ISRC-CN^3

Intelligent Systems Research Centre

Ulster University

Ulster University

Intelligent Systems Research Centre

Computational Neuroscience, Neurotechnology and Neuro-inspired Artificial Intelligence (ISRC–CN^3)

Summer School

25th Aug - 1st Sep 2025

Background

There have been rapid advancements and investments in research and development in brain sciences, neurotechnology, neural data modelling and neuro-inspired artificial intelligence (AI). These advancements have not only led to a deeper understanding of brain functions and disorders, but also the development and application of powerful AI and machine-learning algorithms that affect our everyday lives. In fact, historically, AI was inspired by how intelligence arises from the brain.

The Computational Neuroscience, Neurotechnology and Neuro-inspired AI (CN^3) Summer School (https://www.ulster.ac.uk/conference/isrc-cn3-summer-school) aims to train the next generation of researchers on these state-of-the-art developments. This short course will touch on the areas of computational neuroscience, neural data science and signal processing, neurotechnology and neuro-inspired AI. The School is unique in that it offers important and timely topics that are not covered in other Schools or taught courses, or are delivered only individually, in an integrated way, ranging from pedagogical to advanced levels. Although neural computation and neuro-inspired AI research are conducted in the island of Ireland, there is very little relevant training and taught courses, especially for early career researchers, in the region; this School aims to bridge this gap.

On this note, the organising committee warmly welcome you to attend the Summer School!

About the Intelligent Systems Research Centre

The Summer School will be held at the Intelligent Systems Research Centre (ISRC: https://www.ulster.ac.uk/research/topic/computer-science/intelligent-systems-research-centre), a major research unit within the School of Computing, Engineering and Intelligent Systems at Ulster University in Derry ∼ Londonderry, Northern Ireland. This is the fourth ISRC-CN^3 Summer School. The ISRC is dedicated to developing a bio-inspired computational basis for AI to power future AI technologies. This is achieved through understanding how the brain works at multiple levels, from cells to cognition, and applying that understanding to create models and technologies that solve complex issues that face people and society. To accomplish this, a variety of research strategies and applications are used, including big data and machine learning, brain imaging and neural interfacing, human-computer interaction and neuromorphic computing.

The ISRC is housed in a large, purpose-built facility, with state-of-the-art resources, including neuroimaging, neurotechnology and robotic facilities, and a high-performance computing (HPC) facility for big data analytics and large-scale computational simulations. There will be a tour of labs for in-person attendees. The ISRC is multidisciplinary, with arguably the largest cluster of computational neuroscientists and neuro-inspired AI researchers in the island of Ireland, with strong collaborations with many clinical, biomedical, neuroscience, AI and mental health centres, and industrial partners, allowing its research output to quickly translate into applications.

Summer School Structure

This booklet and pre-school materials, including mathematical and programming notes, have been made available in advance of the event for attendees to review (GitHub links will be sent by separate e-mail).

Required software (Python and MATLAB) can be downloaded and configured before the event.

Web links to attend the lecture and lab sessions will be sent to all applicants closer to the dates of the summer school. Hence, please check your email (and your junk folder) regularly. Information on joining the guest wi-fi accounts will be provided on Day 1 for online access to materials while on campus.

Unless mentioned for a last-minute change, the lecture room will be located in rooms **MU308** within the **MU** building. Computer lab sessions will be held in MG122 (MG building) at the Magee campus. Directions to these locations will be sent to all applicants closer to the date of the event.

Online attendees are themselves responsible for accessing reliable internet. When not speaking online, please remember to turn off the microphone and video camera to avoid echo effects and hanging up during video streaming. At the end of the lecture/talk, for questions and answers, you may turn on your microphone and video camera to ask questions or speak to the lecturer/speaker. You can also ask through the chat platform. During lab sessions, you can ask Tutors questions either verbally or through chat. But please be mindful that we have limited Tutors per lab session. Both lecture sessions and lab sessions will be recorded for attendees' viewing.

Towards the end of the Summer School, feedback from attendees will be requested. Anonymity of feedback is optional. This will be used in reviews and reporting, and for improving future versions of the Summer School. A certificate of participation will also be provided upon completion of the Summer School.

Lectures:

Lectures, including external speakers, will be delivered throughout the day with several breaks within this period. Each day of lectures will be categorised based on general themes.

Day 1 lectures will cover general topics, including introductory neuronal and computational modelling, mathematical techniques, and programming.

Day 2 will be focused on modelling biological neurons and neuronal networks, neuron-glial systems, and neuroscience-based theories of cognition.

Day 3 will discuss topics on neural signal processing, neuroimaging, brain connectivity and modelling of decision dynamics.

Days 4 and 5 will discuss topics on neural engineering, neurotechnology and brain-inspired hardware systems and neuro-inspired AI. A neurotechnology-based project will also be introduced to students.

Days 6 and 7 are weekends, and students can work on their project presentations.

On **Day 8**, attendees will commence by presenting their micro-talks (approximately 10 minutes each) on their individual projects or outcomes of the neurotechnology project. Details and requirements of the project submission will be sent out soon. The school will conclude with talks on translating neuroscience-based research and entrepreneurship by industry experts.

Attendees are encouraged to attend as many of the lectures as possible, as the content of the presentations may be built on that of previous presentations. Lectures will be delivered both physically and online (live streaming). Physical lectures will be broadcast live to those attending the fully online version. Those attending online may ask questions via their own computer's video camera, microphone or type in the chat box in the web link. Lectures will be recorded to allow those who were unable to attend (e.g. due to

different time zones, work-related or other personal responsibilities) or for revisits. We will provide the information on the video clips on our GitHub link (see below).

Lecture Room:

- **Room MU308 - MU Building**

Labs:

Each computer lab session aims to consolidate and reinforce the topics delivered during the lectures of that day. Lab sessions will take place in **room MG122** from 5:30 PM and they will be led by Tutors. These sessions will consist of 'mini' project-like assignments that involve computational modelling and data analysis. Attendees are highly encouraged to explore additional aspects, and their findings may be presented during the project pitches on the final day.

Computer labs will be conducted in Python and MATLAB. If MATLAB is not available, students joining online can download MATLAB's 30-day free trial version or MATLAB's online version (https://uk.mathworks.com/products/matlab-online.html). Codes will be provided by the Tutors and available on GitHub (see below). Data will be provided when needed. See Day 1 lab notes (provided in advance) for further details. We recommend that attendees, especially online attendees, download the relevant software to their own personal computer before the Summer School. Attendees with limited mathematics and computer programming experience should review the prepared mathematical notes or other resources, such as https://www.datacamp.com/, before attending the Summer School.

In-person attendees are recommended to attend as many of these lab sessions as possible. It is optional for online attendees to attend the lab sessions, and they can work on the lab materials independently. Tutors will be available through Slack to help with the Lab. Those who are attending physically will be able to access our computer lab's machines and other computing facilities. Guest accounts will be provided for in-person attendees.

Lab sessions will be partially recorded (especially at the beginning and during demonstrations) to allow those who were unable to attend (e.g. due to time zone differences, work-related or other personal responsibilities) or for revisits. We will provide the information on the video clips on our GitHub link (see below).

Computer Lab:

- Room MG122 - MG Building

ISRC-CN^3 GitHub link:

Notes, codes, datasets, and video clips will be made available at our ISRC-CN^3 GitHub link https://github.com/ISRC-CN3.

For those who are not familiar with computer programming or mathematics, it is advisable that they read, refresh or practise the provided materials (see Day 1 and References in GitHub) prior to the start of the Summer School.

Reimbursements, claims and refunds:

If you are seeking (e.g. travel) reimbursements and claims, or refunds, please remember to save hard copies of your receipts. Then contact Dr Saugat Bhattacharyya for a claim form to be filled out.

Please note that in-person attendees who are attending only for a few days will still be paying the full fee.

Food and social activities:

Lunch and coffee/tea will be provided every day. On Day 1 (25th August), a city walking tour (social activities) will be provided. On Day 4 (28th August), a formal dinner will be provided at the nearby Stitch and Weave located at Ebrington Square.

In-person and online participants will be invited to join the ISRC-CN^3 Slack (https://join.slack.com/t/isrccn32025/shared_invite/zt-3auzsdv91-sYWk~6TTCH5U7xh91I

jfdQ) to interact and network with fellow attendees and lecturers/speakers. In-person attendees may use the Slack platform for planning shared accommodation.

Certification:

Certificate of Attendance will be emailed to attendees after the end of the Summer School.

Organising committee and contacts:

- Dr. Saugat Bhattacharyya (Chair) (s.bhattacharyya@ulster.ac.uk)
- Dr. Cian O'Donnell (Co-chair) (c.odonnell2@ulster.ac.uk)
- Prof. Liam McDaid (Scientific) (lj.mcdaid@ulster.ac.uk)
- Prof. KongFatt Wong-Lin (Scientific) (k.wong-lin@ulster.ac.uk)
- Dr. Richard Gault (Queen's University Belfast, Chair-IEEE EMBS UK&I Chapter) (richard.gault@qub.ac.uk)
- Dr. Bronac Flanagan (Scientific) (b.flanagan@ulster.ac.uk)
- Louise Gallagher (Secretary, Treasurer) (l.gallagher@ulster.ac.uk)
- Michelle Stewart (Secretary) (m.stewart@ulster.ac.uk)
- Elaine Duffy (Secretary) (e.duffy@ulster.ac.uk)
- Gerarld Hasson (Secretary) (g.hasson@ulster.ac.uk)
- Cheryl Mullan (Secretary) (c.mullan@ulster.ac.uk)
- Eoghan Tucker (Secretary) (e.tucker@ulster.ac.uk)

ISRC-CN^3 logo design:

- Niall McShane
- KongFatt Wong-Lin

Web design and development:

- Dorothy Mcllroy
- Una McGirl
- Cheryl Mullan
- Mark Millar
- Roger James
- Saugat Bhattacharyya

IT Support

- Christopher Hasson
- Chris O'Connell

DAY 1 (25TH AUGUST 2025, MONDAY)

Morning Session

08:30 - 09:00	Registration and Breakfast at MU building, Room Number 308's lobby
09:00 - 09:15	Welcome Address – *Saugat Bhattacharyya (Organiser)*
09:15 - 09:45	Principles of Neuronal Modelling - *Dr. Cian O'Donnell*
09:45 - 12:30	Mathematics for neuroscience - *Dr. Barry Dillon*

Afternoon Session

12.30 - 13:15	Lunch and Social Introductions (provided at MU building)
14:45 - 17:00	Introduction to Computational Modelling – *Dr. Cian O'Donnell and Prof. KongFatt Wong-Lin*
17:30 - 19:00	Lab session 1 (at MG122) – Fundamentals of Python & MATLAB programming (notes provided in advance) – *Dr. Sahil Sharma and Dr. Manjurul Islam*

DAY 2 (26TH AUGUST 2025, TUESDAY)

Morning Session

08:30 - 09:00	Breakfast at MU building, Room Number 308's lobby
09:00 - 11:00	Ionostasis at the Tripartite Synapse – *Dr. Marinus Toman*
11:15 - 13:15	How to measure information transfer in the brain? – *Dr. Fleur Zeldenrust* (Online)

Afternoon Session

13:15 - 14:00	Lunch
14:00 - 14:30	Campus Photography and Tour
14:30 - 16:30	Computational modelling of plasticity and learning in brains – *Dr. Cian O'Donnell*
16:30 - 17:00	Break (coffee/tea/snacks provided at MU building)
17:30 - 19:00	Lab session 2 (at MG122) – Modelling neurons, neural networks & cognition – *Dr. Oleg Senkevich*

DAY 3 (27TH AUGUST 2025, WEDNESDAY)

Morning Session

08:30 - 09:00	Breakfast at MU building, Room Number 308's lobby
09:00 - 11:00	Part 1: Neural Signal Processing. Part 2: Group Decision Making using BCI – *Saugat Bhattacharyya*
11:15 - 12:45	Fundamentals of functional and effective connectivity and their applications to neurodevelopmental and mental health conditions - *Maria Dauvermann*

Afternoon Session

12:45 - 13:45	Lunch and Networking
13:45 - 14:30	ISRC Lab Tour
14:30 - 16:00	Modelling the dynamics of decision-making - *KongFatt Wong-Lin*
16:00 - 16:15	Break (coffee/tea/snacks provided at MU building)
16:15 - 17:00	Panel Discussion
17:30 - 19:00	Lab session 3 (at MG122) – Cognitive Modelling and Neural signal processing – *Brendan Lenfesty & Kaniska Samanta*

DAY 4 (28TH AUGUST 2025, THURSDAY)

Morning Session

08:30 - 09:00	Breakfast at MU building, Room Number 308's lobby
09:00 - 10:30	Part 1: Using EEG Signals for Implicit Brain-Machine Interactions. Part 2: Inclusive and Equitable Neurotechnologies – *Dr. Mahnaz Arvaneh*
10:45 - 12:45	Magnetoencephalography and its application to Neurorehabilitation – *Girijesh Prasad*

Afternoon Session

12:45 - 13:45	Lunch and Networking (provided at MU building)
13:45 - 14:30	MEG Lab Tour
14:30 - 16:30	Evolvable Brain-Inspired Hardware Based on Memristors – *Dr. Xingming Shi*
16:30 - 17:15	Panel Discussion (Tutor-led)
17:30 - 18:30	Lab session 4 (at MG122) - Neural Engineering – *Kaniska Samanta*
19:00 -	Social activity - Gala Dinner at Stitch and Weave, Ebrington Square

DAY 5 (29TH AUGUST 2025, FRIDAY)

Morning Session

08:30 - 09:00	Breakfast at MU building, Room Number 308's lobby
09:00 - 11:00	Keynote: Bridging Neuroscience and AI: Large-Scale Neural Modelling with SpiNNaker – *Prof. Steve Furber*
11:15 - 13:15	Introduction to Continual Learning – *Shirin Dora*

Afternoon Session

13:15 - 15:00	Lunch and Networking (provided at MU building)
15:00 - 17:00	Part 1: Decoding mental imagery from electroencephalography (EEG) and applications of AI-enabled wearable neurotechnology for communication and rehabilitation. Part 2: NeuroCONCISE Industry Talk – *Damien Coyle*
17:30 - 19:00	Lab session 5 (at MG122) - Project handover and Lab session 5 – *Toby Newey, Kaniska Samanta and Mark Butler*

DAY 6 and 7 (30TH and 31ST AUGUST 2025)

Social Activity and Project Work

Saturday, 13:00 -	Derry∼Londonderry walking tour

DAY 8 (1ST SEPTEMBER 2025, MONDAY)

Morning Session

09:00 - 09:30	Breakfast at MU building, Room Number 308's lobby
09:30 - 12:30	Participant presentation

Afternoon Session

12:30 - 13:45	Lunch and Networking (provided at MS building)
13:45 - 14:30	Industry Talk: Advancing Neurotechnology-Driven Therapeutics for Alzheimer's Disease: Mechanistic and Clinical Perspectives – *Javier Minguez*
14:30 - 15:15	Industry Talk – *Fred Jordan*
15:15 - 15:45	Prize-giving ceremony and closing remarks

Profiles of speakers

Dr. Cian O'Donnell

Bio: Cian O'Donnell did a B.Sc. in Applied Physics at Dublin City University, followed by an M.Sc. and Ph.D. in Neuroinformatics at University of Edinburgh where he studied biophysical models of electrical noise and synaptic plasticity in single neurons. He then worked for 3 years as a postdoc in the Salk Institute in La Jolla, California modelling synaptic plasticity in neural circuits, and analysing neural population activity data from mouse models of autism. From 2015-2021 he was a lecturer at the University of Bristol, then in October 2021 he joined Ulster University at Magee as a Lecturer in Data Analytics. His research group has 3 postdoctoral RAs and 6 PhD researchers, working on three topics: 1) learning and memory in the brain; 2) neural circuit dysfunction in autism; 3) statistical methods for neuroscience data.

Website here: https://odonnellgroup.github.io.

Lecture Title: Principles of Neuronal Modelling

Date Time: 25th August 2025, 9.15am
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_ZDZjNzNmZmQtMDRlOS00ZmRkLTg4YTAtMmExZjhlMmZlZjhk%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Lecture Title: Introduction to Computational Modelling

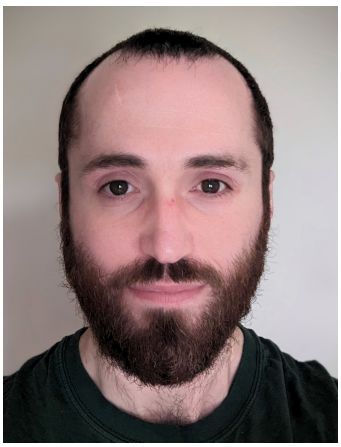
Date Time: 25th August 2025, 14.45pm
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_ZDkxN2I4OTAtZWIzOC00YTM5LWE0MWItOTM0M2ZlYWFjYzli%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d
Synopsis: This lecture will address computational modelling and mathematical analysis of neural dynamics as applied to certain cognitive functions. The focus will be on neural network models that lend themselves to theoretical analysis and support conceptual understanding.

Lecture Title: Computational modelling of plasticity and learning in brains

Date & Time: 26th August 2025, 14.30pm
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_NTcxODEzMTgtM2RhZS00Mjg5LWFiMjgtOTMyMzgzYjI4ZjEw%40thread.v2/0?context=

%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Synopsis: This lecture will introduce the basics of how we think learning works in the brain, and common computational models of synaptic plasticity at the single synapse, single neuron, and neural circuit levels. It will cover classic models of Hebbian plasticity, spike-timing-dependent plasticity, and attractor networks. Finally, we will briefly discuss modern attempts to link brain learning to backpropagation and deep learning in artificial neural networks.



Dr. Barry Dillon

Bio: In 2016, Barry completed his PhD in theoretical physics, where he studied the phenomenology of beyond the standard model physics scenarios. He then held three postdoctoral research positions at the University of Plymouth (2017-2018), Jozef Stefan Institute (2018-2020), and the University of Heidelberg (2020-2023). Since 2018, his research has focused on the application of machine-learning tools to particle physics phenomenology, particularly in the search for new physics at the Large Hadron Collider. In 2023, he worked in machine-learning research and development at AllstateNI, before taking up a position at Ulster University this year as a Lecturer in Mathematics.

Lecture Title: Mathematics for neuroscience - An introduction

Date & Time: 25th August 2025, 9.45am
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_MjhjY2UwNDUtMmIzYi00NzljLTkyYmItOGJmMzI2NmE2ZjNj%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Synopsis: Despite the immense complexity of the brain, mathematical modelling has allowed for major advances to be made towards understanding behaviour, consciousness and disease. Mathematical models can be used to describe processes from the level of single cell voltage dynamics, through emergent behaviour of neural networks to activity patterns in tissue level models. Underlying nearly all of these models are differential equations describing how various quantities (e.g. voltage, firing rate) change in time and space. This lecture introduces some of the mathematical tools needed to understand and analyse solutions of these models. We will see how to describe neural systems using differential equations, how model simplifications can be made whilst retaining essential features and how we can understand solutions both through simulation and using techniques from dynamical systems theory. Along the way we will review any necessary concepts from linear algebra and vector calculus.

Dr. Marinus Toman

Bio: Marinus Toman received the B.Sc. (Hons.) degree in Cloud Computing from Letterkenny Institute of Technology, Donegal, Ireland in 2018 and the PhD degree in Computational Neuroscience as part of the Computational Neuroscience and Neuromorphic Engineering Research Team at Ulster University, Derry, Northern Ireland in 2022. His primary research interests include modelling of glial and neuronal cells in the brain to investigate how memory and learning occurs at a cellular level in the brain. His other research interests include computer science, specifically indoor positioning and localisation.

Lecture Title: Ionostasis at the Tripartite Synapse

Date & Time: 26th August 2025, 09.00am
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_MjYyYmUyM2ItZDdmNy00MDg5LWFlMjktMGI2NmI2MTNiZTg4%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Synopsis: Computational models of neuro-glia interactions are an important tool for researchers studying different levels of the central nervous system; from network level to single cell and sub-cellular. Astrocytes are the most abundant glial cell in the brain and in many brain regions, they come in close proximity to synapses and provide supporting roles like homeostasis. The tripartite synapse is a recent concept that acknowledges both the proximity and the important contribution of astrocytes to neuronal synapses. The tripartite synapse is currently too small a region for experimentalists to probe, therefore, computational models of the tripartite synapse can provide an insight, and possibly predictions, into the signalling dynamics between astrocytes and neurons at the point of information transfer between neurons.

During this lecture, students will learn about astrocyte homeostasis at the tripartite synapse. During the accompanying tutorial, students will learn how to construct computational models of neuro-glia interactions using systems of ordinary differential equations. For the lecture and tutorial, it is assumed students have very little prerequisite knowledge of these topics, and by the end of both sessions, students will have the knowledge and tools they can take away to start building their own computational models of neuro-glial signalling dynamics.

Dr. Fleur Zeldenrust

Bio: Fleur Zeldenrust started studying physics, but switched to neuroscience during her master's degree. She obtained a PhD in computational neuroscience in 2012, from the University of Amsterdam, supervised by Wytse Wadman. After performing postdoctoral research at the École Normale Supérieure in Paris with Boris Gutkin and Sophie Denève, she returned to the Netherlands to design a bachelor's track in computational neuroscience in the Psychobiology BSc degree at the University of Amsterdam. An NWO Veni grant (2015) and later a Marie Curie Training Network grant (2019, 'SmartNets') allowed her to start her own research group at the Donders Institute for Brain, Cognition and Behaviour of the Radboud University in Nijmegen. She recently obtained an NWO Vidi grant (2022) to research the influence of neuromodulators on information processing in the brain. Next to her research, she is very passionate about communicating neuroscience to the public, (co-)founding, amongst others the Dutch Brain Olympiad and the BrainHelpDesk. Recently, she was also one of the founders of a new BSc program in neuroscience.

Lecture Title: How to measure information transfer in the brain?

Date & Time: 26th August 2025, 11.15am
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_MTk1ZjEwMDMtNWUxNC00MzZhLTlmOTYtMjA1N2E4NWYxNWFj%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Synopsis: The brain is a unique system, in that its dynamics have a clear function: making its owner respond to the world around it. In order to perform this function, the brain continuously processes information. How do the dynamics of neurons and networks result in information processing? The physical structure of the brain (its 'hardware') shapes this information processing and vice versa: the computations needed for information processing (the 'software') are adapted to the physical structure of the hardware. Here, I will discuss this relationship between information processing and neural properties on different levels, from single neurons to networks, and from different perspectives, from single cell electrophysiology to network modelling. I will start with introducing the concept of (mutual) information, and how it can be measured in neuroscientific experiments. I will then show how I use this in my research to study how neuron and network properties influence information processing in the brain.

Dr. Saugat Bhattacharyya

Bio: **Saugat Bhattacharyya** is a Lecturer in Computer Science in the School of Computing, Engineering & Intelligent Systems. His research interests are in the area of Brain-Computer Interfacing, Neurotechnology, Human Cognitive Augmentation, Artificial Intelligence, Data Analytics and Machine Learning and their application in Human-Machine Interaction and Neuro-Rehabilitation. His research is primarily focused on developing brain-computer interfacing systems based on robust signal processing, quantitative and machine learning algorithms to draw inference into a user's state of mind through their neural and other physiological signals. He has over 60 publications in the form of peer-reviewed journals and international conferences. He is a recipient of the US-Ireland RD Partnership Programme (Centre-to-Centre Mechanism), MRC Equipment Grant, and GCRF pump-priming as co-investigator, and two PhD fellowships by CSIR, India, and Erasmus Mundus. He is also an associate editor/section board member in Frontiers in Medical Technology and MDPI Brain Sciences.

Date & Time: 27th August 2025, 09.00am
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_YWJlY2MxMzMtZDYyNi00YzA2LTk0ODctOTc5MjJjOGFlZjZl%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Lecture Title: Neural Signal Processing
Synopsis: New neuroscience technologies are opening exciting possibilities in healthcare, rehabilitation, biometrics, and brain–computer interfaces. These tools allow us to observe and even influence brain activity, supporting motor and cognitive functions. Non-invasive methods such as EEG, MEG, fNIRS, and fMRI are especially widely used. Among them, EEG and MEG record complex brain signals that can be difficult to interpret. To make sense of these signals, researchers use well-designed experiments, careful data cleaning, and specialized analysis techniques. This lecture will introduce practical approaches, including filtering, artefact removal, and time–frequency methods, to better understand brain responses during different tasks.

Lecture Title: Group Decision Making using Brain-Computer Interfacing
Synopsis: This talk introduces the emerging field of Collaborative Brain–Computer Interfaces (BCIs) as a transformative technology for human augmentation. By combining neural signals from multiple individuals into a shared computational framework, collaborative BCIs have the potential to enhance problem-solving, learning, and interaction. We will outline the principles behind this approach, including recent advances in signal processing and machine learning that make it possible to interpret and act

on collective brain activity. Potential applications in areas such as healthcare, military decision-making, and workforce enhancement will be discussed, along with ethical considerations shaping the future of this technology.

Dr. Maria Dauvermann

Bio: Dr Dauvermann's research focuses on the identification of risk and resilience markers in young people who are at high risk of developing neurodevelopmental and mental health conditions, and is also interested in the characterisation of biopsychosocial prognostic markers of clinical and functional outcome. She uses cognitive neuroscientific and interdisciplinary methods to integrate neurobiological, psychological and psychosocial factors to better understand how youth vulnerability can influence and be influenced by neurodevelopmental and mental health conditions.

Lecture Title: Fundamentals of functional and effective connectivity and their applications to neurodevelopmental and mental health conditions

Date & Time: 27th August 2025, 11.15am
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_MDQzYjZmMjUtOTkwYS00NTQwLWEyN2EtMDMwZWFmMWE5Nzc5%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Synopsis: Progress in functional brain imaging allows us to non-invasively examine human brain activity in vivo with optimised spatial and temporal resolution. In addition, such neural maps enable the study of functional large-scale networks leading to a better understanding of cognitive functions. For improved clinical practice, greater insight into cognitive function in individuals with neurodevelopmental and mental health conditions is important since disrupted functional networks underlie clinical symptoms and cognitive deficits in neurodevelopmental disorders, such as psychotic disorders and autism spectrum disorders.

In the first part of this lecture, I will discuss the theoretical basis of functional connectivity and provide an overview of different approaches across neuroimaging techniques of functional Magnetic Resonance Imaging (fMRI), electroencephalogram (EEG) and magnetoencephalogram (MEG). In the next step, I will cover the fundamentals of effective connectivity and different methodologies across fMRI, EEG and MEG. We will discuss advantages and disadvantages of both functional and effective connectivity in the context of examining cognitive function in neurodevelopmental disorders. A discussion of how functional and effective connectivity may contribute to clinical and cognitive diagnostic, predictive and treatment interventions in neurodevelopmental and mental health conditions will conclude the lecture.

KongFatt Wong-Lin

Bio: KongFatt Wong-Lin is a Professor of Computational Neuroscience and Machine Intelligence. He leads the Cognitive Neuroscience and Neurotechnology research team at the Intelligent Systems Research Centre in Ulster University. His research interests span computational modelling and mathematical analysis in systems and cognitive neuroscience, psychology, brain disorders, neural computation and engineering, AI, and data science. He received his Ph.D. in Physics with a focus on Computational Neuroscience at Brandeis University, with affiliation to the Volen National Centre for Complex Systems. He was later a research associate at Princeton University, with affiliation to The Program in Applied and Computational Mathematics, and Princeton Neuroscience Institute. He has also received visiting fellowships at the University of Galway and the University of Oxford.

Website: https://www.ulster.ac.uk/staff/k-wong-lin

Lecture Title: Modelling the dynamics of decision-making

Date & Time: 27th August 2025, 14.30pm
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_ZTFlNDkyNDUtNzg4OC00NDEyLTkyMjEtMjkwODBkM2YzODg5%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Synopsis: This lecture will build on the modelling principles and techniques introduced on Day 1 to explore the neural dynamics of decision-making—an essential aspect of cognition. It will discuss the development of theoretical models that capture the dynamics of neural activity and decision-making behaviours, with the aim of illuminating the computational principles underlying decision-making and associated (meta)cognitive processes. Connections to AI, particularly within the context of NeuroAI, will also be highlighted.

Dr. Mahnaz Arvaneh

Bio: Dr Mahnaz Arvaneh is a Senior Lecturer in Biomedical Engineering and Director of the Physiological Signals and Systems Laboratory at the University of Sheffield. Her research focuses on AI-driven, user-centred closed-loop neurotechnologies for cognitive and physical rehabilitation, with expertise in EEG processing and machine learning. She leads interdisciplinary projects such as TeleRegain, a home-based BCI system for stroke rehabilitation, and initiatives addressing equity and adoption barriers in neurotechnology. Dr Arvaneh is also the entrepreneurship lead at the Centre for Machine Intelligence, where she supports the commercialisation of AI research. She contributed to the Royal Society expert perspective report on neural interface technologies and serves as an associate editor for Nature Scientific Reports, IEEE Transactions on Neural Systems and Rehabilitation Engineering (TNSRE), and IEEE Transactions on Biomedical Engineering (TBME). She is a core member of the BCI working group at the British Standards Institution and represents the UK in international BCI standardisation efforts.

Date & Time: 28th August 2025, 09.00am
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_YmI2ZGU0ZDYtN2JmYy00YWJkLWJiYWItOGU4OTM5NTNjNTUy%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Lecture Title: Using EEG Signals for Implicit Brain-Machine Interactions
Synopsis: Traditional BCIs often rely on users' active engagement, which can be mentally demanding and impractical for sustained real-world use. This talk explores implicit BCIs—systems that decode users' intentions from passive, reactive brain responses. I will present a case study on EEG-based control of assistive robots, highlighting a novel approach that goes beyond binary classification to detect multiple types of user feedback. Using Bayesian inference and multi-class EEG decoding, we demonstrate significant gains in both accuracy and scalability, enabling more efficient and intuitive human-robot interaction.

Lecture Title: Inclusive and Equitable Neurotechnologies
Synopsis: While neurotechnologies such as BCIs offer exciting potential, they risk reinforcing existing inequities if inclusivity is not built into their design and deployment. This talk addresses three key barriers to equitable BCI development: underrepresentation in participant samples, biased system design, and adoption challenges in underserved communities. Drawing on recent case studies, we will explore the scope and impact of these issues, and I will share actionable recommendations to help researchers and developers create more accessible and socially responsible neurotechnologies.

Prof. Girijesh Prasad

Bio: Prof. Girijesh Prasad is Professor of Intelligent Systems in the School of Computing, Engineering and Intelligent Systems, Ulster University (UU), UK. He is Director of Northern Ireland Functional Brain Mapping (NIFBM) facility at UU's Intelligent Systems Research Centre, where he leads the Cognitive Neuroscience and Neurotechnology research team.

He received a BTech in Electrical Engineering from Regional Engineering College (now National Institute of Technology) Calicut, India in 1987, an MTech in Computer Science and Technology from University of Roorkee (now Indian Institute of Technology Roorkee), India in 1992, and a PhD in Electrical Engineering from Queen's University of Belfast, UK in 1997. He is a Chartered Engineer, a Fellow of IET, a Fellow of Higher Education Academy, a Senior Member of IEEE, and a founder member of IEEE Systems, Man, and Cybernetics society's Technical Committee on Brain-Machine Interface Systems. In 2017, he was awarded the Fellowship of International Academy of Physical Sciences (IAPS) India, and the Senior Distinguished Research Fellowship of Ulster University. Prof. Prasad joined Ulster University, as a Lecturer in 1999; he was promoted to Senior Lecturer in 2007, Reader in 2008, and Professor in 2011. Previously he worked in industry first as a Digital Systems Engineer and then as a Power Plant Engineer in India, and as a Research Fellow on an EPSRC/industry project at Queen's University of Belfast, UK.

His research interests are in intelligent systems, data engineering, brain modelling, brain-computer interface (BCI) & neuro-rehabilitation, and assistive technology. Under his supervision, an advanced rehabilitation protocol has been developed incorporating an active physical practice stage followed by a mental practice stage, using a neuro-rehab system consisting of a robotic hand exoskeleton and an EEG/EEG-EMG based BCI, which has been trialled on groups of chronic stroke patients in UK as well as India, resulting in transformative change in patients' quality of life. He has published over 285 research papers in journals, edited books, and conference proceedings. He has supervised to completion 22 PhD students. His research has attracted 18 research grant awards amounting to over £10M funding from national and international agencies including Invest Northern Ireland, Department of Employment and Learning, Research Councils UK (RCUK), Leverhulme Trust, Royal Society, UK India Education and Research Initiative (UKIERI), UK Research and Innovation (UKRI) and Irish industry.

Websites: https://pure.ulster.ac.uk/en/persons/girijesh-prasad ; https://scholar.google.com/citations?view_op=list_works&hl=en&hl=en&user=xPw66a0AAAAJ

Lecture Title: Non-invasive brain-computer interfaces: Enhancing applicability using computational intelligence and technological advances

Date & Time: 28th August 2025, 10.45am

Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_M2RkNWU3MDEtMjY3OS00ZDcwLWI4MjItM2FjMzQ3ZDhkMGQw%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Synopsis: A Brain-Computer Interface (BCI), also known as Brain-Machine Interface (BMI), utilizes neuro-physiological correlates of voluntary mental tasks to facilitate direct communication between human brain and computing devices without the involvement of neuro-muscular pathways. The BCI research is, in general, progressing in two main areas: augmentative & alternative communication (AAC) by replacing neuro-muscular pathways and neuro-rehabilitation by helping to activate desired cortical areas for targeted brain plasticity. Current BCI systems however, lack sufficient robustness and performance variability among users is quite high. One of the critical limitations is because of the non-stationary characteristics of brain's neurophysiological responses, which makes it hard to extract time-invariant stable features unique to voluntary mental tasks. In this talk, the presentation will first briefly review state-of-the-art BCI research and then discuss our computational intelligence supported R&D towards robust BCI design using multi-modal neuroimaging techniques and our current application focus in post-stroke neuro-rehabilitation. In particular, it will be discussed how integrating an EEG-EMG based BCI and hand exoskeleton results into a personalized post-stroke neuro-rehabilitation system that ensures active and engaging exercises and leads to enhanced recovery of the paralyzed upper limbs. Also to take advantage of MEG's highest spatiotemporal resolution (306 channels, Elekta Neuromag TRIUX, recorded at 1k Hz) of all neuroimaging modalities, the development of an MEG-based BCI controlling an MEG compatible hand exoskeleton located in a magnetically shielded room (MSR) will be discussed. It will be discussed how using multi-modal neuroimaging modalities facilitates understanding the neuronal mechanisms involved in motor recovery of stroke patients. Finally the remaining R&D challenges will be highlighted.

Dr. Xingming Shi

Bio: Dr. Xinming Shi is a lecturer at Queen's University Belfast. She earned her Ph.D. in Computer Science from the University of Birmingham, UK, in 2023. Her research is dedicated to brain-inspired intelligence, including neuromorphic computing hardware and software, evolutionary learning, and trustworthy brain-inspired systems. She is a 2024 recipient of the Leverhulme Early Career Fellowship from the Leverhulme Trust. Dr. Shi has published extensively in top journals and conferences, including IEEE TNNLS, IEEE TC, IEEE TETCI, and ACM Transactions. She is a member of SIGEVO, Conference Activities and Communications Subcommittee of the IEEE Computational Intelligence Society (CIS), and a Youth Editor of Intelligent Control.

Lecture Title: Evolvable Brain-Inspired Hardware Based on Memristors

Date & Time: 28th August 2025, 14.30pm
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_M2Y1N2U5MjUtZDFhOC00YWQ5LTg4OTEtYmUwMTQwMTBhZDA1%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Synopsis: The convergence of brain-inspired computing and emerging memory technologies is driving a paradigm shift in adaptive and efficient hardware design. In this lecture, a novel class of evolvable brain-inspired hardware based on memristive devices is introduced. These devices, capable of uniting computation and storage within a single compact component, offer significant advantages in terms of energy efficiency, density, and in-memory computing capability. To address limitations in conventional Evolvable Hardware, new circuit representations and evolutionary algorithms have been developed. A tree-based representation has been proposed to improve general applicability and enable efficient transformation into circuit netlists, while a Shapley-value-based genetic programming framework has been employed to enhance evolutionary efficiency. Two types of memristive reconfigurable architectures have been evolved for functional applications such as reservoir computing. Device-level non-idealities, including variability and sneak currents, are not only mitigated but are leveraged to enhance computational richness. Furthermore, an analog time-delay reservoir with memory enhancement has been designed and implemented using memristive circuits. This design enables accurate processing of long-range temporal dependencies with reduced energy consumption. The presented work demonstrates how physical adaptability and computational robustness can be jointly achieved in memristor-based neuromorphic hardware, offering a promising foundation for next-generation edge AI and brain-inspired systems.

Steve Furber

Bio: Professor Steve Furber is a pioneering computer scientist best known as the principal designer of the BBC Microcomputer and the ARM 32-bit RISC microprocessor—technology that now powers billions of devices worldwide.

After a successful career in industry at Acorn Computers, he joined the University of Manchester, where he is the ICL Professor of Computer Engineering. He leads the SpiNNaker project, which builds large-scale neuromorphic systems to simulate brain function in real time.

A Fellow of the Royal Society and the Royal Academy of Engineering, Prof. Furber has received numerous international honors, including the Faraday Medal, Millennium Technology Prize, and Draper Prize for Engineering.

Lecture Title: Bridging Neuroscience and AI: Large-Scale Neural Modelling with SpiNNaker

Date & Time: 29th August 2025, 09.00am
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_ZjdlMjM1ZGYtYWExMC00M2NlLThmMjUtZjFjMWM1MDBjOTVi%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Synopsis: While there is a lot about the brain that we do not understand, we do know a lot about the components from which it is built. Key among these components are the neurons, which are biological cells that receive inputs from many other neurons and produce a single output that goes to many other neurons, and synapses, which form the connections between neurons and adapt over time to their local environment. We also know quite a lot about the diverse neuronal structures of various brain regions such as the cerebellum and the cortex. What we don't understand is how these components and structures generate useful functions in these various brain regions. But we can build computer models of these structures and use these models to test hypotheses relating to those functions.

The human brain is very large, incorporating in the region of 86 billion neurons each with thousands of synapses, so computational platforms designed to support brain-scale models must also be scalable up to large sizes. The SpiNNaker machines have been developed to accommodate such scalability. At the same time, AI models developed for applications other than brain modelling have also become very large and require very

significant computing resources that consume large amounts of energy. Might brain-inspired models running on platforms such as SpiNNaker have something to offer to address the unsustainable energy demands of today's AI models?

Shirin Dora

Bio: Shirin Dora is currently a Lecturer in Computer Science in the Department of Computer Science at Loughborough University. He completed his PhD from Nanyang Technological University in Singapore on the topic of developing biologically plausible learning approaches for spiking neural networks. During his PhD, he developed a keen interest in the mechanisms of perception and cognition in the brain. This led him to pursue a post-doctoral research in computational neuroscience at the cognitive and systems neuroscience group at the University of Amsterdam. In his postdoctoral research, he collaborated with experimentalists in building deep biologically plausible models of perception and multisensory integration in the brain. From October, 2019 to September, 2021, he was a Lecturer of Data Analytics in the Intelligent Systems Research Centre at Ulster University in United Kingdom.

Lecture Title: Introduction to Continual learning

Date & Time: 29th August 2025, 11.15am
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_NWE3YzA4ODAtNjUxNS00YzViLWI5OTAtMmJmZWNkMmU3ZjBi%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Synopsis: To be added.

Prof. Damien Coyle

Bio: Prof. Damien Coyle is a Professor of Neurotechnology and Director of the Bath Institute for the Augmented Human, University of Bath. He is a UKRI Turing AI Acceleration Fellow 2021-25, and was previously director of the Intelligent Systems Research Centre, Ulster University (2017-2022). His research focuses on developing AI to address challenges associated with translating electrophysiological signals into control signals in brain-computer interfaces (BCI) to enable movement-independent communication/interaction targeting assistive and augmentative communication devices, cognitive and physical rehabilitation technology, and human augmentation. He has won several prestigious international awards including the 2008 IEEE Computational Intelligence Society (CIS) Outstanding Doctoral Dissertation Award, the 2011 International Neural Network Society (INNS) Young Investigator of the Year Award and the IET and E&T Innovation of the Year Award 2018. He was an Ulster University Distinguished Research Fellow in 2011, a Royal Academy of Engineering/The Leverhulme Trust Senior Research Fellow in 2013, a Royal Academy of Engineering Enterprise Fellow in 2016-2017 and an Ulster Senior Distinguished Research Fellow in 2021. He is a founding member of the International Brain-Computer Interface Society, an IEEE Brain Technical Community Steering Committee member, and an Advisory board member for the UK Neurotechnology Innovation Network. He is the Founder and CEO of NeuroCONCISE Ltd, an award-winning, AI-enabled, wearable neurotechnology company.

More information: https://pure.ulster.ac.uk/en/persons/damien-coyle

Lecture Title: Decoding mental imagery from electroencephalography (EEG) and applications of AI-enabled wearable neurotechnology for communication and rehabilitation

Date & Time: 29th August 2025, 15.00pm
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_NDA4YWZmNWMtNDVhZC00NzY1LTgzMjMtZGVmY2UzZTQyMmY2%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Synopsis: Research in the field of brain–computer interfaces (BCIs) and neurotechnology has proven that electrical signals in the brain, modulated intentionally by mental imagery, can relay information directly to a computer, where it is translated by intelligent algorithms (some inspired by the brain's neural networks) into control signals that enable communication and control without movement or can improve self- regulation of brain activity. This talk will present results from research at Intelligent Systems Research Centre that shows people with restricted abilities resulting from disease, injury or

trauma may benefit from neurotechnology, including those who have prolonged disorders of consciousness or locked-in syndrome following traumatic brain injury, spinal injury, stroke and post-traumatic stress disorder. Neural activity can be modulated by many kinds of mental imagery e.g., classical motor imagery BCIs distinguish between imagined hand/arm movements. This presentation will also show recent results in decoding imagined three-dimensional limb movements, imagined primitive shapes, emotion inducing imagery and silent/imagined speech from EEG. The presentation will attempt to address the question is it feasible to expect high and robust performance with these types of imagery in EEG-based BCIs and will highlight results which indicate user proficiency in BCI control is a matter of training time, machine learning/AI ability, application of the technology and maintenance of stable affective states. A number of neurogaming applications that enhance BCI user training will be demonstrated.

Dr. Javier Minguez

Javier Minguez received the physics science degree in 1996 from the Universidad Complutense de Madrid, Madrid, Spain, and the Ph.D. degree in computer science and systems engineering in 2002 from the University of Zaragoza, Zaragoza, Spain. During this period, in 1999 he was with the Robotics and Artificial Intelligence Group, LAASC-NRS, Toulouse, France, for eight months. In 2000, he visited the Robot and Computer Vision Laboratory (ISR-IST), Technical University of Lisbon, Lisbon, Portugal, for ten months. In 2001, he was with the Robotics Laboratory, Stanford University, Stanford, CA, for five months. From 2003 to 2008 he was Ramón y Cajal researcher in the University of Zaragoza. In 2008 he was visiting professor at the Institute of Medical Psychology and Behavioural Neurobiology, Tubingen, Germany for six months. Since 2008, he is an associate professor in the Computer Science and Systems Engineering in the University of Zaragoza. His research activity is framed within the Robotics and Real Time Group of the University of Zaragoza and the Instituto de Investigación en Ingeniería de Aragón. His research interests are mobile robot navigation and brain-computer interfaces

Lecture Title: Advancing Neurotechnology-Driven Therapeutics for Alzheimer's Disease: Mechanistic and Clinical Perspectives

Date & Time: 1st September 2025, 13.45pm
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_NGI0Zjg0ZTctZDA4MC00NzY2LThiMWQtMmZlYWEzZjVkZjRj%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Synopsis: This presentation will comprehensively explore neurotechnological interventions targeting Alzheimer's disease (AD), emphasizing mechanistic insights and translational clinical developments. Initially, it will survey the latest scientific advancements in disease-modifying modalities within the medical technology landscape for AD, highlighting strategies aimed at altering pathophysiological trajectories. Subsequently, the focus will shift to two innovative neuromodulation paradigms integrating wearable biosensing technologies with artificial intelligence-based adaptive algorithms. The first approach utilises closed-loop auditory stimulation synchronised with slow-wave sleep oscillations to potentiate deep sleep intensity. This enhancement is hypothesised to facilitate activation of the glymphatic clearance system, promoting cerebral waste clearance—including amyloid-beta and tau proteins—thereby exerting disease-modifying effects. Concurrently, this method aims to augment hippocampal-dependent memory consolidation processes, providing symptomatic cognitive benefits. The second approach employs

EEG-guided neurofeedback training to upregulate alpha-band oscillatory activity. This neuromodulatory strategy is designed to improve working memory and attentional processes, addressing symptomatic cognitive impairment associated with AD pathology. Both interventions have demonstrated safety and preliminary efficacy in Phase 1 and Phase 2a clinical trials. Currently, they are undergoing rigorous evaluation in Phase 2b clinical studies involving cohorts diagnosed with amnestic mild cognitive impairment (aMCI) due to Alzheimer's disease, assessing therapeutic potential in early-stage neurodegeneration.

Fred Jordan

Bio: Fred Jordan is an inventor, entrepreneur, and a scientist. He holds PhD in signal processing from EPFL in Switzerland, where he specialised in image processing technologies. He is also co-author of 18 peer-reviewed publications and over 80 patents.

His first company, AlpVision, was a great commercial success in digital authentication technologies. In 2014 he co-Founded FinalSpark, together with Dr Martin Kutter.

Over his career, he developed a deep expertise in digital technologies and synthetic biology.

Company

FinalSpark is a startup founded with the objective to build a 'Thinking machine'. After several years of research, and trying all possible algorithms with traditional computer hardware, the Founders concluded that the solution for a better AI is... to use another hardware.

Since the best-known processor of information is a human neuron, they started to build computers using living neurons derived from human skin. This led to building the FinalSpark lab in Vevey.

FinalSpark lab is housing thousands of neutrospheres, which are connected to many electrical wires and used for computation. Scientists from all over the world attempt to program them. Some of the brightest minds took on the challenge of teaching a human neuron to process exactly the information we want, using an electric wire. If this goal is achieved, the way towards biological computers replacing the silicon ones will be open.

Date & Time: 1st September 2025, 14.30pm
Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_OGY4NzY1MzAtYmFhMC00MzI3LTg4MGMtMzY5NWYwZmYxZjM0%40thread.v2/0?context=%7b%22Tid%22%3a%226f0b9487-4fa8-42a8-aeb4-bf2e2c22d4e8%22%2c%22Oid%22%3a%22d3079e99-7fd1-41a0-ae91-5192657eae6c%22%7d

Profiles of Tutors

Dr. Amin Azimi

Bio: Dr. Amin Azimi, is a Postdoctoral Research Associate specializing in Computational Neuroscience. He has contributed significantly to the field by developing neural network models to elucidate the coordination of slow oscillations, thalamic spindles, and hippocampal ripples, and their role in memory consolidation. Additionally, Dr. Azimi has expertise in analyzing local field potential (LFP) data during sleep, exploring the effects of endogenous electric fields on neuronal activity through ephaptic coupling.

Currently, Dr. Azimi is working on computational modelling of decision-making processes. His interdisciplinary expertise and innovative computational approaches aim to advance the understanding of neural communication and information transfer, bridging theoretical models with practical insights into memory consolidation and cognitive functions. Dr. Azimi is eager to participate as a tutor for lab sessions at the ISRC-CN3 Summer School.

Dr. Sahil Sharma

Bio: Dr. Sahil Sharma is a postdoctoral research associate at Ulster University's School of Computing, Engineering, and Intelligent Systems, working on predicting therapeutics in blood for epilepsy patients and explainable AI since August 2023. With over a decade of AI and ML experience, Sahil has authored over 10 SCI journal publications.

He has a robust background in teaching and research, having served as a lecturer and assistant professor at Thapar Institute of Engineering and Technology, India, from January 2018 to August 2022, and at Jaypee University, India and Punjab Engineering College, India, until May 2023. During his Masters and PhD, he worked as a Teaching Assistant, Project Associate, and Teaching Associate. Sahil's industry experience includes a brief stint as an AI-ML Consultant at a startup in Mohali, India, where he contributed to developing a 3D Generative-AI product. His current research focuses on improving therapeutic predictions for epilepsy patients, combining his expertise in AI, ML, and XAI for impactful healthcare solutions.

Dr. M. M. Manjurul Islam

Bio: Dr. M. M. Manjurul Islam is based at the Intelligent Systems Research Centre, School of Computing, Engineering and Intelligent Systems, Ulster University, UK, where he is a Postdoctoral Research Associate contributing to the UKRI Smart Nano NI consortium. His research interests include artificial intelligence, machine learning, mathematical modelling, formal methods, signal processing, digital twins, and brain-inspired computing, with applications in predictive maintenance, smart manufacturing, and semiconductor systems.

He is the editor of the Springer Nature volume Artificial Intelligence for Smart Manufacturing and Industry X.0 and has published more than 40 peer-reviewed journal and conference papers. Before joining Ulster University, he worked as a Postdoctoral Researcher at Fondazione Bruno Kessler (FBK), Italy, and as an Assistant Professor in the Department of Computer Science at the American International University-Bangladesh (AIUB).

He received his Ph.D. in Computer Engineering from the University of Ulsan, South Korea, in 2019. Dr. Islam is a Senior Member of the IEEE.

Dr. Oleg Senkevich

Bio: Oleg Senkevich is a postdoc at Ulster University working with Dr. Cian O'Donnell on modelling synaptic noise caused by the stochasticity of molecular dynamics in neurons. My PhD and MSc projects were related to Ising models and random graphs, and my BSc was in physics. I have highly diverse scientific interests, primarily revolving around computing and intelligence, both natural and artificial.

Brendan Lenfesty

Bio: Brendan Lenfesty received his B.Sc. in Computer Science in 2021 from Ulster University, Magee campus. He is currently studying for a Ph.D. in Computational Modelling and Machine Learning in Decision Neuroscience at Ulster University's Magee campus. His research focuses on using computational modelling and machine learning to gain further knowledge of abstract decisions and the mechanistic processes that underly perceptual decisions.

Kaniska Samanta

Bio: Kaniska Samanta is a PhD researcher at the Intelligent Systems Research Centre, Ulster University. He completed his Master's degree in Electrical Instrumentation from Techno India University, India, and his Bachelor's in Technology from Maulana Abul Kalam Azad University of Technology, India, with a specialisation in Instrumentation and Control Engineering. His research primarily focuses on Brain-Computer Interfacing and neural signal processing using non-invasive neuroimaging techniques such as EEG and MEG. With nine journal papers, book chapters, and participation in 7 national and international conferences to his credit, he is deeply committed to advancing BCI technology. Beyond the academic realm, he is an avid traveller and hiking enthusiast, constantly seeking new adventures and experiences in the great outdoors.

Toby Newey

Bio: Toby Newey is a PhD researcher at the Intelligent Systems Research Centre in Ulster University, researching the augmentation of group decision-making using passive, collaborative brain-computer interfaces and computational modelling. He completed his MEng in Biomedical Engineering at Nottingham Trent University in 2024, writing his Master's thesis on the development of a multi-modal (fNIRS/EEG) neurofeedback system. Outside of academia, Toby is learning Portuguese and enjoys walking and foraging wild mushrooms.

Mark Butler

Bio: Mark Butler is a PhD researcher at the Intelligent Systems Research Centre, Ulster University. He completed his Computer Science undergraduate degree at Ulster University, Magee. His current research focuses on Brain-Computer Interface (BCI) systems, particularly using MEG and EEG modalities. He is especially interested in the role of boredom within neurorehabilitation contexts and how cognitive states can be monitored and adapted to in real time. His broader research interests include cognitive neuroscience, passive BCI design, and human-computer interaction.

City of Derry ∼ Londonderry in Northern Ireland

Located in the Northwest of Ireland where The Wild Atlantic Way meets the Causeway Coastal Route, the vibrant city of Derry ∼ Londonderry is renowned for one of the finest Walled Cities in Europe and home to award winning museums, some of the islands best cultural attractions and a variety of lively festivals and events; Derry ∼ Londonderry offers a vibrant social scene where your visitors are guaranteed the warmest of welcomes and hospitality. For delegates looking to experience the local culture, the city walls surround cosy pubs with live music, award-winning museums that tell stories from times past, and vibrant eateries that serve up LegenDerry Food.

This is a special wee place like no other. Our unique geography and diverse climate create the ideal conditions for our food and drink industry to flourish. Our produce harvested and crafted locally from both 'land and lough' is influenced by the latest food trends worldwide. The shores of Lough Foyle provide a vast array of shellfish with the Lough Foyle Irish Flat Oyster being the jewel in the Foyle's crown.

There's so much to discover in the Walled City with bucket loads of activities to suit all tastes. Derry is home to it all! Discover our 400-year-old City Walls, award-winning museums and theatres or why not try your hand at one of our water attractions, like Stand-Up Paddle-boarding. Take a step through history and go on a walking tour – we promise they won't disappoint. Or perhaps you would like to discover all things Derry Girls – no problem. If it's a Derry Girls themed afternoon tea, or screen walking tour

you're after then we've got that on offer too. There really is something for everyone in the city; be inspired by the options below or build your own itinerary from our planner. Don't forget to buy our Visit Derry pass which means you can explore the city and enjoy access to several of the city's top tourist attractions.

Further information:

- Visit Derry (https://www.visitderry.com/)
- Discover Northern Ireland (https://discovernorthernireland.com/information/product-catch-all/visit-derry-information-centre-p689591)
- Derry City and Strabane (https://www.derrystrabane.com/services/tourism/visitor-information-services)

On campus eateries (opened during daytime):

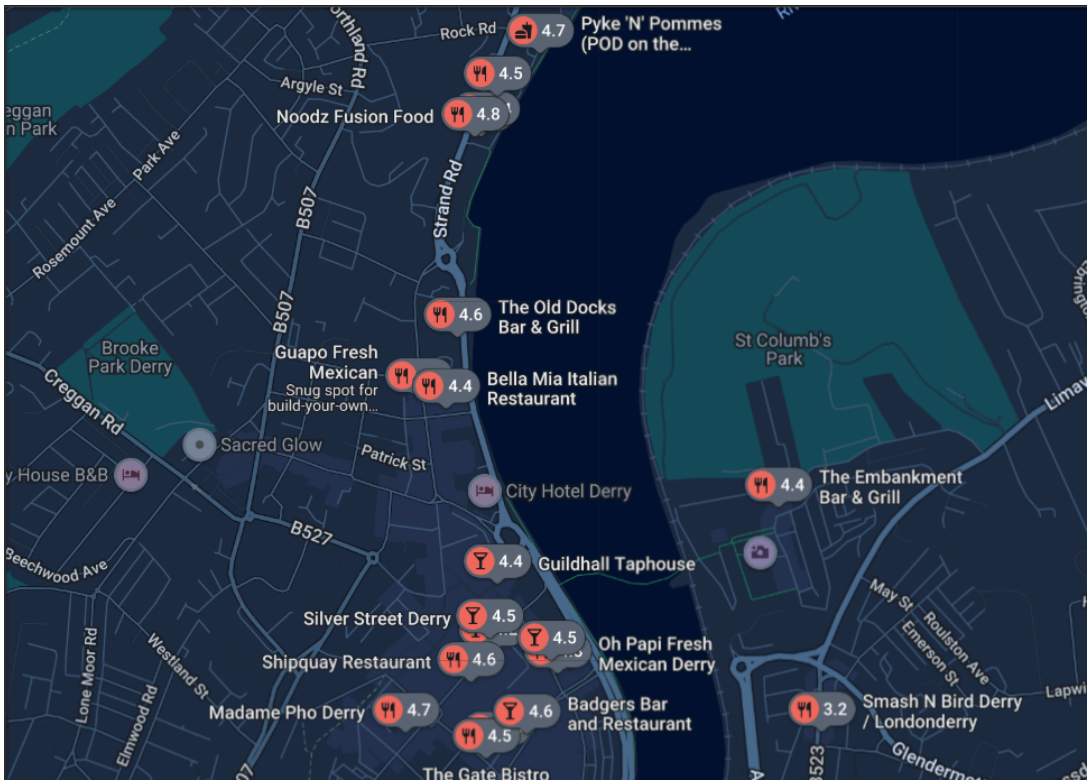
- Jitters (in MG building)
- Rock Road Social (in MF building – entrance at the back)
- Scullery Magee (in MU building)

Nearby restaurants and eateries:

- Guapo (Fresh Mexican)
- Clipper Quay Street Food Market
- Pyke 'N' Pommes (in a bus, along the Foyle River; or one along Strand Road)
- Florentini
- Quaywest
- Mama Masala
- BURN on the river (along Foyle River)
- Saffron Modern Indian Takeaway
- Mandarin Palace
- The Old Docks Bar & Grill
- Madame Pho
- Browns in Town/Bonds Hill
- Pickled Duck
- Fitzroys
- Castle Bistro (Craft Village)
- Patricia's Coffee House (along Foyle River)
- Shipquay Restaurant
- Zora's
- Sandy's African Food Hub

- Domino's Pizza (cityside)
- Mekong Street Food
- El Tapas Gra
- Walled City Brewery
- La Sosta Restaurant

etc.



Bars and pubs:

- Paedar O'Connell's
- Blackbird
- Sandino's Café Bar
- Guildhall Taphouse
- Bennigans Bar
- Grand Central Bar
- The Gweedore Bar
- Kaboodle Bar

etc.

Ulster University, Derry ∼ Londonderry (Magee campus)

The Magee campus of Ulster University in the city of Derry ∼ Londonderry, is one of four campuses in Northern Ireland: https://www.ulster.ac.uk/campuses/magee

It is the oldest campus with a history, dating back to the year 1865. ***Magee campus map:***

- https://www.ulster.ac.uk/maps/derry-londonderry
- Google Map: https://www.google.com/maps/d/viewer?mid=1gdsugbd1SrO_vMTlhmyxvojrR-I&ie=UTF8&t=h&oe=UTF8&msa=0&ll=55.00240881516382%2C-7.321874999999995&z=16

How to get to Derry ~ Londonderry campus?

The MS building at Magee campus lies on Strand Road opposite the Derry City and Strabane District Council.

By Air: The City of Derry airport (https://www.cityofderryairport.com/) is the nearest airport. Or you may fly to Belfast International Airport (https://belfastairport.com/), the next closest airport, or George Best Belfast City Airport (https://www.belfastcityairport.com/). The City of Derry airport (https://www.cityofderryairport.com/destinations/) is only 7 miles from Derry ~ Londonderry city centre. Direct flights from London Stansted, Manchester, Liverpool, Glasgow and Edinburgh. From Belfast International Airport (https://belfastairport.com/) or George Best Belfast City Airport (https://www.belfastcityairport.com/), it is 1 hour 15 minutes and 1 hour 30 minutes from Derry ~ Londonderry city centre (see coach below), respectively. From Dublin airport (https://www.dublinairport.com), it is 2 hours 45 minutes to Derry ~ Londonderry by car or bus.

By rail: Take the Translink (https://www.translink.co.uk/) and stop at Derry ~ Londonderry train station. For example, from Belfast Great Victoria train station, to Derry ~ Londonderry train station, it takes about 2 hours. To go from Dublin (Dublin City, Connolly Rail Station) to Derry ~ Londonderry train station, you have to change trains at Belfast Lanyon Place (formerly Belfast Central) train station. There is (some) wifi service on the trains but no food service. It is better to consume or takeaway food at a train station.

By Bus: There are many buses. For example, bus 212 takes you from Belfast's Europa bus station (besides Belfast Great Victoria Station) to Derry ~ Londonderry bus station in about 1.5 hours. There are also buses (Dublin Coach Services https://www.translink.co.uk/usingtranslink/specialoffers/dublincoachwebsaver) straight from Dublin Airport to Derry ~ Londonderry bus station and back or from Dublin Busáras Bus (https://www.buseireann.ie/) to Derry ~ Londonderry bus station. This is about 4 hours of journey with a break halfway. There is also an economic coach (Aircoach https://www.aircoach.ie/) from Dublin Airport straight to Belfast city, near the Belfast Great Victoria train station and Europa bus station (see above). Another option is the Aircoach service from Belfast International Airport (BFS) to Derry ~ Londonderry Foyleside coach park.

Car hire and taxi service available from airports.

By taxi: Ask the taxi driver to stop at The Gatelodge, which is besides the MS building.

Driving from Strand Road/from Quayside roundabout

After turning in from Strand Road, please slow down and take a first turn on the left after the roundabout and after the traffic lights.

Driving from Foyle Bridge: Pass the Derry City and Strabane District Council, then do a U-turn at a roundabout and slow down and take the first turn on the left right after the traffic lights.

On campus parking:

To park at the ISRC / MS building (parking space P5 – see campus map), collect a parking ticket and use an available parking space underneath the MS building.

Go back to the front entrance, please press the disabled door opener and register at the reception someone. Please take a seat and one of our team members will be with you shortly.

There are also other parking spaces. The largest on campus parking space is P1 facing the neo-gothic-looking MD building.

electric car charger point:

For anyone needing a charging point for an electric car, you can find one in the main car park just below the MD building.

Off campus parking:

To park outside the campus, nearby parking spaces include the Strand Road Car Park, Quayside Shopping Centre & Car Park, and Foyle Street Car Park. However, for the evening lab sessions, it is advisable to park on campus. For instance, if you happen to park outside campus e.g. due to lack of available on-campus parking space, then during dinner break, for convenience, you may wish to move your car and park on campus when it becomes less crowded.

Ulster Visitor Wi-Fi:

Ulster University offers visitor Wi-Fi, which can be accessed by registering on the sign-in form with your name and email address. For more information, please visit the UU Visitor webpage. (https://www.ulster.ac.uk/ds/services/wifi-services/visitor-wifi)

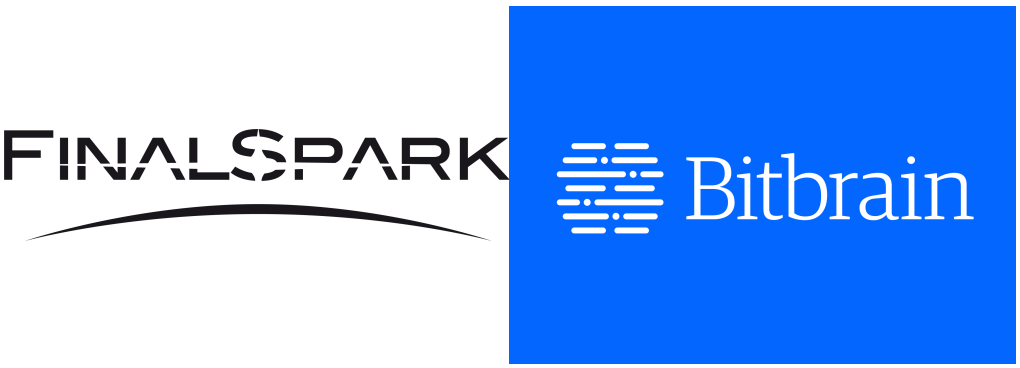
Intelligent Systems Research Centre & Summer School

Address of our Research Centre:

Intelligent Systems Research Centre,
School of Computing, Engineering and Intelligent Systems,
Faculty of Computing, Engineering and the Built Environment,
Ulster University,
Magee campus
Northland Road,
Derry ∼ Londonderry,
BT48 7JL,
Northern Ireland, UK

Note: The Intelligent Systems Research Centre is also the MS building on Magee campus.

Sponsors


FINALSPARK
Bitbrain


IEEE
EMBS
IEEE Engineering in Medicine & Biology Society
VisitDerry