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Keynote

Michael Bronstein

Biographical Note

Michael Bronstein is the DeepMind Professor of AI at the University of Oxford and Head of Graph Learning Research at Twitter. He was previously a professor at Imperial College London and held visiting appointments at Stanford, MIT, and Harvard, and has also been affiliated with three Institutes for Advanced Study (at TUM as a Rudolf Diesel Fellow (2017-2019), at Harvard as a Radcliffe fellow (2017-2018), and at Princeton as a short-time scholar (2020)). Michael received his PhD from the Technion in 2007. He is the recipient of the Royal Society Wolfson Research Merit Award, Royal Academy of Engineering Silver Medal, five ERC grants, two Google Faculty Research Awards, and two Amazon AWS ML Research Awards. He is a Member of the Academia Europaea, Fellow of IEEE, IAPR, BCS, and ELLIS, ACM Distinguished Speaker, and World Economic Forum Young Scientist. In addition to his academic career, Michael is a serial entrepreneur and founder of multiple startup companies, including Novafora, Invision (acquired by Intel in 2012), Videocites, and Fabula AI (acquired by Twitter in 2019).

Keynote

Employing Immersive Virtual Reality to Reveal Principles of Decision-Making

Iain Couzin

Abstract
I will discuss our development and application of new technologies for automated tracking and identification of unmarked individuals, computational sensory reconstruction, bio-mimetic robotics, and 'holographic' virtual reality (VR) for animals, and demonstrate how these quantitative methodologies provide new insights into individual and collective sensing and decision-making. For example, they allow us to reconstruct (automatically) the dynamic, time-varying sensory networks in large animal collectives, to identify at any instant in time the most socially-influential individuals within groups, and to predict cascades of social contagion (behavioral change) before they actually occur. Furthermore, such methodologies enable us to study phenomena across multiple scales of biological organization, from neural interactions to individual and collectives decision-making. Specifically, we have recently investigated how animals choose among spatial discrete options, a central challenge in their lives. Employing an integrated theoretical and experimental approach (using immersive VR), we find that the brain spontaneously reduces multi-choice decisions into a series of abrupt (critical) binary decisions in space-time, a process that repeats until only one option—the one ultimately selected by the individual—remains. This mechanism facilitates highly accurate decision-making, and is shown to be robust both to the number of options available, and to context. Finally, I will show that reverse-engineering evolved solutions can provide new design principles for engineered systems. Employing three considerably different physical robotic platforms—terrestrial vehicles, airborne drones and watercraft—it will be demonstrated that the evolved biological controller, as revealed by VR, provides highly effective performance in all scenarios, utilizing very close to optimal control energy, while requiring no system-specific tuning, and with minimal sensing and computational requirements.

Biographical Note
Iain Couzin is Director of the Max Planck Institute of Animal Behavior and Speaker of the Excellence Cluster "Centre for the Advanced Study of Collective Behaviour" at the University of Konstanz, Konstanz, Germany. Previously he was an Assistant- and then Full-Professor in the Department of Ecology and Evolutionary Biology at Princeton University, and prior to that a Royal Society University Research Fellow in the Department of Zoology, University of Oxford, and a Junior Research Fellow in the Sciences at Balliol College, Oxford. His work aims to reveal the fundamental principles that underlie evolved collective behavior, and consequently his research includes the study of a wide range of biological systems, from neural collectives to insect swarms, fish schools and primate groups. In recognition of his research he has been recipient of the Searle Scholar Award in 2008, top 5 most cited papers of the decade in animal behavior research 1999-2010, the Mohammed Dahleh Award in 2009, Popular Science's "Brilliant 10" Award in 2010, National Geographic Emerging Explorer Award in 2012, the Scientific Medal of the Zoological Society of London in 2013, a Web of Science Global Highly Cited Researcher since 2018, the Lagrange Prize in 2019, and the Falling Walls Life Sciences Award and the Gottfried Wilhelm Leibniz Prize in 2022.

Keynote

Towards Systems that Learn by Themselves

Paolo Favaro

Abstract
The ultimate goal of AI is to build systems that act rationally. Towards this goal it is necessary to think of the key mechanisms for how such systems would learn from data. From the point of view of feasibility and given the amount of data that must be processed, these systems should work with as little manual guidance as possible. Ideally, they should learn directly from data, eg, images, videos and audio, all the information that they need to operate. This has been the philosophy in all my research. I will illustrate several examples of work that we have done in two areas: Computational Photography and Representation Learning, and highlight the focus on avoiding human annotation and its benefits.

Biographical Note
Paolo Favaro received the Laurea degree (B.Sc.+M.Sc.) from Università di Padova, Italy in 1999, and the M.Sc. and Ph.D. degree in electrical engineering from Washington University in St. Louis in 2003 and 2004 respectively. He was a postdoctoral researcher in the computer science department of the University of California, Los Angeles and subsequently in Cambridge University, UK. Between 2004 and 2006 he worked in medical imaging at Siemens Corporate Research, Princeton, USA. From 2006 to 2011 he was Lecturer and then Reader at Heriot-Watt University and Honorary Fellow at the University of Edinburgh, UK. In 2012 he became full professor at Universität Bern, Switzerland. His research interests are in computer vision, computational photography, machine learning, signal and image processing, estimation theory, inverse problems and variational techniques. He is also a member of the IEEE Society.