Using Machine Learning in Safety-Critical Applications: Setting a Research Agenda

Committee

George J. Pappas

Chair

George J. Pappas is the UPS Foundation Professor and Chair of the Department of Electrical and Systems Engineering at the University of Pennsylvania. He also holds a secondary appointment in the Departments of Computer and Information Sciences, and Mechanical Engineering and Applied Mechanics. He is a member of the GRASP Lab and the PRECISE Center. He has previously served as the Deputy Dean for Research in the School of Engineering and Applied Science. His research focuses on control theory, robotics, formal methods, and machine learning with cyber-physical applications such as safe autonomy. He is a Fellow of IEEE, IFAC, and has received various awards such as the Antonio Ruberti Young Researcher Prize, the George S. Axelby Award, the O. Hugo Schuck Best Paper Award, the National Science Foundation PECASE, and the George H. Heilmeier Faculty Excellence Award. Dr. Pappas received his Ph.D. in electrical engineering and computer science from the University of California, Berkeley.

Yiran Chen

Member

Yiran Chen is a Professor in the Department of Electrical and Computer Engineering at Duke University and serves as the director of the NSF AI Institute for Edge Computing Leveraging the Next-generation Networks (Athena) and the NSF Industry-University Cooperative Research Center (IUCRC) for Alternative Sustainable and Intelligent Computing (ASIC). His group focuses on the research of efficient and robust AI models, machine learning and neuromorphic computing, and mobile computing systems. Dr. Chen has published 1 book and more than 500 technical publications and has been granted 96 US patents. He is now serving as the Editor-in-Chief of the IEEE Circuits and Systems Magazine. He received 9 best paper awards, 1 best poster award, and 15 best paper nominations from reputable international conferences and workshops. He received numerous awards for his technical contributions and professional services such as the IEEE Computer Society Edward J. McCluskey Technical Achievement Award, ACM SIGDA Service Award, etc. He is a Fellow of the ACM, IEEE, and AAAS, and now serves as the chair of ACM SIGDA. Dr. Chen received his Ph.D. in computer and electrical engineering from Purdue University.

Thomas G. Dietterich

Member

Thomas Dietterich, NAE, is Distinguished Professor Emeritus in the School of Electrical Engineering and Computer Science at Oregon State University. Dietterich is one of the pioneers of the field of Machine Learning and has authored more than 200 refereed publications and two books. His current research topics include robust artificial intelligence, robust human-AI systems, and applications in sustainability. Dietterich has devoted many years of service to the research community and was recently given the ACML Distinguished Contribution and the AAAI Distinguished Service awards. He is a former President of the Association for the Advancement of Artificial Intelligence and the founding president of the International Machine Learning Society. Other major roles include Executive Editor of the journal Machine Learning, co-founder of the Journal for Machine Learning Research, and program chair of AAAI 1990 and NIPS 2000. He currently serves as one of the moderators for the cs.LG category on arXiv. Dr. Dietterich received his Ph.D. in computer science from Stanford University.

Matthew Gaston

Member

Matthew Gaston is the director of the Artificial Intelligence Division at the Carnegie Mellon University Software Engineering Institute. He also holds an appointment as an Adjunct Associate Professor in the Software and Societal Systems Department in the School of Computer Science at Carnegie Mellon University. As the director of the AI Division, Dr. Gaston leads a diverse team of researchers, engineers, and innovators who assist the US Department of Defense in developing and using AI capabilities that are reliable, responsible, safe, fair, and transparent. He is a leader of the community-wide National AI Engineering Initiative focused on establishing and growing the discipline of AI Engineering. Dr. Gaston has over 25 years of experience at the intersection of advanced technology development and national security including serving in the United States Air Force, ten years at the National Security Agency, serving on advisory boards for research at national laboratories, and leading research and development activities across the community. He has published in the fields of complex networks, machine learning, multi-agent systems, and operations research. Dr. Gaston received the AFCEA Meritorious Service to the Intelligence Community Award, is a graduate of Leadership Pittsburgh, and was a founding trustee of Awesome Pittsburgh. Dr. Gaston received his Ph.D. in computer science from the University of Maryland, Baltimore County.

Anouck Girard

Member

Anouck Girard is a Professor of Robotics and Aerospace Engineering at the University of Michigan, Ann Arbor. Her current research interests include vehicle dynamics and control, as well as optimal decision systems, with applications to autonomous vehicles, cooperative control, autonomy, resource allocation, planning, maneuver coordination and control of vehicles, mobile ground, air, space and ocean robots, flapping-wing vehicles, and foiling America's Cup class catamarans. Dr. Girard is a recipient of the Silver Shaft Teaching Award from the University of Michigan and a Best Student Paper Award from the American Society of Mechanical Engineers and was a Fulbright Scholar at the Technical University of Crete in 2022. She has co-authored the book Fundamentals of Aerospace Navigation and Guidance (Cambridge University Press, 2014). Dr. Girard received her Ph.D. degree in ocean engineering from the University of California, Berkeley.

Robert (Bob) Griffin

Member

Robert (Bob) Griffin is the Director of IBM's Corporate Product Safety and Hardware Compliance mission and is an IBM Sr Technical Staff member (STSM). He has responsibility for direction and compliance of all business units globally in highly regulated domains related to the safety of products, networks, telecommunication systems, and the electromagnetic environment. Bob has worked in the ICT industry and with his peers in industry and consortia in the US and Europe for more than 30 years. He is a recognized thought leader for disciplines including Hazard-based safety engineering, positive regulatory practices, technical standards and the interplay of standards, conformity assessment and regulation that frames today's complex technical regulatory domains. Externally he serves both IBM and US as a member of the US National Committee to the IEC (International Electrotechnical Committee) where he is the US Technical Advisor for the Information and Communications Technologies (ICT) and Consumer Electronics Industries. Internationally he chairs IEC TC108 and convenes its largest working group with a mission to develop product safety standards for the Information Technology, Communications and Consumer products industries. Previously, he co-chaired the Technical Program Committee for the IEEE’s International Product Compliance Symposiums from 2007 to 2011. Mr. Griffin received his B.S. in electrical engineering from North Carolina State University.

Jonathan P. How

Member

Jonathan P. How is the Richard C. Maclaurin Professor of Aeronautics and Astronautics at the Massachusetts Institute of Technology. His research focuses on safe and robust planning and learning under uncertainty with an emphasis on multiagent systems, and he was the planning and control lead for the MIT DARPA Urban Challenge team in 2007. His work has been recognized with multiple awards, including being inducted into the University of Toronto Engineering Hall of Distinction (2022), the 2020 IEEE CSS Distinguished Member Award, and the 2020 AIAA Intelligent Systems Award. He is a Fellow of IEEE (2018) and AIAA (2016) and was elected to the National Academy of Engineering in 2021. Dr. How received a B.A.Sc. (aerospace) from the University of Toronto in 1987, and his S.M. and Ph.D. in Aeronautics and Astronautics from MIT in 1990 and 1993, respectively.

Ashley J. Llorens

Member

Ashley Llorens serves as Vice President and Management Director at Microsoft Research (MSR) where he leads MSR engagement with the rest of Microsoft and with the broader science and technology community through high-ambition collaborative research initiatives and engagement programs. Prior to joining Microsoft, Ashley served as the founding chief of the Intelligent Systems Center at the Johns Hopkins Applied Physics Laboratory (APL), where he directed research and development in artificial intelligence (AI), robotics and neuroscience. As a recognized expert in AI and autonomous systems, Ashley has served on advisory boards and strategic studies for the U.S. Department of Defense, the U.S. Department of Energy and the National Academy of Sciences. Ashley currently serves as a member of the National AI Advisory Committee, which advises the President and White House on matter relating to AI, and of the Defense Science Board. Ashley received his M.S. in Electrical and Computer Engineering from the University of Illinois in Urbana-Champaign.

Lydia Tapia

Member

Lydia Tapia is the Chair of the Computer Science Department at the University of New Mexico. Her research contributions are focused on the development of computationally efficient algorithms for the simulation and analysis of high-dimensional motions. Her primary expertise is in the integration of machine learning for the planning and control of automated motions and tasks in robotics and computational biology domains. Lydia is the recipient of the 2016 Denice Denton Emerging Leader ABIE Award from the Anita Borg Institute, a 2016 National Science Foundation CAREER Award, and the 2017 Computing Research Association Committee on the Status of Women in Computing Research (CRA-W) Borg Early Career Award. She was a Computing Innovations Postdoctoral Fellow at the University of Texas at Austin. Dr. Tapia received her Ph.D. in Computer Science from Texas A&M University.

Aidong Zhang

Member

Aidong Zhang is currently a full professor of Computer Science in the School of Engineering and Applied Sciences at University of Virginia (UVA). She also holds joint appointments with the Department of Biomedical Engineering and School of Data Science at University of Virginia. Dr. Zhang served as a program director as National Science Foundation from 2015 to 2018. Dr. Zhang’s research interests include machine learning, data science, bioinformatics, and health informatics. Dr. Zhang has authored more than 380 refereed publications, including several major conference venues such as NeurIPS, KDD, WWW, IJCAI, AAAI, etc. She was the Editor in-Chief of the IEEE/ACM Transactions on Computational Biology and Bioinformatics (TCBB) from 2017 to 2021 and was General Co-Chair for ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD2022). Dr. Zhang is a fellow of ACM (Association for Computing Machinery), AIMBE (the American Institute for Medical and Biological Engineering), and IEEE (Institute of Electrical and Electronics Engineers). Dr. Zhang received her Ph.D. in computer science from Purdue University.