



Ulster University

Intelligent Systems Research Centre

**Computational Neuroscience,
Neurotechnology and Neuro-inspired
Artificial Intelligence (ISRC-CN³)**

Autumn School

25-31 October 2023

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 deeper understanding of brain functions and disorders, but also the development and application of powerful AI and machine-learning algorithms that affect our everyday life. In fact, historically, AI was inspired by how intelligence arises from the brain.

The Computational Neuroscience, Neurotechnology and Neuro-inspired AI (CN3) Autumn School (<http://www.ulster.ac.uk/faculties/computing-engineering-and-the-built-environment/computing-engineering-intelligent-systems/isrc-cn3-autumn-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, neurotechnology and neuro-inspired AI. The School is unique in that important and timely topics either not delivered in other Schools or taught courses, or delivered only individually, will be delivered here in an integrated way, from pedagogical to advanced levels. These topics include computational modelling of neural-glial systems, neuromodulators, cognition, neurotechnology, self-repaired intelligent machines, lifelong learning and large language models. Mathematical foundations, coding exercises, ethics and entrepreneurship will also be covered. Moreover, 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 for attending the Autumn School!

ISRC-CN³ Autumn School

The Autumn 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 third ISRC-CN³ Autumn School. The ISRC is dedicated to developing a bio-inspired computational basis for AI to power future cognitive technologies. This is achieved through understanding how the brain works at multiple levels, from cells to cognition and apply 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 is 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 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.

Academic researchers at the ISRC and invited external speakers will contribute to the delivery of this 7-day School, which consists of lectures, mini-projects and labs. Labs will consist of modelling and analysing data related to the lectures, resulting in ‘mini’ projects to consolidate the lectures’ content and encourage active and creative participation. Attendees will have the opportunity to present and share their research work on the final day, and awards will be given to the top presenters. Class materials will be made available in advance of the event. Required software (Python and MATLAB) should be downloaded and configured before the event. Foundational topics in mathematical

techniques and computer programming will be provided.

Although the School will focus on research communities especially within the Island of Ireland due to its lack of such training, wider participations are welcomed. We particularly encourage applications from advanced undergraduate, masters, graduate diploma, early-stage career (Ph.D. students and postdoctoral) researchers, and research scientists and engineers in industrial and clinical sectors. Ideally, participants will have some mathematical background at the UK GCE A level / Irish Leaving Certificate level, some familiarity in computer/scientific programming in languages such as Python or MATLAB, or some background knowledge in biology, neuroscience, medicine or psychology.

The School aims to be inclusive by providing high accessibility including those who are underrepresented and/or with caregiving responsibilities, disabilities, and limited funds, and bursaries may be available. The School will adopt a hybrid (physical and virtual) format for delivery of the lectures.

Autumn 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.

MS Teams web links will be sent to all applicants closer to the dates of the autumn school. Hence, please check your email 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 location of lecture room will be in the ISRC Boardroom (Room MS105) within the MS building. Computer lab sessions will be held in MG122 (MG building) and MF124/125 (MF building) at Magee campus (see more information at the end of this document).

Online attendees are themselves responsible for the access of 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. During 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 throughout the lab session 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 Autumn 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 Autumn School. Certificate of participation can be requested upon completion of the Autumn School.

Lectures:

Lectures, including external speakers, will be delivered during the day, from about 9am to 5pm, with several breaks within this period. Each day of lectures will be categorised based on general themes.

Day 1 lectures will be on general topics such as introductory neuroscience, introductory cognitive neuroscience, mathematical techniques and programming.

Day 2 will be focused on modelling biological neurons and neuronal networks, neuron-glia systems, and neuroscience-based theories of cognition e.g. decision-making and learning.

Day 3 will discuss topics on neural signal processing, neural data science, neuroimaging data analysis, neurotechnology, neuromorphic computing and their applications.

Days 4 and 5 will be dedicated to Halloween social activities and project work.

Day 6 will be focused on neuro-inspired artificial intelligence algorithms, especially artificial neural networks, lifelong learning, Large Language Models, decoding mental imagery and their applications and ending with a discussion on research ethics.

On Day 7, attendees will commence by presenting their micro-talks (five minutes each) on their group projects, and awards will be bestowed for the top presentations. The day will also encompass research translation and entrepreneurship, alongside a plethora of industry talks.

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 videocam, 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 video clips' information on our GitHub link (see below).

Lecture Room:

- **Room MS105 (Boardroom)** (Note: MS105 is in the MS building, the ISRC building).

Labs:

Each computer lab session aims to consolidate and reinforce the topics delivered during the lectures of that day. Lab sessions, to be held in room MG122 from 5:15 PM on Days 1-3 and in room MF124/125 from 6:15 PM on Day 6, 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 attendees, especially online attendees, to download the relevant software to their own personal computer before the Autumn School. Attendees with limited mathematics and computer programming experience should check out the prepared mathematical notes or other sources such as <https://www.datacamp.com/> before the Autumn School.

Attendees are recommended to attend as many of these lab sessions as possible. Labs will be delivered physically and broadcast online live. It will also be recorded. 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.

Physical lab sessions will be broadcast live to those attending online. Those who are attending online will be able to join live via Blackboard Learn and may ask questions via their own computer's videocam, microphone or type in the chat box of Blackboard Learn. Online attendees can also use Slack (see the link below) to for questions and discussions after the talks.

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 video clips' information on our GitHub link (see below).

Computer Lab:

- Days 1-3: Room MG122 (Note: MG122 is in the MG building, not the MS building).
- Day 6: Room MF124/125 (Note: MF124/125 is in the MF building, not the MS building).

ISRC-CN³ GitHub link:

Notes, codes, datasets and video clips will be made available at our ISRC-CN³ 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 Autumn School.

Project pitches:

On the final day (31st October, Tuesday), attendees will have the opportunity to present their group projects. Awards will be given to the best project.

Reimbursements, claims and refunds:

If the pandemic situation happens, the Autumn School will be made fully online and fees will be refunded to each in-person attendee.

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

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 October), a city walking tour (social activities) will be provided. On Day 3 (27th October), a formal dinner will be provided at the nearby Bishop's Gate Hotel in the city centre. Please contact Elaine Duffy (below) if you wish to join the walking tour and/or formal dinner.

In-person and online participants will be invited to join the ISRC-CN³ Slack (https://join.slack.com/t/slack-o7l5167/shared_invite/zt-2364bpza9-VFLZOQSPPliiNDzvg8S6FA) to interact and network with fellow attendees and lecturers/speakers. In-person attendees may use the Slack platform for planning share accommodation.

Certification:

Certificate of Attendance will be emailed to attendees after the end of the Autumn 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. Damien Coyle (Scientific) (dh.coyle@ulster.ac.uk)
- Prof. KongFatt Wong-Lin (Scientific) (k.wong-lin@ulster.ac.uk)
- Prof. KongFatt Wong-Lin (Scientific) (k.wong-lin@ulster.ac.uk)
- Dr. Muskaan Singh (Scientific) (m.singh@ulster.ac.uk)

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ISRC-CN³ logo design:

- Niall McShane
- KongFatt Wong-Lin

Web design and development:

- Roisin McCart
- Aine McAleese
- Cheryl Mullan
- Mark Millar
- Roger James
- Saugat Bhattacharyya

IT Support

- Chrisotpher Hasson
- Chris O'Connell

Lecturers and speakers:

- Dr. Elaine Murray (Northern Ireland Centre for Stratified Medicine, Ulster University)
- Dr. Rachel Nicks (University of Nottingham)
- Dr. Cian O'Donnell (ISRC, Ulster University)
- Prof. Liam Mc Daid (ISRC, Ulster University)
- Prof. KongFatt Wong-Lin (ISRC, Ulster University)
- Dr. Saugat Bhattacharyya (ISRC, Ulster University)
- Assistant Professor Maria Dauvermann (University of Birmingham)
- Prof. Girijesh Prasad (ISRC, Ulster University)
- Prof. Damien Coyle (ISRC, Ulster University)
- Prof. Nikola Kasabov (Auckland University of Technology & ISRC, Ulster University)
- Dr. Muskaan Singh (ISRC, Ulster University)
- Dr. Shirin Dora (Loughborough University)
- Prof. Jim Harkin (ISRC, Ulster University)
- Prof. Michaela Black (ISRC, Ulster University)
- Dr. Fred Jordan (FinalSpark)
- Slobodan Tanackovic (g.tec medical engineering GmbH)

See web links and later in the document for profiles.

Tutors (ISRC, Ulster University):

- Day 1 - Abdoreza Asadpour
- Day 2 - Oleg Senkevich
- Day 3 - Kaniska Samanta
- Day 4 - Senhui Qiu

See later in the document for profiles.

DAY 1 (25TH OCTOBER 2023, WEDNESDAY)**Morning Session**

08:30 - 09:00	Welcome package and information at MS building's lobby
09:00 - 09:10	Welcome – <i>Saugat Bhattacharyya (Organiser)</i>
09:10 - 09:30	Opening speech – <i>Liam McDaid (ISRC Research Director)</i>
09:30 - 11:30	Introductory neuroscience – <i>Elaine Murray (UU)</i>
11:30 - 14:00	Lunch (provided at MS building) and/or Derry~Londonderry walking tour

Afternoon Session

14:00 - 16:00	Mathematics for neuroscience – An overview (notes provided in advance) – <i>Rachel Nicks (UoN)</i>
16:00 - 16:30	Break (coffee/tea/snacks provided at MS building)
17:00 - 18:45	Lab session 1 (at MG122) – Fundamentals of Python & MATLAB programming (notes provided in advance) – <i>Abdoreza Asadpour</i>

DAY 2 (26TH OCTOBER 2023, THURSDAY)**Morning Session**

09:00 - 11:00	Computational modelling of plasticity and learning in brains – <i>Cian O'Donnell (UU)</i>
11:00 - 11:15	Break (coffee/tea/snacks provided at MS building)
11:15 - 12:15	Computational modelling of neuronal and glial interactions – <i>Liam McDaid (UU)</i>
12:15 - 14:00	Lunch (provided at MS building) and Campus Tour

Afternoon Session

14:00 - 16:00	Modelling the dynamics of decision-making – <i>KongFatt Wong-Lin (UU)</i>
16:00 - 16:30	Break (coffee/tea/snacks at MS Building)
17:15 - 18:45	Lab session 2 (at MG122) – Modelling neurons, glial cells, neural networks & cognition – <i>Oleg Senkevich</i>

DAY 3 (27TH OCTOBER 2023, FRIDAY)**Morning Session**

09:00 - 10:30 Investigating time series neural data: Common signal processing practices – *Saugat Bhattacharyya (UU)*

10:30 - 10:45 Break (coffee/tea/snacks provided at MS building)

10:45 - 12:15 Fundamentals of functional and effective connectivity – *Maria Dauvermann (UOB)*

12:15 - 13:45 Lunch (provided at MS building) and Networking

Afternoon Session

13:45 - 14:45 Non-invasive brain-computer interfaces: Enhancing applicability using computational intelligence and technological advances – *Girijesh Prasad (UU)*

14:45 - 15:00 Break (coffee/tea/snacks provided at MS building)

15:00 - 16:30 Neuromorphic Engineering – *Jim Harkin (UU)*

16:30 - 17:00 Break

17:15 - 18:45 Lab session 3 (at MG122) – Neural data processing, neural data science & application – *Kaniska Samanta*

19:30 Social activity - Formal dinner and Derry Halloween dressing up

DAY 4 and 5 (28TH and 29TH OCTOBER 2023)

Halloween Social Activity and Project Work

DAY 6 (30TH OCTOBER 2023, MONDAY)**Morning Session**

09:00 - 10:00	Brain-inspired spiking neural network models for life-long and explainable learning – <i>Nikola Kasabov (AUT & UU)</i>
10:00 - 10:15	Break (coffee/tea/snacks provided at MS building)
10:15 - 11:45	Introduction to Lifelong Learning – <i>Shirin Dora (LU)</i>
11:45 - 13:15	Foundations of Large Language Models – <i>Muskaan Singh (UU)</i>
13:15 - 14:45	Lunch (provided at MS building) and ISRC Lab Tour (in MS building)

Afternoon Session

14:45 - 15:45	Decoding mental imagery from electroencephalography (EEG) and applications of AI-enabled wearable neurotechnology for communication and rehabilitation – <i>Damien Coyle (UOB & UU)</i>
15:45 - 16:00	Break (coffee/tea/snacks provided at MS building)
16:00 - 17:30	Panel Discussion: Ethical and regulatory issues in AI & Neuroscience - <i>Michaela Black (UU)</i>
18:15 -	Lab session 4 (at MF124/125) and Project Activity - <i>Senhui Qiu</i>

DAY 7 (31ST OCTOBER 2023, TUESDAY)**Morning Session**

09:30 - 12:30 Attendees' presentation

12:30 - 14:00 Lunch (provided at MS building)

Afternoon Session

14:00 - 16:00 Industry Talks

- *Dr Fred Jordan (FinalSpark)*
- *Slobodan Tanackovic (g.tec medical engineering GmbH)*
- *Prof Damien Coyle (NeuroCONCISE Ltd.)*

16:00 - 16:15 Prize-giving for attendees' micro-talks

16:15 - 16:30 Closing remarks

See link (<https://www.ulster.ac.uk/faculties/computing-engineering-and-the-built-environment/computing-engineering-intelligent-systems/isrc-cn3-autumn-school>) and below for synopses of lectures and talks.

Profiles and presentation synopses of lecturers and speakers



Elaine Murray

Bio: **Elaine Murray** is a Senior Lecturer in Personalised Medicine (Mental Health) in the School of Medicine at Ulster University. She received her undergraduate degree in Biomedical Sciences from Ulster University and her PhD in Neuroscience and Behaviour at the University of Massachusetts, Amherst, where she demonstrated that perinatal disruption of histone acetylation leads to long lasting changes in sexually dimorphic regions of the brain. She then joined the Translational Neuroscience group at the University of Aberdeen as a research fellow, where she worked on the genetic basis of major mental illness as part of a Pfizer Neuroscience Grand Challenge project. Elaine returned to Northern Ireland in 2013 to take up her current post within the Personalised Medicine Centre. Elaine's current research focuses on identifying novel biomarkers to improve diagnosis and treatment of psychiatric disorders. Elaine is a council member of Neuroscience Ireland, Northern Ireland local group representative for the British Neuroscience Association and recently led a CHITIN project investigating mental health among at-risk young people in a cross-border region funded by the EU's INTERREG VA Programme.



Rachel Nicks

Bio: **Rachel Nicks** is an Assistant Professor in Applied Mathematics at the University of Nottingham. Her current research focusses on the application of nonlinear dynamical systems theory to understand mechanisms underlying phenomena observed in neuroscience. Topics of particular interest to her include the formation and evolution of spatiotemporal patterns in coarse-grained models of neural activity and model reduction methods to understand emergent dynamics in neural networks. She received her PhD in pattern formation in the presence of symmetry from the University of Nottingham before joining the University of Birmingham as a lecturer. She returned to the University of Nottingham in 2016 where she is a member of the Centre for Mathematical Medicine and Biology. She also leads the Mathematics in Life Sciences network which runs a series of workshops bringing together mathematicians working at the interface with life sciences.



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://odonnellgrp.github.io>.



Liam McDaid

Bio: Liam McDaid, BEng, PhD (Liverpool), is Professor of Computational Neuroscience at Ulster University. His research focuses on hardware/software implementations of neural based computational systems with particular emphasis on modelling glia-neural interactions. He has secured funding from Higher Education Authority of Ireland, which focuses on inter-neuron on-chip communications and was Co-PI for the EPSRC project (EP/F05551X/1) to develop compact low power spiking neuron cells. Prof. McDaid was PI for a recent EPSRC eFutures (EFXD12011) project and CI on SPANNER (EP/N00714X/1). He also secured funding from the Human Science Frontiers Programme (HFSP) to model G-Protein signaling in astrocytes. He is guest editor for a special issue in the International Journal of Neural Systems and has co-authored over 120 publications.



KongFatt Wong-Lin

Bio: Prof. KongFatt Wong-Lin is based at the Intelligent Systems Research Centre, School of Computing, Engineering and Intelligent Systems, in Ulster University, UK. His research interests lie at the interface of computational modelling and mathematical analysis of systems and cognitive neuroscience, psychology, brain disorders, neural computation and engineering, AI and data science. He is Editorial Member for the Journal of Neuroscience Methods, and Associate Editor for Frontiers in Integrative Neuroscience. Before joining Ulster University, he was a research associate at Princeton University, USA, with affiliation to The Program in Applied and Computational Mathematics, Center for the Study of Brain, Mind and Behavior, and Princeton Neuroscience Institute. Prior to that, he received his Ph.D. in Physics with focus on Computational Neuroscience at Brandeis University, USA, with affiliation to the Volen National Center for Complex Systems. He received the 2011 IJCNN Best Paper Award, the 2016 Ulster University's Distinguished Research Fellowship Award, and the 2019 Ulster University Research Excellence Award. In 2017, he received the Moore Institute Visiting Research Fellowship at the National University of Ireland Galway, and in 2020, a Visiting Fellowship at the University of Oxford.

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



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 its 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 an users' state of mind through their neural and other physiological signals. He has over 60 publications in form of peer-reviewed journals and international conferences. He is a recipient of 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, and served as guest editors in Frontiers in Neuroscience, MDPI Sensors and International Conference on Intelligent Robots and Systems (IROS).



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.



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



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 ET 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>



Nikola Kasabov

Bio: **Nikola Kasabov** is Life Fellow of IEEE, Fellow of the Royal Society of New Zealand, Fellow of the INNS College of Fellows, DVF of the Royal Academy of Engineering UK. He is George Moore Chair Professor of Data Analytics at the University of Ulster UK and the Founding Director of KEDRI and Professor at the School of Engineering, Computing and Mathematical Sciences at Auckland University of Technology, New Zealand. He is a Guest Professor of the IICT Bulgarian Academy of Sciences and Da;lian University, Choina and also an Honorary Professor at the Teesside University UK, the University of Auckland and Peking University in Shenzhen. Kasabov is Past President of the Asia Pacific Neural Network Society (APNNS) and the International Neural Network Society (INNS). He has been a chair and a member of several technical committees of IEEE Computational Intelligence Society and Distinguished Lecturer of IEEE (2012-2014). He is Editor of Springer Handbook of Bio-Neuroinformatics, EIC of Springer Series of Bio-and Neuro-systems and co-EIC of the Springer journal Evolving Systems. He is Associate Editor of several journals, including Neural Networks, IEEE TrNN, Tr CDS, Information Sciences, Applied Soft Computing. Kasabov holds MSc and PhD from TU Sofia, Bulgaria. His main research interests are in the areas of neural networks, intelligent information systems, soft computing, bioinformatics, neuroinformatics. He has published more than 700 publications, highly cited internationally. He has extensive academic experience at various academic and research organisations in Europe and Asia, including: TU Sofia Bulgaria; University of Essex UK; University of Otago, NZ; Shanghai Jiao Tong University and CASIA China, ETH/University of Zurich. Kasabov has received a number of awards, among them:; INNS Ada Lovelace Meritorious Service Award; NN journal Best Paper Award for 2016; APNNA ‘Outstanding Achievements Award’; INNS Gabor Award for ‘Outstanding contributions to engineering applications of neural networks’; EU Marie Curie Fellowship; Bayer Science Innovation Award; APNNA Excellent Service Award; RSNZ Science and Technology Medal; 2015 AUT NZ Medal; Medal “Bacho Kiro” of the SU Pavlikeni and an Honorary Citizen of Pavlikeni, Bulgaria. He is an Honorary Member of the Bulgarian, the Greek and the Scottish Societies for Computer Science. More information: <https://academics.aut.ac.nz/nkasabov>; <https://www.ulster.ac.uk/staff/nk-kasabov>



Muskaan Singh

Bio: Dr. Muskaan Singh is a Lecturer in Data Analytics at the Intelligent Systems Research Centre (ISRC), within the School of Computing, Engineering and Intelligent Systems, Ulster University (UU) and a member of the cognitive analytics research centre (CARL). Her research interest is centred around Natural language Processing with a particular focus on practical applications. She has published at prestigious venues (A* and A-ranked conferences/Journals) such as ACL, NAACL, COLING, INLG, SIGDIAL, AAAI, PACLIC, LREC, INTERSPEECH, AAAI, EMNLP, WeCNLP and ASIS&T.

She is also organiser of Automatic Minuting community events: SummDial at SIG-Dial 2021, AutoMin shared task at Interspeech 2021, SummDial at Dubdial 2022, AutoMin shared task at INLG 2023, Fake News Detection from Social Media Text at RANLP 2023.



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.



Jim Harkin

Bio: **Jim Harkin** holds a Bachelor of Technology, MSc and PhD in Electronic Engineering. He was employed as a post-doctoral researcher in embedded system design at Ulster for 3 years before taking up the post of Lecturer in 2004. He is currently Head of the School of Computing, Engineering and Intelligent Systems at Ulster University on the Magee Campus. His research investigates the design of highly efficient, secure, and reliable embedded systems that emulate bio-inspired computational and fault tolerance capabilities. In particular, he focuses his efforts on the development of the brain-inspired EMBRACE architecture which aims to address electronic reliability challenges by investigating new paradigms of Networks-on-Chip interconnect and harnessing the principles of brain-like repair. His work also explores how neural networks in hardware can be used in Networks-on-Chip interconnect for security and traffic congestion awareness.



Michaela Black

Bio: Michaela Black has a BSc (Hons) in Computing Science, DPhil in the area of Machine Learning with British Telecom with a Patent posted: Rationalization of data used in model of time varying event behaviour (US 7024426 B2) & Data rationalisation (US 20020183999 A1). Michaela has published around 50 publications including book chapters, journals and conferences. Her research covers Artificial Intelligence, Machine Learning, Data Mining, Big Data, Telecoms, Education, Health, Gamification, Games and User Profiling.

She is PI on newly awarded PM18 Big data for Supporting Public Health Policies - MIDAS (Meaningful Integration of Data, Analytics and Services) project of €4.5million, and is grant holder of an international consortium who have been awarded €3.6million Horizon 2020 project PH27 PCP project – MAGIC – Mobile Assistance for Groups and Individuals in the Community and. Within her research she has supervised and successfully completed PhD studentships including Handling Latency for Online Learning with Concept Drift, and has given several invited talks on Big Data and presented to the range of conferences and workshops. Her consultancy work ranges from Horizon2020 applications, SBRi Gamification of Medicines, to InterTradeIreland FUSION projects.

Michaela is involved in a number of regional, national and international Connected Health research projects with particular expertise in Mobile Technology for Health, Gamification and Adaptive AI. As Head of School for School Michaela delivers a strong focus on teaching and developing a strong Research-teaching Nexus, Professional skills, Employability and Entrepreneurship. Her excellence in Teaching has been recognised by his being awarded a Distinguished Teaching Fellowship in 2016.



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 brains took the challenge to teach 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.



Slobodan Tanackovic

Bio: **Slobodan Tanackovic** has an engineering and clinical neurophysiology technical background and has been part of g.tec medical engineering since 2018. He was a member of an epilepsy surgery program at the University Hospital of Coimbra. He has extensive experience in intra-operative neuromonitoring.

Slobodan is a brain-computer interface (BCI) and neuroscience enthusiast who continuously participates in the g.tec's education plan. He is currently developing a solution optimised for ERP acquisition.

Profiles of Tutors



Abdoreza Asadpour

Bio: Dr. Abdoreza Asadpour, a Postdoctoral Research Associate at Ulster University's Intelligent Systems Research Centre, holds a strong foundation in Electrical Engineering, earned from Sharif University of Technology, Iran. Specialising in Computational Neuroscience, AI, and Biomedical Signal Processing, he has made contributions to the neuroscience of tinnitus and computational modelling of decision-making in species. His interdisciplinary expertise is complemented by noteworthy collaborations with esteemed institutions such as Trinity College Dublin and Columbia University. Dr. Asadpour is enthusiastic about fostering learning and will contribute as a tutor for lab sessions at the ISRC-CN3 Autumn School.



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.



Kaniska Samanta

Bio: **Kaniska Samanta** is a second-year 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 specialization in Instrumentation and Control Engineering. His research primarily focuses on Brain-Computer Interfacing and neural signal processing using non-invasive neuro-imaging techniques such as EEG and MEG. With 9 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.



Senhui Qiu

Bio: **Senhui Qiu** received his B.Sc. in Physics from Guangxi University for Nationalities, China in 2010. He received his M.Sc. in Circuits and Systems from Guangxi Normal University, China in 2013. He is currently a PhD researcher at Ulster University's School of Computing, Engineering, and Intelligent Systems in the UK. His research focuses on predictive coding, image classification, reconstruction and generation.



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.



Ravi Jha

Bio: **Ravi Kumar Jha**, currently a second-year Ph.D. researcher at Ulster University's School of Computing, Engineering, and Intelligent Systems, delves deep into the realm of quantum-enhanced algorithms for brain data analysis. A University of Delhi alumnus, Ravi graduated with a Bachelor's in Mathematical Sciences, securing the commendable second rank. Further enriching his academic journey, he earned an M.Sc. with distinction in Applied Mathematics from South Asian University, New Delhi. His professional engagements have seen him at the forefront of research, from being a Research Intern at Universiti Teknologi Malaysia to a Project Scientist at India's esteemed INCOIS. With a keen interest in quantum computing, machine learning, and applied mathematics, Ravi's contributions have been recognised with significant accolades, including a best paper award and the prestigious Vice-Chancellor's Research Scholarship from Ulster University.

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.

Derry ~ Londonderry offers a plethora of choice when it comes to choosing where to stay, with options available to suit everyone’s budget and taste. So, whether you want to stay in the heart of the city action, or somewhere a little quieter, you’ll have plenty to choose from. From international hotel brands, boutique designer hotels right through to five-star self-catering accommodation, including comfortable Bed & Breakfasts and guest houses – we’ve got them in abundance.

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/What-s-On/Tourist-Information>)

Some nearby accommodations:

As the Autumn School is held in the middle of a semester, on-campus accommodation is usually no longer available. However, the city has ten 4-star hotels within a five-mile radius of the city centre, from award winning boutique hotels to larger hotel groups. For more information, please visit <https://www.visitderry.com/accommodation>

Ulster University has a subsidised rate with City Hotel, Derry for Bed & Breakfast. If you would like to book, please email Louise at l.gallagher@ulster.ac.uk to let us know and we will forward your name to City Hotel so that you can avail of this preferred rate.

The Art House and Jazz House (both Clarence property), besides the campus, can be booked and shared among attendees.

Other nearby accommodation include:

- Shipquay Hotel
- Holiday Inn Express Derry
- Maldron Hotel Derry
- Da Vinci's Hotel
- Bishop's Gate Hotel Derry
- Premier Inn Derry Hotel

and others. There are also several economical Bed and Breakfasts and Hostels.

On campus eateries (opened during daytime):

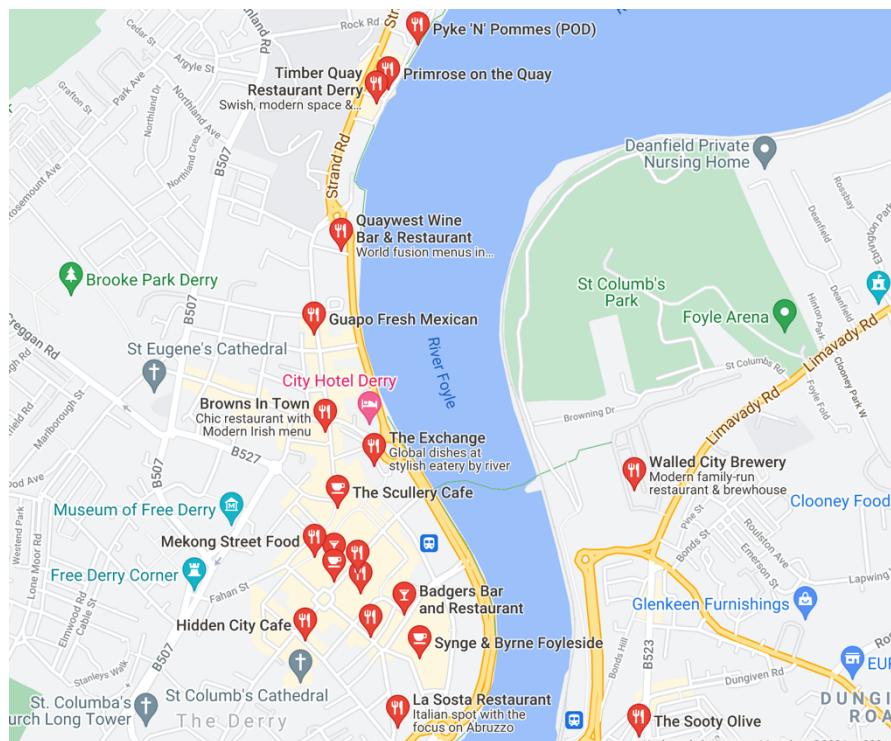
- Jitters (in MG building)
- Bunker Café (in MF building – entrance at the back)
- Scullery Magee (in MU building)

Nearby restaurants and eateries:

- Guapo (Fresh Mexican)
- Pyke 'N' Pommes (in a bus, along the Foyle River; or one along Strand Road)
- Florentini
- Quaywest
- Mama Masala
- Timber Quay Restaurant Derry
- Saffron Modern Indian Restaurant
- Mandarin Palace
- Browns in Town
- Browns Bonds Hill
- Primrose on the Quay (along Foyle River)

- Patricia's Coffee House (along Foyle River)
- Shipquay Restaurant
- The House / Entrada Restaurant
- Zora's
- 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
- The Trinity Bar
- Guildhall Taphouse
- Bennigans Bar
- Granny Annie's
- Grand Central Bar
- The Diplomat Bar
- The Gweedore Bar

etc.

Derry Halloween (28-31 October, 2023):

- <https://derryhalloween.com/>
- <https://www.visitderry.com/whats-on/derry-halloween-p754101>
- <https://www.independent.co.uk/travel/uk/derry-best-halloween-destination-world-europe-carnival-northern-ireland-a9156566.html>



Ulster University, 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.

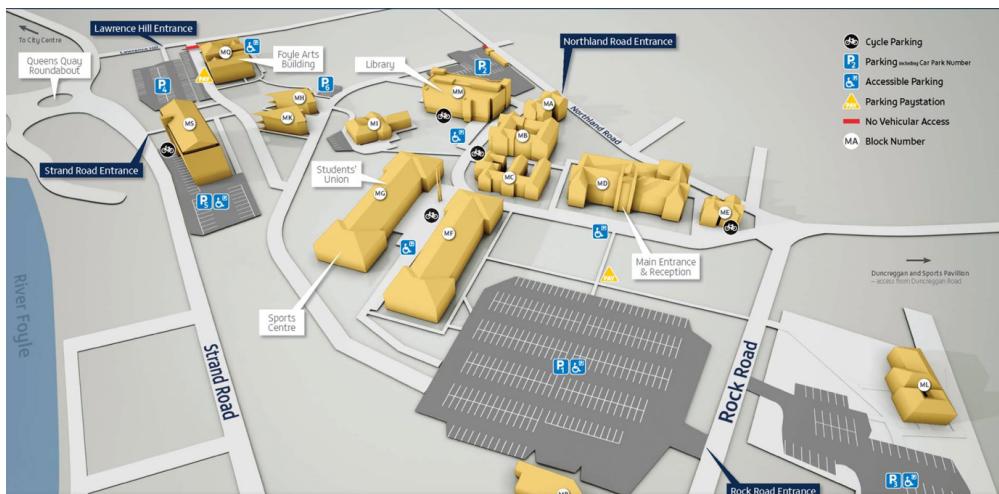
Magee campus map:

- <https://www.ulster.ac.uk/pdf/campus-maps/magee-campus-map.pdf>
- 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-7.32187499999995&z=16

How to get to Derry ~ Londonderry and Magee 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.belfastsityairport.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/>) NI Railways (<https://www.translink.co.uk/corporate/monitoringresults/nirailways>) 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 Gateodge, 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.

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.

Intelligent Systems Research Centre & Autumn 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.

COVID-19 – Health and Safety Guidelines

By attending the ISRC-CN³ in person, you acknowledge that any interaction with the general public poses an elevated risk of being exposed to COVID-19. You further acknowledge that you will undertake all measures to protect your own health and well-being and those of others in attendance at the ISRC-CN³ Autumn School, such measures include:

- (a) wearing masks/facial coverings;
- (b) maintaining social distance;
- (c) washing/sanitizing hands frequently;
- (d) adhering to United Kingdom guidelines at <https://www.gov.uk/coronavirus>, the Northern Ireland guidelines at <https://www.nidirect.gov.uk/articles/coronavirus-covid-19-how-stay-safe-and-help-prevent-spread> and <https://www.nidirect.gov.uk/campaigns/coronavirus-covid-19> , Ulster University's guidelines at <https://www.ulster.ac.uk/coronavirus> , and laws, ordinances and mandates in the locale of the Autumn School at <https://www.derrystrabane.com/Council/Corona-Virus-Advice/Updates>

Within the campus, please remember to follow the directions in placed, use hand sanitizers frequently, and cover your face with a face mask when indoor. If you have symptoms of COVID-19, please self-isolate. COVID-19 vaccination is highly encouraged before in-person attendance of the Autumn School.

Finally, by attending ISRC-CN³, you and any guests voluntarily assume all risks related to exposure to COVID-19 and agree not to hold ISRC-CN³; Ulster University; or any of their affiliates, directors, officers, employees, agents, contractors, or volunteers are not liable for any illness or injury.

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