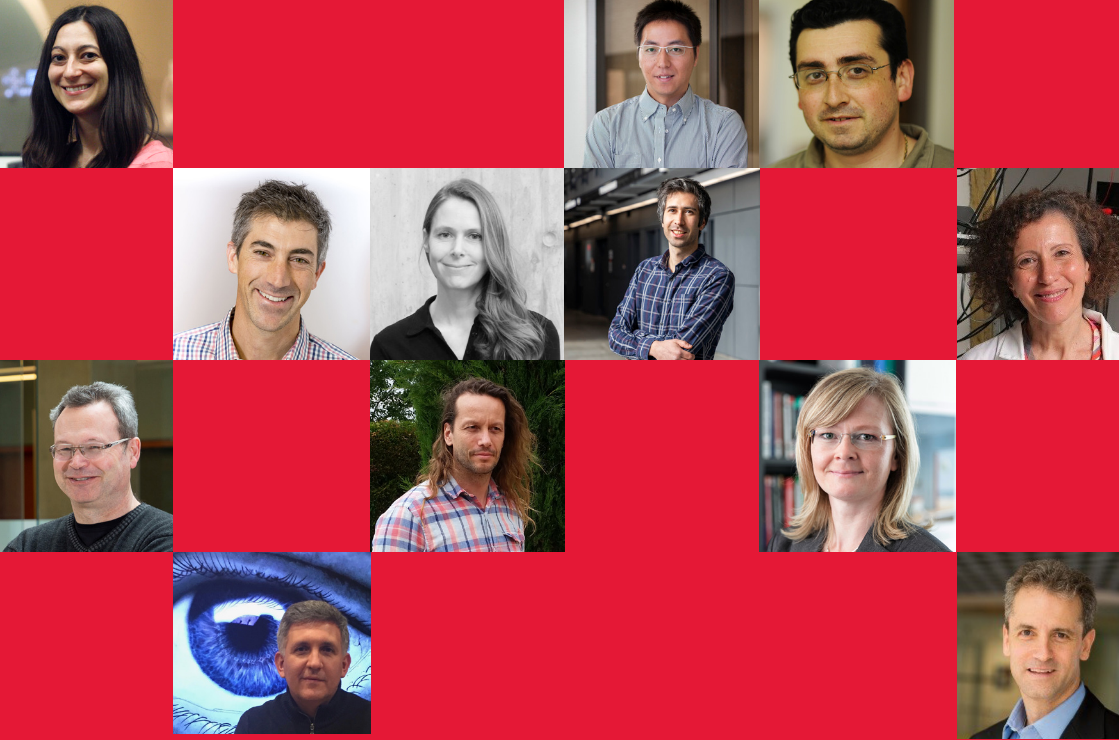

The Centre for Vision Research
& Vision: Science to Applications

INTERNATIONAL CONFERENCE ON PREDICTIVE VISION

JUNE 10-13, 2019
NEW STUDENT CENTRE
YORK UNIVERSITY

Poster Award Sponsors

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Thank you also to the Vice-President of Research & Innovation and departments of Kinesiology and Electrical Engineering & Computer Science.

Welcome!

Welcome to the 2019 Centre for Vision Research and VISTA biennial conference. We are excited to hear from our outstanding list of invited speakers. Let me tell you a little about the Centre here at York University.

We are an interdisciplinary, diverse and highly interactive group of thirty six vision scientists along with their trainees who approach vision science from many converging points of view. The group has deep roots going back to the founding influence of Ian Howard in the 1960's.

Our members are drawn from departments of Kinesiology, Biology, Psychology, Computer Science, Physics, Philosophy and Digital Media and our research ranges from basic science through to human performance, engineering and clinical applications. We hope you will have a chance to meet many of us during your visit and visit some of our labs.

The topic of predictive vision was selected as embracing, and being consequential to, virtually all approaches to vision-hopefully this conference will give us all something to consider concerning our particular topics of interest, and perhaps make us all look a little differently at visual processes.

Laurence Harris
Director

Centre for Vision Research

VISTA VISION: SCIENCE TO APPLICATIONS

YORK UNIVERSITY

WHAT IS VISTA?

Vision: Science to Applications is a research program based at York University in Toronto. VISTA provides important graduate, post-doctoral and researcher funding opportunities to enable cutting-edge research. Funded in part by the Canada First Re-search Excellence Fund (CFREF), VISTA has created numerous projects and technologies that will help people live healthier, safer and more productive lives.

WHAT ARE THE BENEFITS OF BEING PART OF VISTA?

- Become a member of an interdisciplinary research community across the research areas of health, science, engineering, humanities and arts.
- Work with over 50 industry partners offering opportunities for collaboration, internship and career development.
- Join an international network pushing the boundaries of vision research in North America, Europe and Asia.

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$10,000 per year for a max. of 2 years
2 competitions per year

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2 competitions per year
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TRAVEL AWARDS

VISTA will support flight and accommodation for visiting scholars, students and fellows to/from academic institutions.

www.yorku.ca/vista | More to vision than meets the eye.

CVR-VISTA International Conference Committee

Patrick Cavanagh

"Research in vision is an adventure of discovery, full of surprises and challenges, with the ever pleasant company of hardy, ingenious colleagues and students. We are like tourists observing and describing the mysterious customs and rituals of the visual system. OK, sometimes the weather turns bad, the luggage is lost, and we take the wrong road. But what a fabulous trip." Patrick Cavanagh started at Université de Montréal and has since been involved in research at Harvard University, Université Paris Descartes, Dartmouth College and Glendon College.

Doug Crawford

Scientific Director of the Vision: Science to Applications program and member of the Centre for Vision Research. Doug Crawford has founded various groups and programs, including the York Neurophysiology Labs, the York Graduate Diploma Program in Neuroscience, the Canadian Action and Perception Network (CAPnet), the 'Brain in Action' International Research Training Program, and most recently, the CFREF-funded VISTA program.

Rick Wildes

Associate Director of the Vision: Science to Applications program and member of the Centre for Vision Research. Honors include receiving a Sarnoff Corporation Technical Achievement Award, the IEEE D.G. Fink Prize Paper Award for his Proceedings of the IEEE publication "Iris Recognition: An Emerging Biometric Technology," and twice giving invited presentations to the US National Academy of Sciences.

Irit Printz

Irit Printz is the CVR Coordinator, where she takes care of the administrative needs of the centre and of faculty members. She specializes in logistics and coordinates numerous events like the CVR/VISTA Summer School, the CVR Seminar Series and international conferences. Before coming to York University, Irit worked in the non-profit and educational field. She is currently studying for a PhD in Higher Education Policy.

Keynote Speaker

James J. DiCarlo M.D., Ph.D.

Peter de Florez Professor of Neuroscience
Head, Department of Brain and Cognitive Sciences
Investigator, Center for Brains, Minds, and Machines
Investigator, McGovern Institute for Brain Research
Massachusetts Institute of Technology

James DiCarlo is a Professor of Neuroscience, and Head of the Department of Brain and Cognitive Sciences at the Massachusetts Institute of Technology. His research goal is to reverse engineer the brain mechanisms that underlie human visual intelligence.

He and his collaborators have revealed how population image transformations carried out by a deep stack of neocortical processing stages–called the primate ventral visual stream–are effortlessly able to extract object identity from visual images.

His team uses a combination of large-scale neurophysiology, brain imaging, direct neural perturbation methods, and machine learning methods to build and test artificial neural network models of the ventral visual stream and its support of cognition and behavior. Such an engineering-based understanding is likely to lead to new artificial vision and artificial intelligence approaches,new brain-machine interfaces to restore or augment lost senses,and a new foundation to a meliorate disorders of the mind.

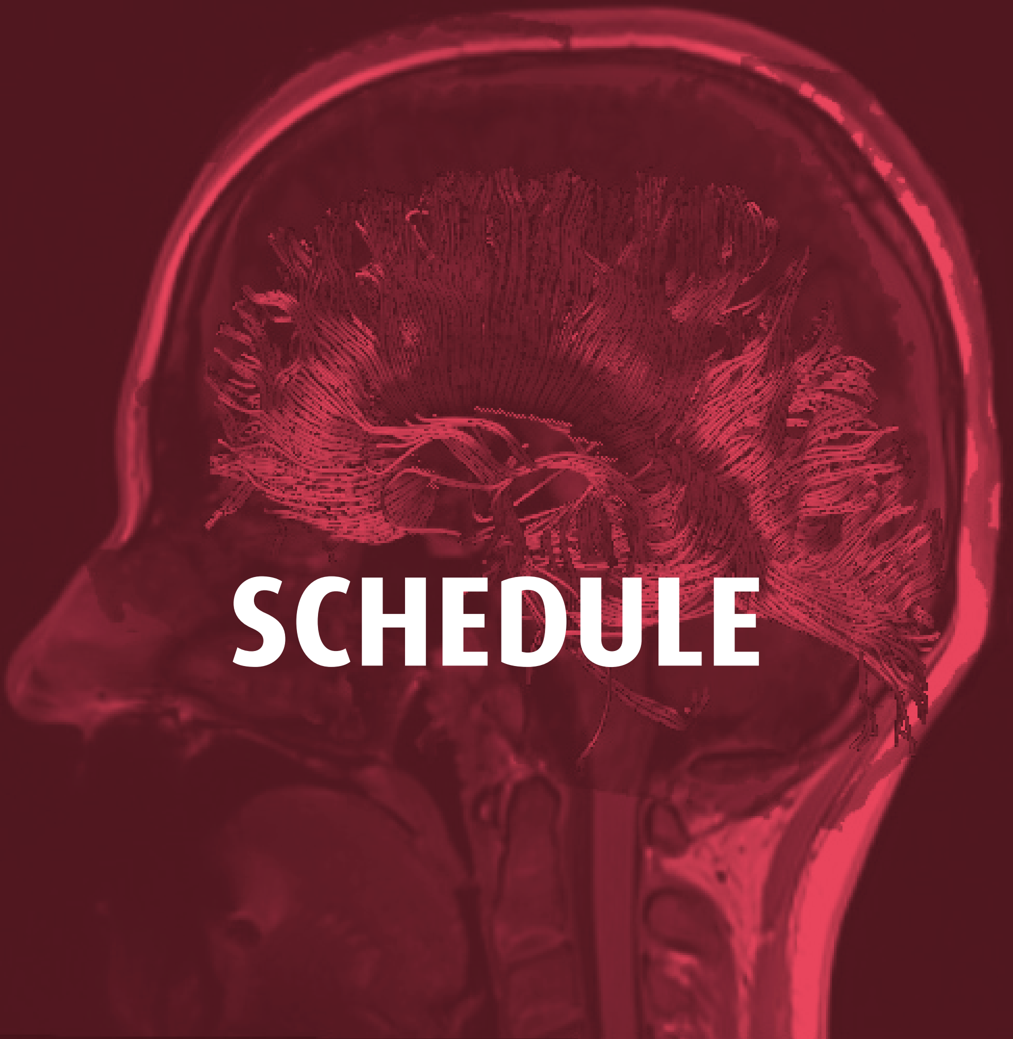
REVERSE ENGINEERING VISUAL INTELLIGENCE

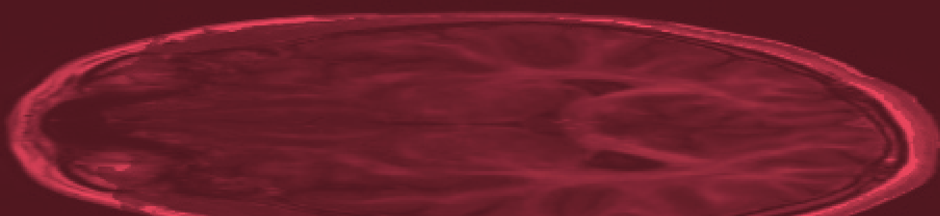
The brain and cognitive sciences are hard at work on a great scientific quest—to reverse engineer the human mind and its intelligent behavior. Yet these fields are still in their infancy. Not surprisingly, forward engineering approaches that aim to emulate human intelligence (HI) in artificial systems (AI) are also still in their infancy. Yet the intelligence and cognitive flexibility apparent in human behavior are an existence proof that machines can be constructed to emulate and work along side the human mind. I believe that these challenges of reverse engineering human intelligence will be solved by tightly combining the efforts of brain and cognitive scientists (hypothesis generation and data acquisition), and forward engineering aiming to emulate intelligent behavior (hypothesis instantiation and data prediction). As this approach discovers the correct neural network models, those models will not only encapsulate our understanding of complex brain systems, they will be the basis of next-generation computing and novel brain interfaces for therapeutic and augmentation goals (e.g.,brain disorders).

In this session, I will focus on one aspect of human intelligence—visual object categorization and detection—and I will tell the story of how work in brain science, cognitive science and computer science converged to create deep neural networks that can support such tasks. These networks not only reach human performance for many images, but their internal workings are modeled after—and largely explain and predict—the internal workings of the primate visual system. Yet, the primate visual system(HI)still outperforms current generation artificial deep neural networks(AI), and I will show some new clues that the brain and cognitive sciences can offer. These recent successes and related work suggest that the brain and cognitive sciences community is poised to embrace a powerful new research paradigm. More broadly,our species is the beginning of its most important science quest—the quest to understand human intelligence—and I hope to motivate others to engage that frontier along side us.

Contents

SCHEDULE





MONDAY, JUNE 10

8:30 am	**Registration**	
9:00 am	**Welcoming Remarks** – CVR Director, Laurence Harris	
9:15 am	**Session 1 - Moving targets, moving sensors: eyes and cameras.**	
	Chairs: Patrick Cavanagh and Michael Brown	
9:15 am	Julie Golomb	Ohio State University
9:55 am	Doug Crawford	York University
10:35 am	**COFFEE BREAK (20 min)**	
10:55 am	Chris Pack	McGill University
11:35 am	Yasutaka Furukawa	Simon Fraser University
2:00 pm	**Session 2 - Concurrent predictions across streams and modalities.**	
	Chairs: Denise Henriques and Ingo Fruend	
2:00 pm	David Whitney	UC Berkeley
2:40 pm	Jackie Gottlieb	Columbia University
3:20 pm	**COFFEE BREAK (20 min)**	
4:20 pm	Antonio Torralba	MIT
4:50 pm	Heiner Deubel	University of Munich
5-7 pm	**Welcome Reception**	

TUESDAY, JUNE 11

9:00 am	**Session 3 - Attention and recurrent processes.**	
	Chairs: Maz Fallah and Doug Crawford	
9:00 am	Rufin VanRullen	CerCo, France
9:40 am	Julio Martinez	Western University
10:20 am	**COFFEE BREAK (20 min)**	
10:40 am	Joel Zylberberg	York University
11:20 am	John Tsotsos	York University
12-2 pm	**POSTER SESSION 1**	
12-6 pm	**Industry Exhibition 1**	
	Hosts: James Elder and Katherine Seton	
2:30 pm	**Session 4 - Analyses of human actions and activities.**	
	Chairs: Rick Wildes and Rob Allison	
2:30 pm	Angelika Lingnau	Royal Holloway
3:10 pm	Peter Thier	University of Tübingen
3:50 pm	**COFFEE BREAK (20 min)**	
4:10 pm	Christoph Feichtenhofer	Facebook AI Research
4:50 pm	Leonid Sigal	UBC

WEDNESDAY, JUNE 12

9:00 am	**Session 5 - Visually guided control.**	
	Chairs: Doug Crawford and Michael Jenkin	
9:00 am	Pierre-Michel Bernier	University of Sherbrooke
9:40 am	Katja Fiehler	University of Giessen
10:20 am	**COFFEE BREAK (20 min)**	
10:40 am	Alexander Gail	University of Gottingen
11:20 am	Angela Schoellig	University of Toronto
12-2 pm	**POSTER SESSION 2**	
12-5 pm	**Industry Exhibition 2 with hors d'oeuvres**	
	Hosts: James Elder and Katherine Seton	

THURSDAY, JUNE 13

9:00 am	**Session 6 - Scene dynamics.**	
	Chairs: Jennifer Steevesand James Elder	
9:00 am	Jim Little	UBC
9:40 am	Mary Hayhoe	University of Texas Austin
10:20 am	**COFFEE BREAK (20 min)**	
10:40 am	Dan Kersten	University of Minnesota
11:20 am	Danny Dilks	Emory University

2-4 pm **POSTER SESSION 3**

4:00 pm **Introduction to VISTA** - Scientific Director, Doug Crawford

Poster Award Presentation

Keynote Address - Jim DiCarlo (MIT)

7:00 pm **BBQ Banquet** Registration required.
Black Creek Pioneer Village, 1000 Murray Ross Pkwy,
North York M3J 2P3

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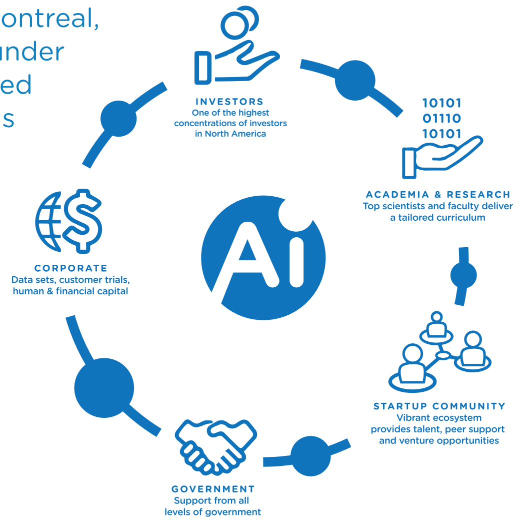

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SPEAKERS & ABSTRACTS

Speakers

Julie Golomb

Ohio State University

Dr. Julie Golombis an Associate Professor in the Department of Psychology, Center for Cognitive and Brain Sciences, and Neuroscience Graduate Program at the Ohio State University. Her research explores the interactions between visual attention, memory, perception, and eye movements using human behavioral and computational cognitive neuroscience techniques. Julie received her B.S. in Neuroscience from Brandeis University, her Ph.D. in Neuroscience from Yale University, and was a post-doctoral research fellow at MIT before joining the faculty at Ohio State in 2012. She has won early career awards including Sloan Research Fellow in Neuroscience, APA Distinguished Scientific Award for Early Career Contribution to Psychology, APF Fantz Award, and Federation of Associations in Behavioral and Brain Sciences Early Career Impact Award. Her lab is supported by funding from the NIH, NSF, Sloan Research Foundation, and Ohio Supercomputer Center.

SPEAKERS

REMAPPING LOCATIONS AND FEATURES ACROSS SACCADES: A DUAL-SPOTLIGHT THEORY OF ATTENTIONAL UPDATING

How do we maintain visual stability across eye movements? We make rapid, saccadic eye movements several times each second, with the resulting input to our visual system being a series of discrete, eye-centered snapshots. Yet the world does not appear to "jump" with each eye movement. Even though visual input is initially coded relative to the eyes, in retinotopic coordinates, we perceive objects in stable world-centered, spatiotopiclocations. Much work has focused on how visual information is rapidly updated to maintain spatiotopicre presentations. However, predictive spatial remapping is only part of the story. In this talk I'll discuss some recent findings from our lab in support of a dual-spotlight theory of remapping, where spatial attention must be both updated to the new location (fast, predictive stage) and withdrawn from the previous retinotopic location (slow, post-saccadic stage), resulting in a period of time where spatial attention may be simultaneously facilitating both locations. The implications of this transient splitting of spatial attention go beyond spatial processing, and can have striking consequences for feature perception and object binding, such that features from two different spatial locations may be temporarily mixed together.

Doug Crawford

York University

John Douglas (Doug) Crawford is the Canada Research Chair in Visuomotor Neuroscience, Distinguished Research Professor in Neuroscience, and Scientific Director of the Vision: Science to Applications (VISTA) program at York University, Toronto. Crawford completed his PhD in Physiology at Western in 1993 and spent two years as an MRC Fellow at McGill, before joining the York Centre for Vision Research in 1995. His lab primarily investigates control visual gaze in 3D space, eye-hand coordination, and spatial memory during eye movements. He has published over 150 papers, and garnered numerous research awards, including the 2004 Steacie Prize and the 2016 CPS Sarrazin Award.

SPATIAL UPDATING IN SUPERIOR COLLICULUS CELLS DURING SMOOTH PURSUIT

As we move through space, the brain must update any visual information that is stored in retinal coordinates. The mechanisms of spatial updating have been studied intensively in association with saccades, much less during (equally important) slow eye movements. Here, we will examine both theoretical and neurophysiological aspects of updating during smooth pursuit eye movements. I will first present a state-space model that replicates neural phenomena associated with transsacca-dicupdating, e.g., anticipatory remapping, but instead predicts continuous velocity-driven updating during pursuit. I will then confirm this prediction in superior colliculus (SC) visual cells, showing how the memory trace for saccade targets travels continuously –like a moving hill—across the SC retinotopic map during pursuit. I will then provide data suggesting that these responses sum with visual responses in normal lighted conditions, likely indicating that what is being updated is actually spatial attention. This provides a complementary slow updating mechanism to the better known fast anticipatory remapping phenomena, with each mechanism ideally suited for the computational requirements of vision and memory during slow vs. fast eye motion.

Chris Pack

McGill University

Christopher Pack got his Ph.D. in computational neuroscience from Boston University in 1998. After that, he completed postdoctoral training at Harvard Medical School and joined the faculty at the Montreal Neurological Institute in 2005. His lab studies the neurophysiological basis of perception and learning, using methods including single-neuron electro physiology, computational modeling, brain stimulation, and psychophysics. He is currently a professor in the Department of Neurology & Neurosurgery at McGill and holds a Chercheur-boursierde mérite from the FRQ.

EFFECTS OF TRAINING ON VISUAL MOTION INTEGRATION

Local stimulus features are the building blocks of visual perception, but they are not by themselves sufficient for object recognition or navigation. These behaviors require the integration of features across spatial locations. Using motion stimuli as examples, I will show how the integration of visual information is highly dependent on experience. Specifically, practicing a motion discrimination task changes the way in which the brain integrates visual information, and such changes are highly sensitive to the stimulus used during training. Evidence from reversible inactivation and human psychophysics indicates that effect of training is to alter the contribution of different cortical areas to perceptual decisions. Moreover, training on an eye movement tasks alters the way in which observers integrate visual information even during fixation. Thus our perception of global structure in visual scenes adapts to expectations based on recent experience.

Yasutaka Furukawa

Simon Fraser University

Yasutaka Furukawa is an assistant professor of Computing Science at Simon Fraser University. Prior to SFU, He was an assistant professor at Washington University in St. Louis, and a software engineer at Google. He is a pioneer in automated 3D reconstruction and visualization. His multi-view stereo (MVS) algorithm has been recognized as the best 3D reconstruction algorithm from calibrated photographs, and has been used at numerous academic and industrial settings. He received the best student paper award at ECCV 2012, the best paper award at 3DV 2013, the NSF CAREER Award in 2015, and CS-CAN Outstanding Young CS Researcher Award 2018. He completed his Ph.D. at Computer Science Department of University of Illinois at Urbana-Champaign in May 2008.

COMPUTATIONAL MOTION SENSING AND GEOMETRIC PERCEPTION

In this talk, I will present two recent breakthroughs in motion estimation and geometry reconstruction research. First, I will present a technique that can estimate your motion trajectories from a smart phone in your pocket, hand, bag, or any combinations of those. The approach utilizes Inertial Measurement Unit (IMU) and would lead to an ultimate anytime anywhere navigation system, as IMUs 1) are energy efficient; 2) work anywhere even inside a pocket; and 3) are in every smart phone, which everyone carries everyday all the time. Second, I will present reconstruction techniques that holistically represent scenes as semantically segmented CAD-quality models. In particular, I will present techniques in two problem scenarios: 1) single-view piecewise planar surface reconstruction; and 2) floor plan reconstruction from full 3D house scans.

David Whitney

UC Berkeley

David Whitney is a professor of Psychology, Neuroscience, and Vision Science at UC Berkeley, where he is also the director of the Cognitive Science program. David received his PhD from Harvard in 2001 with Patrick Cavanagh, and then completed a postdoc at Western University with Mel Goodale. In 2004, David joined the faculty at UC Davis and then moved to Berkeley in 2009. David's lab studies perceptual and motor localization, crowding, ensemble perception, and serial dependence.

CONTINUITY FIELDS AND THE SERIAL DEPENDENCE OF VISUAL PERCEPTION

The visual world appears stable over time despite fluctuations in retinal images that occur due to a variety of factors, ranging from internal and external noise to changes in viewpoint, lighting, gaze, etc. A common explanation for the seeming stability of scenes is that the visual system is simply insensitive to these changes (e.g., change blindness) due to capacity limits or other bottlenecks. An alternative explanation is that the visual system actively stabilizes perceptual interpretations by anchoring them to previous percepts. Indeed, the past is a good predictor of the present. Recently, a large number of studies have found evidence that perception is actively stabilized via serial dependence: objects at this moment appear more similar to previously seen objects. This serial dependence is spatially, temporally, and featurally tuned, such that the perceptual capture only happens if sequential objects are in nearby locations, recent in time, and are similar in their image. These tuning properties reveal a spatiotemporal operator called a Continuity Field, which actively stabilizes perception. Serial dependence has been reported for a variety of basic features, in addition to locations, object shape, face emotion and identity, attractiveness, aesthetic judgments, etc., suggesting that Continuity Fields likely operate at many levels across both dorsal and ventral streams. Here, I will show that Continuity Fields are a double-edged sword: they are generally beneficial in that they actively create an illusion of perceptual stability; but, in unique situations that are unstructured or uncorrelated over time (such as visual search in radiology or airport screening), Continuity Fields can have a detrimental effect on recognition. Continuity Fields are key to understanding the nature of moment-to-moment perceptual awareness and how the visual system balances the competing needs of perceptual accuracy with stability.

Jackie Gottlieb

Columbia University

Jacqueline Gottlieb is Professor of Neuroscience in the Mortimer B. Zuckerman Institute for Mind Brain and Behavior at Columbia University, New York. She completed her undergraduate education in cognitive science at the Massachussetts Institute of Technology, her PhD in neurobiology at Yale University and her postdoctoral training at the National Institute of Health. Dr Gottlieb studies the mechanisms of attention and their relation with learning, curiosity and decision making using physiological and behavioral approaches in humans and non-human primates.

SPEAKERS

MECHANISMS OF CURIOSITY AND INFORMATION SAMPLING IN HUMANS AND NON-HUMAN PRIMATES

The vast majority of neuroscience research focuses on tasks in which participants receive explicit instructions about what they should memorize, attend to or learn. In natural behavior however, we rarely have the benefit of such explicit instruction. Instead, our brains must endogenously determine which one, of the practically infinite set of available signals and cues, is more relevant or important and thus worthy of memory or attention. Despite the ubiquity and importance of active sampling decisions, their mechanisms remain very poorly understood. I will discuss recent studies from our laboratory that examine this question as it pertains to sampling that is intrinsically motivated (curiosity) and sampling that is motivated by instrumental (extrinsic) goals. I will describe new behavioral tasks for examining active sampling in humans and monkeys, single neuron responses related to active sampling in monkeys, and behavioral and electroencephalography (EEG) correlates of sampling in humans. Together, these studies begin to reveal the distributed processes through which the brain estimates the benefits and costs of gathering information and implements active sampling policies.

Antonio Torralba

MIT

Antonio Torralba is a Professor of Electrical Engineering and Computer Science at MIT, the MIT director of the MIT-IBM Watson AI Lab, and the director of the MIT Quest for Intelligence. He received the degree in engineering from Telecom BCN, Spain, in 1994 and the Ph.D. degree from the InstitutNational Polytechnique de Grenoble, France, in 2000. He received the best student paper award at CVPR in 2009, and the 2010 J. K. Aggarwal Prize from the International Association for Pattern Recognition (IAPR). In 2017, he received the Frank Quick Faculty Research Innovation Fellowship and the Louis D. Smullin('39) Award for Teaching Excellence.

DISSECTING NEURAL NETS AND MULTIMODAL LEARNING

With the success of deep neural networks and access to image databases with millions of labeled examples, the state of the art in computer vision is advancing rapidly. Even when no examples are available, Generative Adversarial Networks (GANs) have demonstrated a remarkable ability to learn from images and are able to create nearly photo realistic images. The performance achieved by convNetsand GANs is remarkable and constitute the state of the art on many tasks. But why do convNetswork so well? what is the nature of the internal representation learned by a convNetin a classification task? How does a GAN represent our visual world internally? In this talk I will show that the internal representation in both convNetsand GANs can be interpretable in some important cases. I will then show several applications for object recognition, computer graphics, and unsupervised learning from images and audio. I will show that an ambient audio signal can be used as a supervisory signal for learning visual representations. We do this by taking advantage of the fact that vision and hearing often tell us about similar structures in the world, such as when we see an object and simultaneously hear it make a sound. I will also show how we can use raw speech descriptions of images to jointly learn to segment words in speech and objects in images without any additional supervision.

Heiner Deubel

University of Munich
Department of Psychology, Ludwig-Maximilians Universität München, Munich, Germany

Heiner Deubel studied Electrical and Communication Engineering in Karlsruhe and received a doctoral degree from the Technical University of Munich, Germany. After working a year with Fred Miles in the lab of Bob Wurtzat the NIH in Bethesda, he went to the Max-Planck-Institute of Behavioral Physiology and later joined the group of Wolfgang Prinz at the Max-Planck-Institute of Psychological Research in Munich. In 1997, he became Professor and Academic Director at the Department of Psychology of the Ludwig-Maximilians-University in Munich. Heiner Deubel's research has been focused on the control of eye movements, the coupling of attention and action, visual stability, and motor plasticity.

SPEAKERS

VISUAL PREDICTIONS ACROSS SACCADES

For many years, the established view of transsaccadic memory was that of a small-capacity, non-maskable, high-level short-term memory that was commonly equated to visual working memory. Only recently, experimental evidence has shed some doubt on this perspective, demonstrating for example transsaccadic optimal integration of early visual features such as orientation and color, and transsaccadic fusion of pre-and post saccadic stimuli.

After a brief review of these reports, I will present a series of recent experimental studies on how pre-and post saccadic stimulus contrast and post saccadic stimulus blanking affect the detection of changes of position, orientation and form of stimuli across the saccade. A model will be proposed in which trans saccadic memory is the source of a remapped postsaccadic, quasi-visual percept which depends on pre saccadic stimulus contrast, is suppressed by high-contrast post saccadic stimuli, and can be displaced in perceptual space by means of visual landmarks. This mechanism contributes to visual stability across eye movements, but may also play a role for oculomotor control processes.

Rufin VanRullen

CerCo, France

Following initial training in Maths and Computer Science, Rufin VanRullen obtained a PhD in Cognitive Science from Toulouse (France) under the supervision of S. Thorpe. After a postdoc with C. Koch at Caltech, he joined the CerCo(Toulouse, France) in 2001 as a CNRS Research Scientist, and became a CNRS Research Director in 2010. He was a visiting scientist at the Harvard Vision Lab from 2005 to 2007, with P. Cavanagh. He has published more than 100 scientific journal articles, including influential papers on neural coding, object recognition, feed-forward vs. feedback processes, and attention.

ALPHA OSCILLATIONS, TRAVELLING WAVES AND PREDICTIVE CODING

Alpha oscillations are not strictly spontaneous, like an idling rhythm, but can also respond to visual stimulation, giving rise to perceptual "echoes" of the stimulation sequence. These echoes propagate across the visual and cortical space with specific and robust phase relations. In other words, the alpha perceptual cycles are actually travelling waves. The direction of these waves depends on the state of the system: feed-forward during visual processing, top-down in the absence of inputs. Based on neural network models and experimental evidence, I will tentatively relate these alpha-band echoes and waves to back-and-forth communication signals within a predictive coding system.

SPEAKERS

Julio Martinez-Trujillo

Western University
Robarts Research Institute, Schulich School of Medicine and Dentistry, Departments of Physiology and Pharmacology, and Psychiatry, Brain and Mind Institute, Western University, London, Ontario, Canada

Dr. Martinez-Trujillo studied Medicine at the University of Havana, Cuba, pursued medical training in Neurology and Clinical Neurophysiology at the Cuban Neuroscience Center. MSc/PhD in Neurobiology at the University of Tübingen, Germany. In 2000 postdoctoral training at the Centre for Vision Research, York University. In 2004 became a Canada Research Chair and assistant professor at McGill University. In 2014 joined Western University as associate professor and Western Research Chair in Autism. In 2016 became full professor. His scientific work investigates the brain mechanisms underlying cognition, specifically attention and memory and how they fail during brain disease.

NEURONAL POPULATION CODES FOR ATTENTION

Attention can be defined as the filtering and modulation of information processing in the brain. Attention allows focusing on behaviorally relevant information while filtering out the irrelevant. Studies in macaque monkeys have shown that single neurons increase their response rates when activated by attended stimuli while relatively decrease their responses rates when activated by distracters. This phenomenology has been captured by several theoretical and computational models that account for the effects of attention on perception and behavior. Over the last decades studies have shifted their focus from how attention modulates single neuron responses to how attention modulates the response profile of neuronal populations. Here I will present work on that specific topic. I will present data on how attention shapes the response profile of populations of simultaneously recorded neurons in the visual cortex of macaques. I will expand on how between neurons phenomena such as signal and noise correlation shape the way in which attention affects information coding in visual cortical areas. Finally, I will present results from a series of experiments showing how attention shapes information processing in populations of neurons in naturalistic settings (virtual environments).

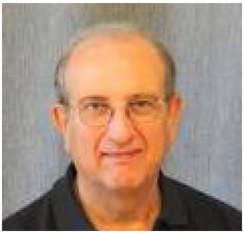
Joel Zylberberg

York University

Joel Zylberberg completed his B.Sc. in physics at Simon Fraser University, and spent much of that time working as a research assistant in laboratories covering several disciplines: materials chemistry, nuclear physics, particle physics, and astrophysics. Starting his Ph.D. (in Physics) at UC Berkeley, he was interested in cosmology and spent 2 years studying the expansion of the universe with the Berkeley Supernova Cosmology Project. In parallel, he had a growing interest in neuroscience, and that interest eventually overtook his interest in space physics. He spent the final 2 years of his Ph.D. studying theoretical neuroscience. From 2012-2015 he was an Acting Assistant Professor of Applied Mathematics at the University of Washington (Seattle), where he continued to study theoretical neuroscience. From 2015-2018, he was an Assistant Professor at the University of Colorado School of Medicine and, since 2019, has been Assistant Professor at York University in Toronto.

Transformation of the neural code between retina, thalamus, and cortex

Light from the environment impinges on the retina, where it is transformed from visual images into patterns of neural spiking. Those spikes propagate along the optic nerve to the lateral geniculate nucleus (LGN) of the thalamus, and then on to visual cortex. A longstanding question in vision science is to determine the "neural code": the correspondences between patterns of spiking in the retina, LGN, and cortex, and the external visual stimuli. In this talk, I will highlight recent work from my lab, that uses neural population recordings in the mouse visual system to tackle this problem. First, I will show how the retina makes use of two "modes" of visual information coding: one that operates on fast timescales, has low spatial resolution, and in which correlations between cells are unimportant; and one that operates on slower timescales, has higher spatial resolution, and in which correlations between cells help encode the visual information. Next, I will show how the fast-timescale neural code is transformed between the LGN and V1: while neural responses in V1 are more correlated than in LGN, those correlations contribute less to information encoding. This leads to the V1 neural code being more linearly decodable to recover the stimulus compared to LGN, consistent with recent theoretical work based on artificial neural networks.



John Tsotsos

York University

John Tsotsos is a Distinguished Research Professor of Vision Science at York University. He received his doctorate in Computer Science from the University of Toronto. In 1980 he founded the Computer Vision Group at the University of Toronto, which he led for 20 years. He has been a CIFAR Fellow, is an IEEE Fellow and Canada Research Chair in Computational Vision. Other honours include a 1987 inaugural Marr Prize citation, York University's 1st President's Research Excellence Award, and the 2011 Geoffrey J. Burton Memorial Lectureship from UK's Applied Vision Association. Elected as Fellow of the Royal Society of Canada in 2010, he became the first computer scientist to receive its 2015 Sir John William Dawson Medal for sustained excellence in multiple domains.

SPEAKERS

THE INTERESTING PARTS OF VISION HAPPEN OUTSIDE THE FEEDFORWARD PATHWAY

The overwhelming bulk of vision research, regardless of discipline, has focused on the characteristics of the brain's first feedforward pass, from retina to the higher levels of interpretive visual areas. However, it may be that more interesting processes occur outside that pathway. Those actions may be the reason that vision has the generality of function that not only human, but perhaps many biological vision systems, enjoy. In this presentation, a theoretical argument will be presented to justify this assertion. Several examples will be shown of the functional breadth of those actions. Some seem to be automatic, others volitional. Certainly, few are externally observable and thus the currently popular data-hungry learning strategies might not be appropriate tools with which to gain a better understanding. Using our Selective Tuning model as a foundation, examples involving dorsal-to-ventral feedback for contour and shape, attentional selection and localization, attentional priming, fixation control, the role of saliency and network interference reduction will be shown. Further, recent human evidence for the broad impact of some of the model's predictions will be described. Together, these represent the beginning of a story that has the potential to explain the generality of vision as being the result of top-down or recurrent dynamic tuning of the basic processes of vision realized by the feedforward pass to enable their best performance for the task and stimuli of the moment.

Angelika Lingnau

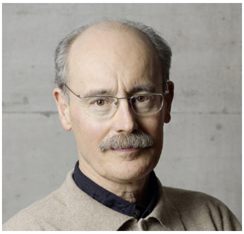
University of Regensburg, Germany

Angelika Lingnau obtained a diploma (2001) and a PhD (2004) in Psychology from the Technical University Braunschweig, Germany. As a postdoc, she worked on visual motion processing (supervisor: Andrew T. Smith) at Royal Holloway University of London (RHUL), and on the neural basis of action observation (supervisor: Alfonso Caramazza) at the Center for Mind/Brain Sciences (CIMeC), University of Trento, Italy. From 2015 to 2018, she has been Reader in Human Neuroscience and Director of the Combined Universities Brain Imaging Centre at RHUL. Since 2018, she is Full Professor of Cognitive Neuroscience at the University of Regensburg, Germany, and Visiting Professor at the CIMeC.

Her research focuses on the processes involved in the observation, planning, execution, and recognition of human actions. She has published 37 peer-reviewed articles (h-index: 20, >1400 citations). She has been ad-hoc reviewer for more than 35 journals and is Associate Editor for Journal of Neuroscience.

THE LATERAL OCCIPITOTEMPORAL CORTEX IN ACTION

Understanding other people's actions is fundamental for successful social interactions, and for the selection and preparation of our own actions. A network of regions, referred to as the action observation network, is known to be recruited during the observation of actions. However, the precise division of labour between the different nodes of this network is debated. I will present a number of studies using multivariate pattern analysis and representational similarity analysis of functional magnetic resonance imaging and magnetoencephalography data that addressed this question. The results highlight the role of the lateral occipitotemporal cortex, a region that is known to be recruited during a variety of different tasks, ranging from the perception of basic and biological motion to the perception of body parts, tools, and the processing of action-related words. I will discuss these results in light of the ongoing debate on the neural basis of action recognition and point out possible future directions.



Peter Thier

University of Tübingen
Hertie Institute for Clinical Brain Research,
Dept. Cognitive Neurology

Peter Thier is Professor of Neurology and Chairman of the Department of Cognitive Neurology at the Center for Neurology and Hertie Institute for Clinical Brain Research as well as chairman of the interdisciplinary Werner Reichardt Center of Integrative Neuroscience at Tübingen University. His current research and associated clinical interests (in brackets) include the roles of joint attention and action understanding for social interactions (impaired social interactions, e.g. in autism), the cerebellar basis of motor learning and cerebellar contributions to cognition (functional consequences of cerebellar disease), brain mechanisms warranting perceptual stability during ego-motion and distinction between 'self' and 'non-self' (non-vestibular dizziness, disturbances of agency in schizophrenia) and transformations in sensorimotor coordination and the role of cerebro-cerebellar communication (spatial disorientation, motor disturbances).

SPEAKERS

THE ROLE OF THE SUPERIOR TEMPORAL SULCUS (STS) IN CONTROLLING SOCIAL GAZE FOLLOWING

Primates follow the other's gaze to an object of interest to the other, allowing the two agents to establish joint attention. Whereas humans exploit both eye and head gaze cues, monkeys rely mostly on head gaze. This difference notwithstanding, the underlying neural architectures seem to be very similar with a distinct patch of cortex in the STS playing a central role. As shown by our comparative fMRI work this gaze following patch (GFP) is selectively activated if observers shift attention to a target determined by the other's gaze, BOLD activity that is, moreover, modulated by relevant contextual information. Neurons in the monkey GFP establish a linkage between the other's gaze direction and the object, singled out by her/his gaze, if this linkage is pertinent within the prevailing social context. Microstimulation of the monkey GFP disrupts gaze following if applied in a period in which the information needed for the linkage between gaze and object becomes available. However, if applied earlier, that is at a time the monkey may see the alternative instruction not to follow gaze, the ability to implement this instruction is compromised. In short, the GFP plays a causal role in orchestrating gaze following and its executive control.

Christoph Feichtenhofer

Facebook AI Research

Christoph Feichtenhofer is a Research Scientist at Facebook AI Research (FAIR). He received the BSc (with honors), MSc (with honors) and PhD degree (with honors) in computer science from TU Graz in 2011, 2013 and 2017, respectively. He is a recipient of a DOC Fellowship of the Austrian Academy of Sciences and his PhD thesis was awarded with the Award of Excellence for outstanding doctoral theses in Austria. His main areas of research include the development of effective representations for video understanding. He aims to find efficient solutions for problems that are grounded in applications such as recognition and detection from video.

SLOWFAST NETWORKS FOR VIDEO RECOGNITION

This talk will highlight recent progress in video recognition at Facebook AI Research. The talk will center around SlowFast networks, a video model that involves (i) a Slow pathway, operating at low frame rate, to capture spatial semantics, and (ii) a Fast pathway, operating at high frame rate, to capture motion at fine temporal resolution. The Fast pathway can be made very lightweight by reducing its channel capacity, yet can learn useful temporal information for video recognition. The talk will further highlight a long-term feature bank, supportive information extracted over the entire span of a video, to augment state-of-the-art video models, as well as recent work in 3D human pose estimation in video.

Leonid Sigal

UBC

Leonid Sigal is a Associate Professor at the University of British Columbia (UBC). He was appointed CIFAR AI Chair at the Vector Institute in 2019 and an NSERC Tier 2 Canada Research Chair in Computer Vision and Machine Learning in 2018. Prior to this, he was a Senior Research Scientist, and a group lead, at Disney Research. He completed his Ph.D. at Brown University in 2008; received his B.Sc. degrees in Computer Science and Mathematics from Boston University in 1999, his M.A. from Boston University in 1999, and his M.S. from Brown University in 2003. He was a Postdoctoral Researcher at the University of Toronto, between 2007-2009. Leonid's research interests lie in the areas of computer vision, machine learning, and computer graphics; with an emphasis on machine learning and statistical approaches for visual recognition, understanding and analytics.

ACTION, ACTIVITIES AND BEYOND

Automatic understanding and interpretation of human actions and activities is one of the core challenges in computer vision. Many real-world systems could benefit from various levels of human action understanding, ranging from surveillance and human-computer interactions to robotics. In this talk, I will discuss some of the approaches we developed over the years for addressing aspects of this challenging problem. In particular, I will first discuss a strategy for learning activity progression in LSTM models, using structured rank losses, which explicitly encourage the architecture to increase its confidence in prediction over time. The resulting model turns out to be especially effective in early action detection. I will then talk about some of our recent work on single-frame situational recognition. Situational recognition goes beyond traditional action and activity understanding, which only focuses on detection of salient actions. Situational recognition further requires recognition of semantic roles for each action. For example, who is performing the action, what is the source and/or target of the action. We propose a mixture-kernel attention Graph Neural Network (GNN) for addressing this problem. Out GNN enables dynamic graph structure during training and inference, through the use of graph attention mechanism, and action-specific context-aware interactions between the roles. Finally, time permitting, I will also briefly discuss our recent work on video generation that uses disentangled appearance / activity latent space for generating realistic activity videos.

Pierre-Michel Bernier

University of Sherbrooke / Université de Sherbrooke
2009-2011 Post doc: Brain Imaging Center(Dr Scott Grafton) in the Department of Psychological and Brain Sciences, University of California Santa Barbara. 2005-2009 PhD: Sciences du Mouvement Humain/Neurosciences (Dr Jean Blouin) Laboratoire de Neurobiologie de la Cognition, CNRS & Aix-Marseille Université. 2003-2005 MSc: Motor Control and Learning (Dr Ian Franks) School of Human Kinetics, University of British Columbia. 2000-2003 Undergraduate: Kinésiologie at the Université de Montréal (dean's list). One of the main aims of his laboratory is to uncover the mechanistic principles underlying the learning and retention of new motor behaviours. In particular, studying how learning and retention are shaped by the processing of both errors and rewards.

OSCILLATORY MANIFESTATIONS OF SENSORY PREDICTION ERRORS IN PARIETAL REGIONS DURING VISUALLY-GUIDED REACHING

To ensure optimal accuracy of motor behaviour across development and aging, the relationship between sensory input and motor output must be continuously updated, a process called sensorimotor adaptation. The main error signal driving adaptation is the sensory prediction error (SPE), that is, the mismatch between the expected and actual sensory consequences of a movement. While the cerebellum has long been associated with the processing of SPEs, it has remained elusive whether neocortical regions also contribute to this process. One region that has been suggested to play a role is the parietal cortex, with considerable neuro imaging work revealing increased activity in this region early in adaptation, when SPEs tend to occur. Here I will present a set of experiments in which we directly tested the hypothesis that the parietal cortex contributes to SPE processing in the context of visually-guided reaching. Using electroencephalography (EEG), I will first show that visual event-related potentials (ERPs) over parietal regions are increased when visual feedback of the hand is experimentally perturbed either temporally or spatially. I will then present the oscillatory content of this response, and show that SPEs are associated with increased low theta-band (2-4 Hz) as well as low beta-band activity (13-18 Hz), two rhythms that have been linked to the propagation of SPEs and to the update of sensory predictions along the dorsal visual stream, respectively. Overall, these increased ERP and oscillatory responses to visual reafferent feedback when it is mis-predicted as compared to when it is correctly predicted support a role of parietal regions in the processing of SPEs.

Katja Fiehler

University of Giessen, Germany

I hold a professorship in Experimental Psychology at the University of Giessen, Germany. I studied Psychology at the Technical University Dresden and did my PhD on performance monitoring at the Max-Planck Institute for Human Cognitive and Brain Sciences in Leipzig. I started my work on perception-action coupling during a Post Doc at the University of Marburg. In 2011, I was awarded a Heisenberg-Professorship from the German Research Foundation (DFG) to build up my research group on Perception & Action at the University of Giessen. My group is interested in spatial coding for action and predictive mechanisms in goal-directed movements. By combining psychophysical experiments with eye and hand movement tracking in the lab and in virtual reality we try to understand how humans represent objects in space to guide eye and hand movements and how they predict the sensory consequences of their actions. In addition, we investigate the underlying cortical mechanisms by using MRI.

SPATIAL CODING FOR ACTION

Goal-directed movements rely on both egocentric and allocentric target representations. So far, it is widely unknown which factors determine the use of allocentric information for spatial coding for action. We established a behavioral paradigm which allows us to probe allocentric coding of targets for reaching. Participants are asked to encode the location of objects in a naturalistic visual scene. After a brief delay, a test scene reappears with one object missing (= reach target) and other objects systematically shifted in space. After the test scene vanished, participants have to reach towards the remembered location of the missing target on a grey screen. By quantifying the reaching errors relative to the physical shift of the surrounding objects we determine the contribution of the allocentric reference frame in spatial coding of reach targets. In a series of experiments we investigated the key factors influencing the use of allocentric information in reaching: gaze behavior, task relevance, scene coherence, and scene semantics. In the talk, I will present recent findings on allocentric coding in online and memory-guided reaching in 2D and virtual 3D space.

Alexander Gail

University of Gottingen

A. Gail received his Diploma (M.S. equivalent) in Physics in 1997, and his Ph.D. degree in Neurophysics in 2002 from the University of Marburg, Germany. From 2003 to 2006 he did his postdoc at the California Institute of Technology, Devision of Biology, Pasadena, in the lab of Richard Andersen. Since 2006 he is heading the research group Sensorimotor Neuroscience and Neuroprosthetics at the German Primate Center, which was initiated in the context of the Bernstein Center for Computational Neuroscience, Göttingen, Germany. Since 2012 he is additionally Associate Professor at the Department of Biology, Georg August University and the German Primate Center, Göttingen, Germany. His research specializes on the neurophysiological basics of primate goal-directed sensorimotor behavior with a focus on motor planning and a translational perspective on neuroprosthetics. Methods include systems level multi-area neurophysiology in the cerebral cortex of rhesus monkeys, combined with human psychophysics and computational modelling.

VISUALLY GUIDED REACH PLANNING IN DYNAMIC ENVIRONMENTS

Planning a reach towards a visual target requires integration of visual target location with multi sensory information about the current body posture. The frontoparietal reach network in primates, like the parietal reach region (PRR) and the dorsal premotor cortex (PMd) rhesus monkeys, shows sustained activation in preparation of reach movements which is spatially selective and independent of immediate visual input. This putative motor planning activity can co-encode reach goals in visual and physical body-centered (egocentric) frames of reference which could be interpreted as predictive encoding of pending sensory feedback about the planned movement (Kuanget al. 2016). Here I will present more recent studies which investigate reach goal encoding in dynamic situations when either the target object or the animal itself will sometimes relocate prior to the reach movement, i.e. when the actual movement cannot be prepared since the final reach goal location is not determined yet (object relocation) or the final body posture for reaching is not achieved yet (subject relocation). This will include reaches to targets beyond peripersonal space in a free walk-and-reach task with wireless neurophysiological recordings from multiple brain areas in rhesus monkeys (Berger et al. 2018). Specifically, I will focus on the question in how far allocentric (object-or room-centered) reach goal encoding becomes available in parietal or premotor motor planning activity in tasks where the cognitive task demands spatial working memory of reach goals in non-egocentric or outside-peripersonal frames of reference.

Angela Schoellig

University of Toronto

Angela Schoelligis an Assistant Professor at the University of Toronto Institute for Aerospace Studies and an Associate Director of the Centre for Aerial Robotics Research and Education. She holds a Canada Research Chair in Machine Learning for Robotics and Control, is a principal investigator of the NSERC Canadian Robotics Network, and is a Faculty Affiliate of the Vector Institute for Artificial Intelligence. She conducts research at the intersection of robotics, controls, and machine learning. Her goal is to enhance the performance, safety, and autonomy of robots by enabling them to learn from past experiments and from each other. She is a recipient of a Sloan Research Fellowship (2017), an Ontario Early Researcher Award (2017), and a Connaught New Researcher Award (2015). She is one of MIT Technology Review's Innovators Under 35 (2017), a Canada Science Leadership Program Fellow (2014), and one of Robohub's"25 women in robotics you need to know about (2013)". Her team won the 2018 North-American SAE Auto Drive Challenge sponsored by General Motors. Her PhD at ETH Zurich (2013) was awarded the ETH Medal and the Dimitris N. ChorafasFoundation Award. She holds both an M.Sc. in Engineering Cybernetics from the University of Stuttgart (2008) and an M.Sc. in Engineering Science and Mechanics from the Georgia Institute of Technology (2007). More information can be found at: www.schoellig.name.

HIGH-PERFORMANCE ROBOT NAVIGATION USING VISION

Over the past decade, advances in robot hardware and software have enabled new robot applications ranging from warehouse management using hundreds of mobile robots, to videography with small unmanned aerial vehicles and aerial light shows with swarms of drones. However, with few exceptions, these applications rely on external infrastructure such as GPS, custom floor tags or ultra-wide band to know the locations of the robots and compute robot control commands based on this information. To avoid the reliance on external infrastructure and improve localization accuracy, vision is a great alternative including sensors such as stereo vision and lidar. In my talk, I will present work that uses vision for robot localization. I will highlight the opportunities and challenges that come with placing vision in a closed-loop robot control system. In particular, I will showcase our work on (1) autonomous, outdoor flight based on stereo vision at speeds up to 15 m/s, (2) autonomous off-road racing of a mobile robot using stereo vision, and (3) developing the winning car of the 2018 Auto Drive competition relying on information from monocular cameras and lidar. This is joint work with Tim Barfoot and our student teams.

Jim Little

UBC

James Little is Professor in the Department of Computer Science at the University of British Columbia specializing in computer vision. Previous to UBC he was a research scientist at the MIT Artificial Intelligence Laboratory. His vision research has focused on vision for mobile robotics, in particular mapping, navigation and their application to assistive technology. More recently he has been investigating motion and activity recognition in the context of sports video understanding.

CHALLENGES IN AUTOMATING SPORTS BROADCASTING

We describe mechanisms that allow a collection of cameras to assemble an informative broadcast of a team sporting event, without requiring extensive augmentation of the camera systems. Using consumer-grade cameras means that camera pose must be estimated from the image stream. The system must also identify the current stage of the game and predict a plausible future sequence of play, using only the detected position of the players, in real time. Finally, the lack of ground truth for the camera selection process means we must take advantage of unannotated broadcast streams to regress a selector that determines which camera is broadcast, consistent with typical broadcast selection, and dependent on the predicted evolution of the game.

Mary Hayhoe

University of Texas Austin

Mary Hayhoe is a Professor in the Center for Perceptual Systems at the University of Texas Austin. She received her Ph D from the University of California at San Diego and was a member of the Center for Visual Sciences at the University of Rochester from 1984-2006, when she moved to UT. She been a leader in developing virtual environments and experimental paradigms for the investigation of natural visually guided behavior. She has expertise in human eye movements in natural environments, especially how gaze behavior relates to attention, working memory, and cognitive goals. She served on the Board of Directors of the Vision Sciences Society from 2011-2016 and was President in 2015. She is also on the Editorial Board of the Journal of Vision.

SPEAKERS

PREDICTION IN THE VISUAL CONTROL OF ACTIONS

It is commonly accepted that the somato sensory consequences of a planned movement are predicted ahead of time using stored internal models of the body's dynamics, and such predictions are a critical component of the control of movement. However, evidence for the fundamental role of prediction in vision has been less clear. I will review some of the roles that prediction plays in vision, such as intercepting a moving target. In this context, both pursuit and saccadic eye movements reveal predicted future trajectory and are a robust and pervasive aspect of natural behavior. Predictions must be based on past experience, and eye movements during interception appear to be based on some combination of the visual information specific to a particular trajectory together with a memory-based component. One value of such memory representations in control of movements is that it allows shared representation that can guide both eye and body movements and lead to efficient coordination patterns. Memory representations constitute visual priors, or internal models, and form the basis of prediction. Thus, predictive signals can be seen as tightly interwoven with incoming sensory data, and are a fundamental aspect not only of visual perception, but of the actions that are guided by vision.

Dan Kersten

University of Minnesota

Daniel Kersten is professor of Psychology at the University of Minnesota and a member of the graduate faculties in Neuroscience, and Computer Science and Engineering. He did his undergraduate training in mathematics at MIT, followed by an M.S. in mathematics, and a Ph.D. in psychology at the University of Minnesota with Gordon Legge. After studying with Horace Barlow at Cambridge University, he joined the faculty at Brown University, moving to the University of Minnesota in 1989. In addition to his interest in natural flows, his current work focuses on the neural representations and computations underlying human body pose perception.

THE PERCEPTION OF NATURAL FLOWS

Human vision has the facility to interpret retinal input from moving materials (e.g. water waves, smoke, windblown foliage, etc.). The facility is remarkable given that the input is a high-bandwidth, complex function of intrinsic physical, geometric and photometric properties of substances, and their interactions with light and viewpoint. I'll show examples of natural dynamic flows that illustrate visual abilities to "decode" flow patterns to infer their properties and causes. Analogous to object perception, these observations demonstrate how inferences about flows range over levels of abstraction from shallow properties such as colour and optic flow, to deeper attributes such as viscosity and elasticity, and further to support affordances, for example whether a material is penetrable. The "depth" of these decisions depends critically on the spatial and temporal context. I'll describe results from a study with Yaniv Morgenstern in which we measured perceptual judgments of material category, attributes, affordances, and between-flow similarities. I'll also review relevant work on modeling natural flows and the computational challenges for understanding how the brain supports flow perception and inferences that range from shallow to deep.

Danny Dilks

Emory University

Daniel D. Dilks is an Assistant Professor of Psychology at Emory University. Prior to going to Emory, he received his Ph.D. in Cognitive Science from Johns Hopkins University, after which he became a Postdoctoral Fellow and later a Research Fellow in the Kanwisher Laboratory at MIT. Most broadly, he is interested in understanding the human visual experience (e.g., how we recognize people, places, and things) from infancy to adulthood. Thus, his research focuses on three big questions about human vision: i) How is the adult visual cortex functionally organized?, ii) How does this organization get wired up in development?, and iii) How does the visual system change in adulthood? To address these questions, Dilks uses a variety of methods, including psychophysics, functional magnetic resonance imaging (fMRI), neuropsychology, and transcranial magnetic stimulation (TMS) – whatever it takes to answer the question.

SCENE RECOGNITION: HOW AND WHY?

Our ability to perceive the visual environment is remarkable: we can recognize a place or "scene" (e.g., a kitchen, a beach, Berkeley) within a fraction of a second – even if we have never seen that particular place before (Potter, 1976) – and almost simultaneously use that information to seamlessly navigate. Given the ecological importance of scene recognition, it is perhaps not surprising then that particular regions of the human brain are specialized for processing visual scene information: the parahippocampal place area (PPA) (Epstein & Kanwisher, 1998), the retrosplen-ialcomplex (RSC) (Aguirre & D'Esposito, 1999), and the occipital place area (OPA) (Dilkset al., 2013). While the exact function each of these regions plays in scene processing remains unknown, it is currently believed that the scene processing system as a whole (comprised of the three scene-selective cortical regions) is a monolithic system in the service of navigation. However, in this talk, I will present multiple lines of evidence challenging the pervasive theory that all three scene-selective cortical regions serve the purpose of navigation. Instead, I propose that scene processing is comprised of two distinct pathways: one responsible for navigation, including RSC and OPA, and another responsible for scene categorization (e.g., recognizing a scene as a kitchen, a beach, etc.), including PPA.

CHAIRS & HOSTS

Session Chairs & Hosts

Session Chairs & Hosts

Rob Allison

Robert Allison is a Professor at York University and a member of the Centre for Vision Research. He obtained his Ph.D., specializing in stereoscopic vision in 1998 and did post-doctoral research at York University and the University of Oxford. His research enables effective technology for advanced virtual reality and augmented reality and for the design of stereoscopic displays. He is recipient of the Premier's Research Excellence Award and a York Research Chair in recognition of this work.

Michael Brown

Michael S. Brown received his undergraduate and Ph.D. degrees in Computer Science from the University of Kentucky in 1995 and 2001 respectively. He has over 13 years of academic experience working in Asia, holding prior faculty positions at the Hong Kong University of Science and Technology, the Nanyang Technological University (Singapore), and the National University of Singapore. His research interests are in the areas of computer vision, image processing, and computer graphics with an emphasis on physics-based models for image enhancement and restoration. He regularly serves on the senior program committees of the major computer vision conferences (CVPR, ICCV, ECCV) and is currently an associate editor for the IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI) and the International Journal on Computer Vision (IJCV).

Session Chairs & Hosts

Patrick Cavanagh

Associate Member of the Vision: Science to Applications program and member of the Centre for Vision Research. Patrick Cavanagh started at McGill as a computer/electrical engineer, wanting to make thinking computers. He then went to Carnegie-Mellon University for a doctorate (PhD) to mingle with Herb Simon and Allen Newell. His earliest interests centered on short-term memory and neural models and these projects evolved into research in vision. An academic transient, he is currently traveling through attention and the position sense.

Doug Crawford

Doug Crawford completed his Ph.D. in Physiology at Western University in 1993 and then spent two years as an MRC Fellow at the Montreal Neurological Institute, before joining the York Department of Psychology in 1995. For the past 23 years his work at the York Centre for Vision Research has focused on the control of visual gaze in 3D space, eye-hand coordination, and spatial memory during eye movements. This has resulted in over 140 papers in publications such as Nature, Science and Annual Review of Neuroscience, and has garnered numerous awards, including the 2004 Steacie Prize and the 2016 Canadian Physiological Society Sarrazin Award.

Session Chairs & Hosts

James Elder

James Elder received his Ph.D. in Electrical Engineering from McGill University in 1996. His current research is focused on natural scene statistics, perceptual organization, contour processing, shape perception, single-view 3D reconstruction, attentive vision systems, AI for sports videography and machine vision systems for dynamic 3D urban awareness. His research has won multiple awards and honours, including the Premier's Research Excellence Award and the Young Investigator Award from the Canadian Image Processing and Pattern Recognition Society. He is currently the Director of the NSERC CREATE Training Program in Data Analytics & Visualization and Principal Investigator of the Intelligent Systems for Sustainable Urban Mobility (ISSUM) project and serves on the Editorial Boards for the Journal of Vision and the ACM Transactions on Applied Perception.

Maz Fallah

Mazyar Fallah is the Associate Dean, Research & Innovation in the Faculty of Health, a member of the Centre for Vision Research as well as an Associate Professor in the School of Kinesiology and Health Science. He has bachelor's degrees in biology and psychology from the Johns Hopkins University, and master's and doctoral degrees in psychology and neuroscience from Princeton University. He is a systems neuroscientist investigating the neurophysiology of cognitive processes such as attention, object representation, and visual perception, with relation to decision-making, movement (eye and hand), and cognitive abilities. His research uses behavioural, electroencephalography (EEG), electro physiology, and oculomotor techniques to investigate these processes in health and disease.

Session Chairs & Hosts

Ingo Fruend

Ingo Fruend is an Assistant Professor for Computational Neuroscience at York University. His research combines behavioural and neural data with computational modeling to understand how high-level visual processes interact with low level feature encoding. He received a Ph.D. in Christoph Herrmann's lab and then went on to do postdoctoral work with Felix Wichmann and James Elder. Before taking on his current position at York, he worked as a Data Scientist at Zalando and later as an A.I. engineer at Twenty Billion Neurons.

Denise Henriques

Denise Henriques earned her PH.D. and MA in Psychology at York University, and did her postdoctoral training in the Department of Neuroscience at U. Minnesota and in the Department of Physiology and Pharmacology at Western University. Her work on sensorimotor control and learning has led an invited review in the Annual Review of Neuroscience, citations in both a textbook and a popular science book, and several early-career awards including an Ontario Ministry of Innovation Early Researcher Award (2007), and the Alfred P Sloan Fellowship (2009), as well as many international seminar invitations. She has collaborations with researchers in Giessen, Munich, Nijmegen, and UC San Diego.

Session Chairs & Hosts

Michael Jenkin

Michael Jenkin is a Professor of Computer Science and Engineering and a member of the Centre for Vision Research at York University. Working in the fields of visually guided autonomous robots and virtual reality, he has published over 150 research papers, including co-authoring Computational Principles of Mobile Robotics with Gregory Dudek and a series of co-edited books on human and machine vision with Laurence Harris.
His current research interests include: work on sensing strategies for AQUA, an amphibious autonomous robot being developed as a collaboration between Dalhousie University, McGill University and York University; the development of tools and techniques to support crime scene investigation; and the understanding of the perception of self-motion and orientation in unusual environments including microgravity.

Katherine Seton

Marketing & Events Coordinator at VISTA, Katherine Seton came to York University in October 2018. She graduated from the University of Birmingham (BA Hons) in 2012 and is a member of the Chartered Institute of Marketing. Katherine has worked in a variety of PR, marketing, communication and event roles within the not-for-profit, education and commercial sectors in Europe, the Middle East and Australia.

Session Chairs & Hosts

Jennifer Steeves

Jennifer Steeves completed her Ph.D. at York University in 2001. She subsequently was a postdoctoral fellow at the Robarts Research Institute and Western University where she performed neuro imaging studies with functional MRI on neurological patients with visual form agnosia and prosopagnosia. She was hired at York University in 2005 and was Director of research-dedicated York MRI Facility from 2014-2018. Now, she serves as Associate Dean Research in the Faculty of Science at York University.

Rick Wildes

Richard P. Wildes received the Ph.D. degree from the Massachusetts Institute of Technology in 1989. Subsequently, he joined Sarnoff Corporation (Now SRI) in Princeton, New Jersey, as a Member of the Technical Staff in the Vision Technologies Group. In 2001, he joined the Department of Computer Science and Engineering at York University, Toronto, where he is an Associate Professor and a member of the Centre for Vision Research. Honors include receiving a Sarnoff Corporation Technical Achievement Award, the IEEE D.G. Fink Prize Paper Award for his Proceedings of the IEEE publication "Iris Recognition: An Emerging Biometric Technology," and twice giving invited presentations to the US National Academy of Sciences.

POSTERS

Poster Session 1

Tuesday, June 11 (12-2:00pm)

Invariance of human image recognition measured using Generative Adversarial Nets	Jay Patel	1
Depth perception from monocular self-occlusions	Domenic Au	2
A computational mid-level model of lightness and lighting	Richard Murray	3
The effect of motion parallax and stereopsis on the sense of presence in the pit room environment	Siavash Eftekharifar	4
Effects of Dance on Speech Functionality for those Living with Parkinson's Disease (PD)	Tiffany Mak	5
The Effects of Dance on Couple Outcomes Yoked to a Partner with Parkinson's Disease	Eden Rose	6
Tracing the double-drift illusion	Marius 't Hart	7
Rapid reorganization in healthy adult human primary visual cortex following non-invasive and reversible deprivation	Yaseen Jamal	8
Spatial Frequency Filtering: Choices Matter	Sabrina Perfetto	9
Task-dependent attention to object features revealed by multivariate pattern analysis of electrophysiological signals	Nina Lee	10
Organization of population receptive fields in the parahippocampal place area	Charlotte A Leferink	11
Fast and Accurate Vision-Based Stereo Reconstruction and Motion Estimation for Image-Guided Surgery	Andrew Speers	12
Dancing with Parkinson's Disease: Investigating Medication Dosage and Number of Falls	Alyssa M. Pagliuso	13
Time course and hierarchy of grasp parameters revealed by EEG representational dissimilarity analysis	Lin Lawrence Guo	14
Estimated Counting during Dichoptic Viewing in Amblyopia	Audrey Wong-Kee-You	15

Poster Session 2

Wednesday, June 12 (12-2:00pm)

cTBSto V1 alters GABA and Glx	Karlene Stoby	1
Representation of non-local shape information in deep neural networks	Shaiyan Keshvari	2
A computational model of V2: neural mechanisms underlying texture perception	Tim Oleskiw	3
Monocular depth discrimination in natural scenes: Humans vs. deep networks	Kedar P. Vilankar	4
Importance of context and chromaticity in using computer screens for lightness matching experiments	Khushbu Y. Patel	5
Re-balancing the eyes using monocularly -directed attention	Sandy Wong	6
The influence of spatiotemporal structure on recall performance in memory-guided saccade sequences	Sharmini Atputharaj	7
Convolutional Network Model of Allocentric Landmark Impact on Target Localization	Sohrab Salimian	8
Decreased Error Rates in Learning through Novel Sequence of Ocular Movements	Tenzin Chosang	9
What is a scene? Concavity as an intrinsic property of a scene	Annie Cheng	10
Structural and Functional Connectivity of Attention Control and the Effect of Auditory Stimulus on Sustained Focus: The Virtual Brain Model	Azin Dastpak	11
Automatic Initialization and Tracking in Optical Motion Capture by Learning to Rank	Saeed Ghorbani	12
Bootstrapping Metric Structure from Relief Structure	Michael Wang	13
Perceived depth from motion parallax and stereopsis in physical and virtual objects	Brittney Hartle	14
Multiplicative modulations enhance unique hue representation	Paria Mehrani	15

Poster Session 3
Thursday, June 13 (2-4:00pm)

SMILER: An Easy and Consistent Way to Compute Saliency Maps	Calden Wloka	1
Decoding neural mechanisms of eye-head-hand coordination in primate ventral premotor (PMv) cortex during visually guided reaches	Veronica Nacher	2
Red Speeds while Green Slows Response Inhibition in a Stop Signal Paradigm	Gifty Asare	3
Influence of 2D Shape on Contour Depth Perception	Kris Ehinger	4
Updating grasp plans for oriented objects across saccades: An fMRIa functional connectivity study	Bianca Baltaretu	5
Influence of Dance for Young Adults with Disabilities	Ruth-Anne Andrew	6
Assisted Target Detection in Airborne Search and Rescue.	Maryam Shirazi	7
Multiplexing of allocentric and egocentric gaze coding in the frontal eye field (FEF) neurons of rhesus macaques.	Vishal Bharmauria	8
Artistic expression and finger painting in VR	Sarah Vollmer	9
Horizontal selectivity and crowding during face discrimination in the visual periphery	Matthew Pachai	10
Stereoscopic Depth Cues Facilitate Rapid Scene Categorization	Matt Anderson	11
Influence of Gaze Direction on Hand Location and Orientation in a Memory-Guided Alignment Task	Gaelle Nsamba Luabeya	12
The impact of a 1-hour dance intervention on sleep quality in patients with Parkinson's disease	Max Esser	13
Generative adversarial nets capture perceptually relevant features of natural images	Rimma Konoval	14
Predictive mechanisms are involved in perceptual stability across saccades	Aarlenne Khan	15

Navigational Affordance Processing Revealed by Temporal Dynamics of Scene ERPs	Jeff Nador	16
Subjective Assessment of Image Compression Artefacts in 2D viewing versus Stereoscopic Viewing	Sanjida Sharmin Mohona	17
It wasn't me: External source attribution dampens shifts in predicted sensory consequences but not proprioception	Raphael Gastrock	18
How does Predictive Sensorimotor Control differ in people with high and low levels of autistic traits?	Tom Arthur	19
Advancing Video Categorization	Vida Movahedi	20
Contour features predict valence and threat judgements in scenes	Claudia Damiano	21
How spatial coding is affected by mid-level visual object properties within and outside of peripersonal space.	Harun Karimpur	22
Contrast Representation in Generative Adversarial Nets	Elee Stalker	23
Predicting the action outcome of left-and right-footed penalties in a representative experimental setting in soccer	Johannes Kurz	24
The Effects of Visual Art for People with Parkinson's Disease	Josilyn Weidman	25
Predictive influence of visual landmarks on frontal eye field (FEF) visual and memory responses	Adrian Schuetz	26
Early recurrence enables figure border ownership	PariaMehrani	27
EFlash-induced shape distortion illusion by polygons with rounded apexes	Kenzo Sakurai	28
The slow process of the two-rate model affects the rebound in a visuomotor adaptation	Ambika Tara Bansal	29
Feedback but not age influence the multi-rate model	Jennifer E. Ruttle	30
Dance improves motor and non-motor symptoms in Parkinson's Disease	Karolina Bearss	31

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