Computational Neuroscience, Neurotechnology and Neuro-inspired AI Autumn School

Prof. Liam McDaid – Research Director

Institute of Informatics – 1984

School of Computing and Intelligent Systems – 2001

School of Computing Engineering and Intelligent Systems – 2017

Computational Neuroscience, Neurotechnology and Neuro-inspired AI Autumn School

School of Computing Engineering and Intelligent Systems (SCEIS) - offers professionally recognised courses

- Undergraduate courses available full or part time

  - Artificial Intelligence – BEng(Hons)
  - Computer Science – BSc(Hons)
  - Electrical & Electronic Engineering – BEng(Hons)
  - Information Technology – BSc(Hons)
  - Mechanical & Manufacturing Engineering – BEng(Hons)
  - Renewable Energy Engineering – BEng(Hons)

- Postgraduate courses available full or part time

  - Data Science – MSc
  - Professional Software Development – MSc
  - Smart Manufacturing Systems – MSc

Intelligent Systems Research Centre

Intelligent Systems Research – 1994

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Brain Computer Interface Lab – 2004

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Intelligent Systems Research Centre (ISRC) – 2007

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Cognitive Robotics Lab – 2009

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NI Functional Brain Mapping Facility – 2013

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Centre for Engineering & Renewable Energy – 2014

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Cognitive Analytics Research Lab CARL 2017

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Spatial Computing and Neurotechnology Innovation Hub (SCANi) hub - 2020

Vision – Understanding brain function using a range of techniques – transfer knowledge to develop and deploy brain-inspired AI algorithms

SCEIS/ISRC

~100 people in internationally recognised research centre

- 42 academic staff
- 26+ Externally funded Research Associates/Research Fellows
- 46+ PhD students
- 20+ summer internships students supporting research

Research Excellence Framework (REF) 2021 (UoA 11 – Computer Science and Informatics) – how UK government assesses QR - governs funding distribution

- *6th largest submission*
- *Ranked 9th overall for research power*
- *4* rating on impact*

ISRC Research Teams

- **Human Centred Computing** - Three key pillars: Sensors for remote health monitoring, Human-Centred AI, Intelligent rehabilitation and self-management.
- **Intelligent Data Analytics** – Application of intelligent algorithms (AI, ML, etc) to complex & challenging data analytics problems - e.g., genomics data/biomarkers
- **Computational Neuroscience and Neuromorphic Engineering** – Three key pillars: Computational modelling (cellular level) – NeuroAI – Neuromorphic Computing.
- **Cognitive Robotics** – Bioinspired algorithms for sensory systems – deployed to give robots human-like sensing capabilities for seamless interaction, with applications in vision systems, assistive devices, tactile sensing, and industry 4.0.
- **Cognitive Neuroscience and Neurotechnology** – Understanding brain dynamics, structure/function to develop ways to restore, maintain and enhance physical and cognitive function through brain-computer interfaces.

Labs/Facilities

- **Northern Ireland Functional Brain Mapping facility - houses the only magnetoencephalography (MEG) system in Ireland –** measures electrical activity (arising from blood flow) in the brain – visualise/measure brain activity through heat map - non evasive technique for evaluating brain disorders/diseases
- **Spatial Computing & Neurotechnology Innovation Hub - for next generation computing and human computer interaction -** technologies for spatial computing including text, voice, gesture, augmented reality/virtual reality, an advanced car/flight simulator – mobile robots
- **Brain-Computer Interface (BCI) Laboratory -** 64 channel EEG system and multiple mobile EEG recording devices – enclosed in an EMF shielded/noise insulated room
- **Cognitive Robotics Laboratory** - equipped with a wide range of advanced robotic platforms - PR2 robot, Shadow Dexterous Hand, SUMMIT XL robots- has various vision/motion capture systems that permit capture of 2D/3D visual data
- **The NI-HPC Centre** - High Performance Computing (HPC) facility funded by EPSRC and jointly managed by Queen's and Ulster University

Current Projects

- AI EPOCMON: AI-Enabled Point of Care Monitoring, **US Ireland R&D** Partnership Programme Centre-to-Centre Mechanism, £299,999.00
- Smart Manufacturing Data Hub (SMDH), April 22 – March 25, £12,834,872, **InnovateUK**
- **EPSRC** (£614,000), Nervous, July 2022 for 4 years
- **BBSRC**, Synaptic strength instability from stochastic gene expression in neurons, £362,829 (funder contribution)**,** 05/2021-04/2023
- **Leverhulme Trust** Research Project Grant. Generalisable neural learning from noisy synapses, £207,224, 02/2020-02/2023
- **British Neuroscience Association (BNA)** Local Group Funding, £750, 2022
- **HEA North-South Research Programme** *AIM4HEALTH* 200K (2022-24)
- **EU Horizon Europe**: LUCIA: 14M (2023-26)
- **Invest NI PoC** - Magic Glass: Virtual Reality Upper Arm Stroke Rehabilitation: 122.5k (2022- 24)

- **HERC2021** : CONFORM: CobOt eNvironments FOR Manufacturing, DfE, £484177
- **Co Fund NI** (230.000) Investor June 2022
- **Angel** (£220,000) Investor June 2022

Strategic Projects

- City Deals – CARL (AI Centre of Excellence - 16.5 M) and CIDRA (Robotics & Automation - 22.5M) projects – Bridging the gap between academic and industry – will educate and steer industry in the adoption of AI
- Leverhulme Doctoral Scholarships – (NeuroAI) - Partner with UoR for 15 PhD students over 8 years - Develop new AI algorithms based on recent experimental/computational brain research
- Artificial Intelligence Collaboration Centre (AICC - ~13M over 5 years) – Partner with QUB - Train postgraduate in AI and promote adoption by industry
- UK Smart Manufacturing Data Hub (£53.8M) - To drive industry towards investing in digital technology
- Smart Nano NI (£63.9M) - develop new nano manufacturing technologies to accelerate development in the area of photonics.
- Hartree NI - funded by the Hartree National Centre for Digital Innovation (HNCDI) programme - To improve their competitiveness and growth through the adoption of digital technologies

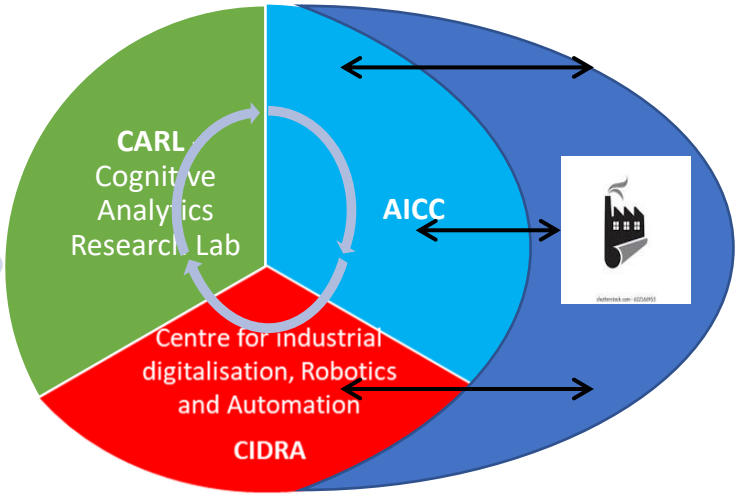
ISRC – Translational Research

TRL 2 → TRL 7

ISRC

Intelligent Systems Research Centre

- NeuroAI
- Neuromorphic Computing
- Cognitive Robotics
- Data Analytics
- Neuro Technology
- Human Centred Computing

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