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The Inaugural Artificial Intelligence School for Computer Science and Operations Research Education (AI-SCORE)

By Lavanya Marla, Ferdinando Fioretto, Michael C. Fu, Sven Koenig, David Shmoys

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ORMS TODAY

The operations research (O.R.) and computer science (C.S.) communities have recently started cross-fertilizing their respective strengths in developing foundational methodological and computational tools for artificial intelligence (AI) – with the objective of enabling decision-making in a broad range of use-inspired problem domains, and striving to realize the full latent potential of progress in individual fields.

New methodologies that permit the automated integration of model-building (often a focus of O.R. approaches) and data-driven (often a focus of C.S. approaches) technologies have the potential to combine the best of both worlds to address problems that go beyond the current capabilities of either community. C.S.. Potential synergies run along multiple fronts, such as combining probabilistic planning and reasoning methods from both fields; combining the computational paradigms and methodological/algorithmic approaches from O.R. and C.S. to improve interpretability, trustworthiness and fairness in decision-making; and combining C.S. capabilities that can exploit massive data-driven methods with O.R. capabilities that can capture salient features of complex systems by using a model-based approach to drive effective decision-making.

Professional communities in both fields – namely, INFORMS, representing OR/MS professionals, and the Association for Computing Machinery (ACM) Special Interest Group on Artificial Intelligence (SIGAI), representing C.S. researchers – convened in workshops funded by the Computing Research Association's Computing Community Consortium (https://cra.org/ccc/), recommending a dedicated "school" to (1) train the next generation of

researchers to be dually conversant in both methodological traditions and (2) pose challenge problems that are positioned to excite researchers across the C.S.-O.R. spectrum to catalyze the kinds of advances that are possible.

The concept of the AI School for Computer Science and Operations Research Education (AI-SCORE) Summer School arose as a result of these ongoing efforts and discussions across the O.R. and C.S. communities. The inaugural program was held in College Park, Maryland, May 27-June 1, 2024, hosted by the Robert H. Smith School of Business, University of Maryland, and was generously sponsored by the National Science Foundation, ACM SIGACT (ACM Special Interest Group on Algorithms and Computation Theory), INFORMS, SIGAI, and AI Journal. The Summer School aimed to curate and present new ideas that integrate methodological advances at the interface of AI and O.R. to young researchers in both communities. It brought together carefully curated senior and mid-career experts, with topics. and tutorials interwoven across O.R. and C.S. communities. The School articulated the state-of-the-art research, as well as seeded future directions of cross-community research – the goal being not merely delivering the methodologies but conveying a perspective toward their integration from researchers working at the cutting edge. Moreover, experts jointly created tutorials and hands-on curated datasets or discussion themes aligned with the integration of the O.R. and C.S. The focus audience was early doctoral cohorts, and the goal was providing this next generation of C.S. and O.R. researchers with the tools to speak each other's language and concretely collaborate across disciplines. Lavanya Marla and Ferdinando Fioretto were the co-chairs of the Summer School, and Professors Michael Fu, Sven Koenig and David Shmoys advised the formation of the school.

We targeted first- and second-year Ph.D. students who completed their qualifying exams and were in the stage of identifying or having identified a thesis topic at the confluence of O.R. and C.S. Students interested in participating were asked to fill out a short application form. The cohort

group was restricted to allow for greater interaction and the formation of teams to work on hands-on exercises and foster long-term connections facilitating future collaborations. Eventually, about 16 students from both the O.R. and C.S. communities, with a total of 32 students, were chosen.

Inaugural class of AI-SCORE at Van Munching Hall, Smith School of Business, University of Maryland, College Park. Photo courtesy of Smith School of Business.

The first day of the inaugural AI-SCORE featured keynotes from eminent senior researchers. Professors Michael Fu, Kevin Leyton-Brown, Tuomas Sandholm and David Shmoys provided insightful overviews of the foundational concepts in O.R. and AI and highlighted the progress made in bridging these fields. The ensuing panel discussion, moderated by the Summer School chairs Lavanya Marla and Ferdinando Fioretto, involved a vibrant discussion with students on the future of the intersection of these areas, as well as practical and career aspects of blending the O.R. and AI communities.

The next four days of the School allowed for a deep dive into two specific topics. through modules, each involving a leading mid-career researcher from each of the O.R. and C.S. communities. The topics were chosen to represent two of three bridging perspectives at the C.S.-O.R. interface: (1) methodology-driven, (2) objective-driven and (3) application-driven. For 2024, the topics chosen were reinforcement learning and fairness, representing methodology-driven and objective-driven perspectives, respectively. The speakers complemented the tutorials with data-driven hands-on coding exercises or thematic discussions that illustrated the ideas in practice. The reinforcement learning module was led by Professors Vivek Farias and Scott Sanner on days 2 and 3, and the fairness module was led by Professors Siddhartha Banerjee and Aaron Roth on days 4 and 5. Professor Sven Koenig discussed reinforcement learning in the context of the 2024/2025 League of Robot Runners competition and inspired students to build on their knowledge from the Summer School.

The ideas covered by each instructor were chosen with the intent of discussing foundational as well as cutting-edge topics that had ample scope for novel research in the future. Approaching each module from both the O.R. and C.S. perspectives resulted in highlighting the complementarity between the theoretical, analytical and computational perspectives – often one field emphasizes approaching a topic from one perspective, whereas the other field has often adopted a complementary perspective.

The keynotes and two modules were well received and fostered active participation from students working in cross-disciplinary teams. This setup effectively promoted the exchange of ideas and active interaction and engagement from the students toward the development of new methodologies that leverage both model-building and data-driven approaches.

Overall, the goals of the AI-SCORE Summer School were achieved, as evidenced by the high level of engagement and solutions proposed by the participants. Student feedback was strongly positive, emphasizing the

excitement to bring O.R. and AI toward a common platform, and the need for further iterations of the school on other topics at the intersection.

Looking ahead, future iterations of the AI-SCORE Summer School are planned to continue fostering collaboration between the fields, with a focus on further integrating computational paradigms and algorithmic approaches to improve interoperability, trustworthiness and privacy in decision-making, and including (possibly) decision-making for intelligent robots and multimodal shared mobility, as well as tools that automate the process of integrating policy guidance and operational support for areas such as public health.


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Sven Koenig

Sven Koenig is Chancellor's Professor and Bren Chair at the University of California, Irvine. He is a fellow of the Association for the Advancement of Artificial Intelligence (AAAI), Association for Computing Machinery (ACM), Institute of Electrical and Electronics Engineers (IEEE) and American Association for the Advancement of Science (AAAS). See idm-lab.org for additional information.

David Shmoys

David Shmoys is the Laibe/Acheson Professor and director of the Center for Data Science for Enterprise & Society at Cornell University. He is a Fellow of INFORMS, ACM, SIAM and AAAS; and received the

2013 Lanchester Prize, 2018 Wagner Prize and 2024 Kimball Medal, all bestowed by INFORMS.

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