a great 2024!

MEMBER SPOTLIGHT

Pascal Van Hentenryck is the A. Russell Chandler III Chair and Professor in the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) at the Georgia Tech and the Associate Chair for Innovation and Entrepreneurship. He is also the director of the NSF AI Institute for Advances in Optimization (AI4OPT) and the director of the Socially Aware Mobility (SAM and the Risk-Aware Market Clearing (RAMC) labs.

Engineering Approach to Trustworthy AI in Transformative Era

Trustworthy AI has been receiving increased attention since the release of ChatGPT, the executive order of the White House on AI, and the EU's AI act. The objective naturally is to ensure that AI technology, which is truly transformative, is deployed for the benefits of society and its people. Such issues are not new as eloquently communicated by a movie like "Oppenheimer" for a different type of technology.

At AI4OPT, trustworthiness is not negotiable, given the focus on engineering applications. AI technology should not bring down a power grid, create inventory shortages, or slow down manufacturing processes. The AI system must be trustworthy by design, and provides safety, reliability, and quality guarantees, as any other engineering systems. AI4OPT strives to bring this engineering mindset to the development of AI systems. Its research on optimization proxies provides a good illustration on AI4OPT approach to trustworthiness. An optimization proxy approximates an optimization problem, typically using a differentiable programming. Since this optimization proxy is intended to be deployed in complex infrastructures, it is critical that the approximation comes with guarantees on feasibility (satisfying engineering, physical, and business constraints), optimality (certifying how good the solution is), and reliability (ensuring that it is only used within the proper operating conditions). Uncertainty quantification, through innovative use of conformal predictions, is another thread in trustworthy AI in the Institute.

Watch AI4OPT: Optimization Proxies
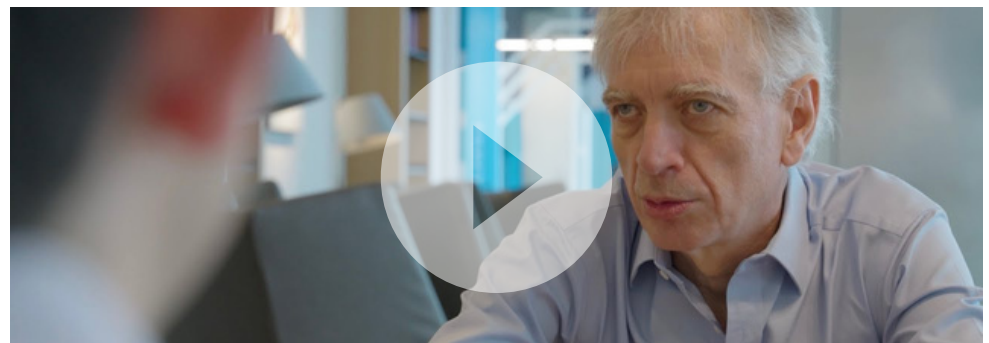
AI4OPT is engaged in substantial research on Trustworthy AI, addressing the above engineering requirements, as well as fundamental issues such as explainability, interpretability, and privacy. It is a challenging area, but one that is critical to address for the success of AI technologies.

ACCOMPLISHMENTS AND ANNOUNCEMENTS

The AI Institute for Advances in Optimization (AI4OPT) hosted its second annual industry day event, TechFest, which featured speakers and presentations from core industrial partners. The participating companies and their representatives included: Southern Company, Kinaxis, Union Pacific Railroad, Best Buy Beep, and GE Vernova. These companies and their representatives contributed to the event, showcasing their expertise and advancements in the intersection of artificial intelligence and mathematical optimization.

Researchers and staff of the Los Alamos National Laboratory (LANL) visited AI4OPT to discuss future collaboration in research as part of the Institutes strategic initiative in AI. **Read more...**

The **NeurIPS 2023** conference took place in December. It featured numerous posters and presentations by AI4OPT faculty and students. NeurIPS 2023, the 37th Annual Conference on Neural Information Processing Systems, was held at the Ernest N. Morial Convention Center in New Orleans.

The **2023 WLA Prize in Computer Science or Mathematics** was awarded to Arkadi Nemirovski and Yurii Nesterov for their significant contributions to convex optimization theory, including self-concordant functions, interior-point methods, optimization complexity theory, accelerated gradient methods, and methodological advances in robust optimization.

2023 VNN-COMP Award

Congratulations to the AI4OPT winners and participants of the 2023 VNN-COMP Award! Special recognition to Haoruo Zhao, Michael Klaminkin, Mathieu Tanneau, Wenbo Chen, Pascal Van Hentenryck, Hassan Hijazi, Juston Moore, and Haydn Jones from the Georgia ITech and LANL. Recognized in the Verification of Neural Networks Competition, at the 35th International Conference on Computer-Aided Verification, demonstrate excellence in formal methods and verification for neural networks. A big thank you to the Lu Jin Family Foundation and the VNN-COMP'23 organization team for supporting the awards.

STUDENT HIGHLIGHT

Meet **Guancheng "Ivan" Qiu**, a third-year Ph.D. student in Operations Research at Georgia Tech. Ivan works in the energy group of AI4OPT, advised by Director Pascal Van Hentenryck. His current work focuses on optimization proxies (machine learning models that predict solutions to optimization problems), mainly with applications in the power system. This has the potential to scale the use of optimization in the industry by significantly accelerating the generation of high-quality solutions.

Q: Could you please share more about your research focus and how you became involved with AI4OPT?

A: I first learned about AI4OPT from the news. The papers on the website of the lab, especially the ones on optimization proxies, were very intriguing to me. I also happened to have taken Pascal's class on constraint programming a while earlier, and I liked his enthusiasm. So, I emailed Pascal asking whether I could try working at the lab for a semester, and that was how it all started.

Why I find optimization interesting, or even applied math in general, is probably complicated and manifold. But I do remember a particular moment in my senior undergraduate year when I was working on a homework problem for an introductory optimization class and realized that I was learning to model and then improve potentially anything in real life. That was very exciting to me.

Q: What specific problems in optimization and AI are you working on, and how do you think your work will make a difference in our daily lives?

A: I believe we are in a critical stage of the development of optimization and AI. In the recent decades, more difficult and large-scale optimization problems are gradually becoming tractable in practice due to improvement in algorithms and computing power, but many useful problems remain out of reach, and the ones we can solve today are not always benign. Moreover, there simply seems to be infinite potential in applications of optimization to numerous fields. AI is also progressing at a daunting pace. Many believe it will transform our world more drastically than the Industrial Revolution, but there are probably also far more risks and challenges about AI than steam engines. Compared to the numerous future generations to come, today we are potentially still laying part of the foundation for these two technologies, and I feel like they would become central to our society very soon and remain so in the foreseeable future. I would like to make my share of contribution to this cause.

Q: Outside of your research work, what hobbies or activities do you enjoy?

A: I've played the piano for many years, but I started learning jazz only lately. I've also been more actively putting together band performances with friends. My recent goal is to produce a few good jazz recordings and performances.
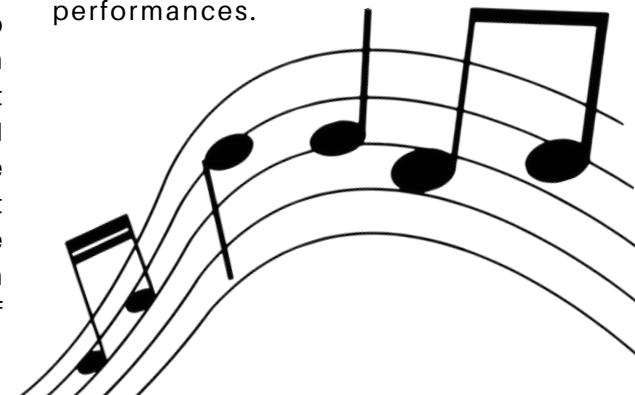
NEWS AND PUBLICATIONS

GA Congressman Explores AI4OPT's Innovations and Societal Impact

AI4OPT Director Engages in Discussions with Kinaxis Leadership at Headquarters

AI4OPT members participate in Belgian Delegation exploration of Atlanta's Tech Future

Publications

AI4OPT is creating trustworthy AI in a variety of ways. This includes developing real-time risk analysis tools, deriving performance guarantees, and detecting attacks on data integrity.

- Wenbo Chen, Mathieu Tanneau, and Pascal Van Hentenryck. Real-Time Risk Analysis with Optimization Proxies. arXiv:2310.00709, 2023.
- Guancheng Qiu, Mathieu Tanneau, and Pascal Van Hentenryck. Dual Conic Proxies for AC Optimal Power Flow. arXiv:2310.02969, 2023.
- Rachel Harris and Daniel K. Molzahn. Detecting and Mitigating Data Integrity Attacks on Distributed Algorithms for Optimal Power Flow using Machine Learning. Hawaii International Conference on System Sciences, 2024. handle:10125/106765

EVENTS AND CONFERENCES

EDUCATIONAL INITIATIVES AND WORK OF OUR MEMBERS

HerWILL Cutting-Edge Technology Workshop Series

A series of expert-led workshops on cutting edge technology that will keep job seekers relevant and in demand to not only help them survive, but thrive in the current public, private, and academic landscape. Our seasoned industry experts will guide you through hands-on sessions, providing valuable insights and practical skills that are essential in today's rapidly evolving tech landscape, covering topics such as Artificial Intelligence, Machine Learning, Cybersecurity, and more.

Collaborative Bridge Theme

Driven by its disciplinary diversity, AAAI has incubated numerous AI sub-disciplines and conferences and has nurtured for decades the cohesion of AI. New communities often emerge when two or more disciplines come together in order to explore new opportunities and perspectives; today, both are plentiful. The purpose of this year's Bridge Program is to tap into new sources of innovation by cultivating collaboration between two or more communities directed towards a common goal. Our interpretation of bridges is broad and encompasses disciplines within and outside of AI. Hence, the communities that our Bridge Program is intended to bring together could be distinct subfields of AI, such as planning and learning, or different disciplines that contribute to and benefit from AI, such as AI and the humanities.

AI4OPT Seminar Series

The AI4OPT Seminar Series is returning this year and will continue to feature seminars on a wide range of AI and mathematical optimization topics. The series, coordinated by its members, is now in its third year and it has hosted over 10 speakers around the country and world. It is open to the public. Artificial intelligence (AI) and machine learning (ML) majors, faculty and researchers are encouraged to attend.

OUTREACH AND EDUCATION

FACULTY TRAINING PROGRAM INVITES NEW PARTICIPATION

Faculty Training Program Update
(Cohort 2024 - 2026)

With the continued success of our first cohort Faculty Training Program (FTP), AI4OPT is now preparing interviews for the **2024-2026 cohort**. For more information about the FTP's Cohort 2022-2024 Progress, click **here**.

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 you are interested in media relations or learning more about AI4OPT's research, education, and partnership initiatives, please do not hesitate to get in touch with us via email or phone.

More about the FTP

The AI4OPT Faculty Training Program (FTP) provides faculty members from historically Black colleges and universities (HBCUs) and minority-serving institutions (MSIs), in the US, with courses in artificial intelligence (AI), data science, and course design to establish a minor or major data science program at their institutions. An ambitious undergraduate education initiative led by Charles Pierre, an associate professor in mathematics in the Department of Mathematical Sciences at Clark Atlanta University.

The FTP is structured into cohorts and cycles that span three academic years. During the initial two years, participants in the cohort will enroll in courses tailored to STEM professors with a mathematics background but no prior exposure to AI, developed by AI4OPT. Following two years of coursework, participants will have acquired sufficient AI knowledge to join regular courses offered at AI4OPT institutions, including the University of Southern California, UC Berkeley, and Georgia Tech.

Stay informed by subscribing to our newsletter and following @AI4OPT on social media!

Click here to subscribe to newsletter!