# UK ROBOTICS SUMMER SCHOOL EDINBURGH

More information can be found at https://ukrss.site.hw.ac.uk/

Location: Room G01, Postgraduate Centre, Heriot-Watt University (2nd to 6th June)

Date: 2nd - 6th June 2025

**Monday 2nd June – Reasoning, control, collaboration, and learning in robotics**

**08:30 – 09:00 Refreshments**

09:00 – 09:10 Introduction to Summer School, Yvan Petillot, Heriot-Watt University

9:10 – 10:30 Planning in robotics, Ron Petrick, Heriot-Watt University

**10:30 – 11:00 Refreshments**

11:00 – 12:30 Agile and Versatile Robots: Real-Time Optimization for Planning, Control, and Estimation, Carlos Mastalli, Heriot-Watt University and Sergi Martinez, Heriot-Watt University

**12:30 – 13:30 Lunch**

13:30 – 15:00 Integrated reasoning, control, collaboration, learning, Mohan Sridharan, University of Edinburgh

**15:00 – 15:30 Refreshments**

15:30 – 16:00 Economics, society, ethics, robotics and AI, Cristina Tealdi, Heriot-Watt University

16:00 – 17:00 Responsible Research and Innovation /Equality Diversity and Inclusion in robotics and AI round table discussion. Short talks to set the scene followed by a panel style Q&A with the audience, Ioannis Konstas, Heriot-Watt University, Thusha Rajendran, Heriot-Watt University, Cristina Tealdi, Heriot-Watt University

**Tuesday 3rd June - Bioinspired Robotics**

**08:30 – 09:00 Refreshments**

09:00 – 10:30 Bioinspiration – why and how and research highlights, Barbara Webb, University of Edinburgh

**10:30 – 11:00 Refreshments**

11:00 – 12:30 Robot building workshop – connecting sensing to action, Barbara Webb, University of Edinburgh

**12:30 – 13:30 Lunch**

13:30 – 15:00 The robot zoo – surveying the landscape of bioinspiration, participants will present

---

17:00 – 18:15 Tour of the Bayes Centre, Mohan Sridharan, University of Edinburgh. Students meet outside the Bayes Centre, 47 Potterrow, Edinburgh. EH8 9BT

18:30 – 20:30 Summer School Dinner (Sponsored by the UK-RAS Network) at Café Andaluz, 10-11 George IV Bridge, Edinburgh EH1 1EE.

**Wednesday 4th June - Generative AI for Robotics**

**08:30 – 09:00 Refreshments**

09:00 – 10:30 Introduction to Generative AI for Robotics, Oliver Lemon, Heriot-Watt University and Alessandro Suglia, Heriot-Watt University

**10:30 – 11:00 Refreshments**

**11:00 – 12:30** Fundamentals of Generative AI, Alessandro Suglia, Heriot-Watt University

**12:30 -13:30 Lunch**

13:30 – 15:00 Multimodal Generative AI for Robotics and/or practical session using AutoGen, LeRobot, Oliver Lemon, Heriot-Watt University and Alessandro Suglia, Heriot-Watt University

**15:00 – 15:30 Refreshments**

15:30 – 16:15 Invited online talk, Georgia Chalvatzaki, TU Darmstadt

Bio: https://www.ias.informatik.tu-darmstadt.de/Team/GeorgiaChalvatzaki

16:15 – 17:00 Why is language an embodied problem? Yonatan Bisk, Carnegie Mellon University

Abstract: We all speak, gesture, and communicate every day, so it may come as naturally to us as walking or breathing, but it's actually a rather unique ability. We all agree on the meaning of words without thinking about it, we construct novel combinations that others have never heard before and yet they have no trouble understanding us, and we want in the future that our computers and robots can do the same. So, where did we learn the meaning of words? And how does that help us teach robots to understand language? The goal of this talk is to provide an introduction to thinking about Talking to Robots, what makes it interesting, what makes it hard, and what the next steps are for AI.

Bio: Yonatan Bisk is an assistant professor of computer science at Carnegie Mellon University – Language Technologies Institute and Robotics Institute (courtesy). He received his PhD from the University of Illinois at Urbana-Champaign working on unsupervised Bayesian models of linguistic syntax. He runs the CLAW lab, Connecting Language to Action and the World. His group works on grounded and embodied language and communication, placing perception and interaction as central to how language is learned and understood. He has held appointments at USC's ISI (working on grounding), the University of Washington (for commonsense research), Microsoft Research (for vision+language), and Meta Inc (for Embodied AI). Website: http://www.yonatanbisk.com

17:00 – 17:45 Embracing Language as Grounded Communication, Jesse Thomason, University of Southern California

Abstract: Language is not text data, it is a human medium for communication. The larger part of the natural language processing (NLP) community has doubled down on treating digital text as a sufficient approximation of language, scaling datasets and corresponding models to fit that text. In this talk, I'll highlight some of the ways my lab enables agents and robots to better understand and respond to human communication by considering the

grounded context in which that communication occurs, including neurosymbolic multimodal reasoning, natural language dialogue and interaction for lifelong learning, and utilizing NLP technologies on non-text communication.

Bio: I am an Assistant Professor at the University of Southern California where I lead the Grounding Language in Actions, Multimodal Observations, and Robots (GLAMOR) Lab. Our research enables agents and robots to better understand and respond to human language by considering the grounded context in which that language occurs. Previously, I was a postdoctoral researcher at the University of Washington, and I received my PhD from UT Austin. Website: https://jessethomason.com/

**Thursday 5th June - Human robot interactions**

**08:55 – 09:25 Refreshments**

09:25 – 09:30 Welcome

09:30 – 10:00 Developing Social Robots, PAL Robotics

10:00 – 11:00 Interactive Activities with PAL Robots, Severin Lemaignan, PAL Robotics

**11:00 – 11:30 Refreshments**

11:30 – 12:30 Getting Comfortable around Humans: A Path for Close and Physical Human-Robot Collaboration, Louis Figueredo, Nottingham University. (30 mins talk, 10mins Qs, 20mins interactive session on a topic chosen by the speaker)

**12:30 – 13:30 Lunch**

13:30 – 14:30 Multimodal Transparency in Human-Robot Interaction: From Perception to Explanation, Elmira Yadollahi, Lancaster University (30 talk, 10 mins Qs, 20 mins interactive session on a topic chosen by the speaker)

14:30 – 15:00 HealthCare Robotics, Lynne Baillie, Heriot-Watt University. (20mins talk, 10mins Qs)

**15:00 – 15:30 Refreshments**

15:30- 16:15 Robot Tour for users with Visual Impairment, Shenando Stals

16:15 – 16:45 Panel on issues and solutions to developing social robots for particular user

groups, Sight Scotland Panel Chair and all speakers

16:45 Thanks and Depart

**Friday 6 June - Validation and verification of AI and National Robotarium Tour**

*NB. The afternoon refreshments at 14:30 will take place at the National Robotarium*

**08:30 – 09:00 Refreshments**

9.00 – 9:10 Welcome, schedule for the morning session

9.10-9.50 - Formal Verification for Autonomous Systems with Machine Learning Components, Ekaterina Komendantskaya, Heriot-Watt and Southampton University

Abstract: This lecture will give an overview of the main trends in formal verification of autonomous systems with machine learning components, including most popular tools currently available and the leading international competitions and benchmarks. The main emphasis will be on usability of the available technologies from the perspective of Robotics applications. The second part of the talk will give a summary of the course we teach on this topic, as part of the CDT on Dependable and Deployable AI for Robotics. The talk will end with reflection of best ways to adopt formal methods in Robotics, from training and research perspectives. Related Materials: https://vehicle-lang.github.io/tutorial/

Bio: Ekaterina Komendantskaya is a professor at Heriot-Watt and Southampton universities. Her research is dedicated to neuro-symbolic methods; most recently — to applications of formal methods in verification of machine learning and of complex systems with machine learning components. She has published over 90 papers in international venues, including CAV, ESOP, ITP, AAAI, ICLP, PPDP; has given dozens of invited talks, including most recently at Newton Institute Cambridge, Imperial College London, Dagstuhl, PADL, TYPES, PPDP. She has been in the PC of main Logic and Programming Language conferences (POPL, LICS, ESOP, ICFP, ICLP, FLOPS, PPDP, PADL), and has been serving as a PC chair of PPDP19, PADL'20, MPC'22, FLOPS'26, ITP'26. She has held individual and collaborative research grants to the total value of £ 16 million. Currently, she is an ``ARIA Creator'' in the Mathematics for Safe AI project run by ARIA, the Advanced Research and Innovation Agency. She is a CoI and lead of Verification training in the CDT on Dependable and Deployable AI for Robotics, Edinburgh, UK.

9.50 - 10.10 - Colin Kessler, PhD student, Edinburgh Centre for Robotics, Neural Network Verification for Gliding Drone Control Colin Kessler, Heriot-Watt University and the University of Edinburgh

Abstract: This talk will outline a novel case study on the verification of centimetre-scale bio-inspired drones equipped with neural network controllers, using neural network verification and reachability tools. These systems pose unique safety and robustness challenges due to their small size and complex aerodynamics, yet the evaluated tools and methods could be generally applied to other neural network controlled dynamic systems. The main focus will be on the applicability of cutting-edge tools and methods, demonstrating how they both facilitate and limit formal evaluations of safety and robustness.

Bio: Colin Kessler is a PhD student at the Edinburgh Centre for Robotics. His research focuses on the simulation and control of bio-inspired microgliders, particularly on investigating robustness and safety properties of neural network controllers. He earned his degree in Mechanical Engineering from the University of Edinburgh in 2023 and has experience in systems and software engineering.

10.10 - 10.30 - Verifying NLP Systems: Challenges and Emerging Approaches, Marco Casadio, PhD student, Heriot-Watt University.

Abstract: As language technologies become integral to safety-critical applications (e.g. medical assistants or chatbots), the need for reliable, verifiable NLP systems is growing. Yet, most progress in neural network verification has focused on vision, leaving NLP comparatively under-explored. This talk will give a high-level overview of what makes verification of NLP models particularly difficult: from the structure of language inputs, to the opacity of embeddings (embedding-gap) and the instability of model behaviour. I'll outline some of the techniques we've explored to address these issues, and reflect on where existing verification methods fall short.

Bio: Marco is a PhD student at Heriot-Watt University. His interests involve verification and machine learning and his research focuses on applying and adapting verification techniques in Natural Language Processing problems and systems.

**10.30 - 11.00 Refreshments**

11.00 - 11.45 - Restrictions in practice, the extent to which AI is trusted with decisions in industrial automation examples, Michael Williams, SLB Research Cambridge.

Abstract: This lecture will give an industrial perspective on AI Safety. SLB operates in the highly regulated and safety conscious energy services sector. This talk will highlight fully autonomous directional drilling and the successful examples of trusted decision-making. It will outline the SLB approach to automation including identification of the responsible person, and their role in trust. A number of examples where AI and automation have made exciting proof-of-concept but remain short of the standard required for the industry will also be shared. Reasons for this shortfall will be speculated and presented as challenges in verifiable, explainable and auditable AI.

Bio: Michael John Williams is a Principal Research Scientist at SLB Research in Cambridge. His research focusses on supporting decision-making in energy sector problems. This involves developing statistical, physical and logical techniques and defining integration approaches that enable trusted automation. He has published over 70 patents, conference and journal papers on a wide range of topics and acts as an industrial member on a number of technical advisory boards for UKRI and universities.

11.45 - 12.30 - Safety Verification of Vision-based Learning-Enabled CPS, Chao Huang, Southampton University.

Abstract: In recent years, cyber-physical systems (CPS) have increasingly relied on learning-based controllers to navigate and operate within complex environments. Many of these controllers are implemented as neural networks that process sensor data to make real-time decisions. Given the safety-critical nature of numerous applications utilizing neural network-controlled autonomous systems, e.g., autonomous vehicles, it is imperative to ensure their safety through formal verification. In this presentation, I will begin by discussing our previous work on the formal verification of simple neural network-controlled systems, where the system state is assumed to be known precisely at each step by the controller. Following this, I will introduce our latest research, which addresses scenarios where image-based inputs, such as those provided by a camera, are used to perceive the environment—such as in the case of Tesla's systems, through abstraction and conformal prediction. Lastly, I will highlight the remaining challenges in ensuring the safety of such complex systems.

Bio: Dr. Chao Huang is Associate Professor in CPS at University of Southampton, UK. Prior to Southampton, he served for the Department of Computer Science at the University of

Liverpool as a Lecturer. His research interests include safety-oriented learning and verification of machine learning algorithms, in particular reinforcement learning, as well as their applications in robotics, transportation, etc.

**12.30 – 13:30 Lunch**

13:30 - 14:30 The UK-RAS Network; an overview of activities and opportunity to engage, Andy Weightman, University of Manchester

**14:30 – 15:00 Refreshments (Go to the National Robotarium)**

**15:00 - 17:00** Exhibits and demonstrations in Atrium and a Tour of the National Robotarium.