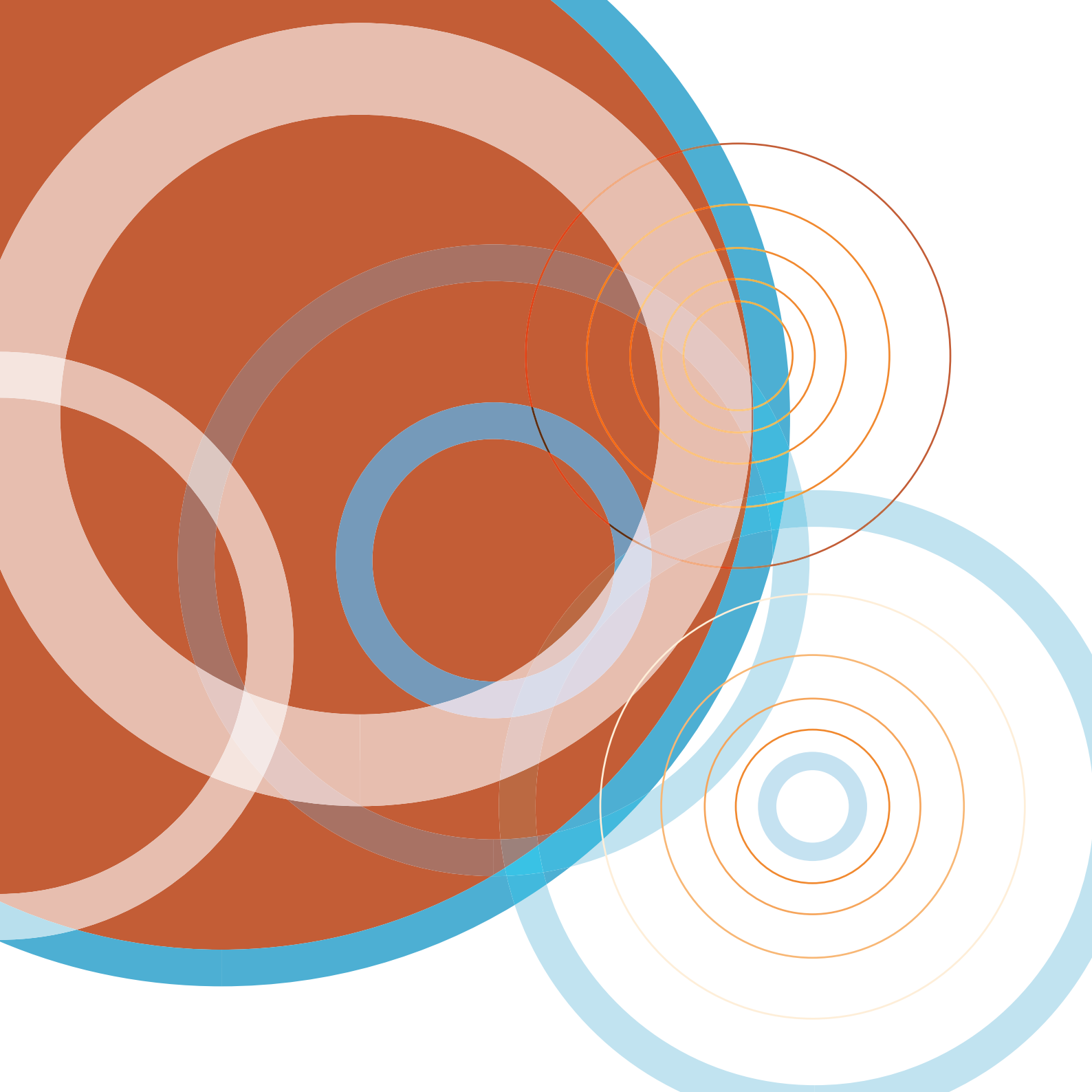

DCU
RESEARCH INSTITUTE FOR NETWORKS AND COMMUNICATIONS ENGINEERING
RINCE
Research Institute for
Networks and Communications Engineering



Mission Statement

The Institute's mission is to define new research directions, and make landmark contributions to the knowledge and understanding of the information and communication technologies of the Global Information Society.

Professor Liam Barry, Director

Building on Excellence

Established in 1999 through competitive funding obtained from Cycle I of the Programme for Research in Third Level Institutes, RINCE, or The Research Institute for Networks and Communications Engineering, is a national centre for excellence in Information and Communications Technology within the Faculty of Engineering and Computing at DCU.

With its researchers affiliated to the School of Electronic Engineering and the School of Computing at DCU, RINCE currently has 20 academic staff members, 18 research fellows, and over 40 research postgraduate students collaborating on a wide variety of research projects.

In addition to funding from private industry, RINCE has obtained funding from Enterprise Ireland, Science Foundation Ireland, the Irish Research Council for Science, Engineering and Technology (IRCSET), EU Framework Programmes, Higher Education Authority PRTLI, and the Health Research Board. Over the last five years RINCE members have earned an average of €2.4 million in external funding per annum, with 5 SFI Investigator Grants awarded over the past 5 years. This large amount of funding has driven the expansion of PhD supervision within the institute, with 2006 seeing the largest number of PhD completions (18) in a single year for the institute. The increased level of research activity within RINCE has also resulted in a major increase in the number of research papers published by RINCE members in international peer reviewed conferences and journals, with over 100 such publications in 2006.

To build upon the successes that have been achieved since its establishment RINCE is supporting and developing a number of strongly focused key research areas, intent on making significant and recognised contributions on the research landscape, while also providing an environment which nurtures new and emerging research groups so that they can reach their full potential.

Objectives

The main high-level objectives for RINCE are to:

1. ***Support three key research Centres within RINCE***
   The following have been designated as key research focus areas
   - Centre for Image Processing & Analysis
   - Network Innovations Centre
   - Centre for High Speed Devices & Systems

   These areas have been identified as having the required critical mass, track record, and cohesion to be the main flagship research areas and are in line with the main focus of national and international research developments.

2. ***Increase the quality and quantity of research output***
   RINCE will look to increase both the quality and quantity of research being undertaken within the institute. This objective is in line both with the institutional strategy outlined in DCU's research strategy and also the national strategy outlined in Strategy for Science Technology and Innovation (SSTI) (2006-2013). The SSTI identifies the need to significantly increase the number of people with advanced qualifications working in science and engineering, with a doubling of PhD graduates by 2013. The SSTI also presents the need for a major enhancement in the quality of research undertaken by enterprise both directly and in collaboration with third level institutions.

3. ***Be at a competitive advantage in terms of soliciting a significant proportion of funding in line with its standing as a National Centre for Excellence***
   Consistent with DCU's research strategy that looks to increase the research income of the university, RINCE will maximise the level of external funding that the institute can obtain for its research programmes.

4. ***Strengthen national and international collaborative linkages with both academic and industrial partners***
   This objective is consistent with both institutional and national strategies wherein the development of collaborative linkages with both national and international partners is viewed as being critical to future success. The SSTI has identified the need to introduce measures to increase the interaction between firms and higher education institutions.

5. ***Develop vanguard postgraduate training initiatives***
   We actively seek to improve uptake of engineering courses in Ireland via recruitment in the world marketplace and via mentoring of the highest calibre students for research-based careers.

Centre for Image Processing & Analysis

Dr. Derek Molloy

Dr. Robert Sadleir

Professor Paul Whelan

The Centre for Image Processing and Analysis (CIPA) acts as a focus for **Computer Vision** research in DCU. Its digital and non-digital IPA research programmes relate to issues involved in the **acquisition (custom sensor design), processing, quantitative analysis, classification, visualisation and systems engineering (integration) for a wide range of computer vision applications**. Specifically, CIPA focuses on the issues involved in the automation or semi automation of **image feature segmentation**, and its associated **quantitative analysis**, at both a micro and macro level. CIPA currently consists of a core team of 21 full time researchers working on computer vision (specifically image segmentation), medical imaging (specifically computer aided detection/diagnosis) and their associated visualisation projects.

Expertise:

The **core expertise** provided by *CIPA* is in its ability to develop and design novel computer based solutions that will allow the **automatic extraction of key image features [specifically from 2D, video, 3D and 4D data sources]** with a view to a **robust and reliable quantitative analysis, classification or tracking of the key information/data within the scene**.

Key Projects:

The centres research programme builds on past investments by the HEA (PRTLI I), HRB, SFI, EI and EU. Current research programs are funded by **SFI** (medical imaging and quantitative image processing & analysis), **Enterprise Ireland commercialisation grants** and **IRCSET awards** (PhD Studentships). CIPA is also active in IP development and were recently were awarded **2 INVENT Invention Disclosure Awards**. Current & recent projects include:

- **Computer Vision:** 3D Imaging/Industrial Vision, Colour Texture Analysis, High resolution 3D image acquisition systems
- **Medical Imaging (Computer Aided Detection and Diagnosis):** Skin Cancer Feature Detection and Measurement, Morphological Analysis of the Colon, Functional Analysis of Cardiac Images.
- **Visual Biometrics:** Face feature segmentation and classification, Real-time Motion Segmentation and Tracking
- **Image Visualisation:** 3D Human Modelling, Bio-medical Visualisation, 3-D Computer Graphics

Selected Linkages: Mater Hospital, RCSI, National Biophotonics & Imaging Platform, Range of European and North American Universities, Robotiker Infotech (Spain), Agilent, Biomedical Diagnostics Institute/NCSR, Range of industrial partners.

Director: Prof. Paul F Whelan **Web link:** www.cipa.dcu.ie

Educational/Outreach Programme:

CIPA currently teaches in to a wide range of DCU educational & outreach programmes:

2nd Level: **SFI Secondary Teacher Assistant Researcher (STAR).**

3rd Level: **EE425: Image Processing & Analysis.** This module concentrates on developing the fundamentals necessary to design and develop a wide range of imaging solutions.

Summer Internships: **SFI UREKA (Undergraduate Research Experience & Knowledge Awards).**

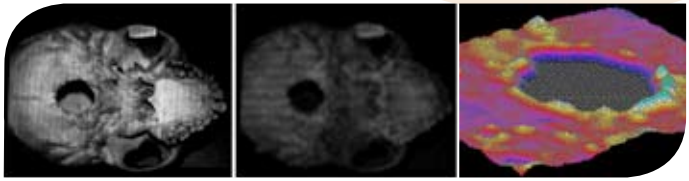
Graduate Education: **Unique Major in Image Processing & Analysis is now available within the Masters in Electronic Systems.** This Major will prepare graduates to specialise in the areas of image processing and analysis, computer & machine vision, biomedical imaging and image synthesis techniques. Students taking this Major will study three core modules:

- EE544: Computer & Machine Vision, EE502: Digital Signal Processing, EE563: 3D Graphics & Visualisation

Plus at least one module from the following set:

- EE564: 3D Image Analysis, EE565: BioMedical Image Acquisition, EE553: Object Oriented Programming

IRCSET PhD Studentships: CIPA currently hosts a number of IRCSET funded PhD students.



Centre for High Speed Device and Systems


Professor Liam Barry


Dr. Marissa Condon


Dr. Tony Holohan


Dr. Pascal Landais


Professor Patrick McNally

The focus of the HSDS Centre is the development of high-speed electronic and photonic materials and devices for future ultra-fast communications systems, with complementary simulation and analysis tools also being developed. Research within the group encompasses the development and processing of nano-materials; the design and demonstration of new sub-systems and devices for future terabit/s optical time division multiplexed and wavelength division multiplexed networks; and efficient modeling and simulation of high-frequency circuits and devices. HSDS **currently consists of 28 researchers** based in DCU. These researchers are working on a range of projects ranging from applied commercial research to blue-skies research.

Expertise:

The **core expertise** provided by the High Speed Devices and Systems (HSDS) Group is its ability to accurately design and characterise novel high speed materials and devices. This involves the initial simulation and modeling of the devices from basic material properties, through to efficient time and frequency domain analysis of high frequency devices and circuits, and to complete systems simulations which demonstrate device performance in practical systems. The group also has significant expertise in the experimental characterisation of materials and devices, ranging from advanced non-destructive electronic nano-materials characterisation, through to complete optical and electrical characterisation of optoelectronic devices, and to performance testing of novel devices and sub-systems in complete broadband communication systems.

Key Projects:

Currently our main research programs are funded by 4 SFI Principal Investigator Grants, 4 SFI Research Frontiers Grants, and 5 Enterprise Ireland commercialisation grants. Current & recent projects include:

- Applications of wavelength tunable laser diode in next generation optical networks
- Development of all-optical characterisation and processing technologies for Terabit/s optical transmission systems
- Design of radio-over-fibre distribution systems for broadband access networks
- Design, realisation and characterisation of new III-V lasers for terahertz emission.
- Design, realisation and characterisation of low noise semiconductor optical amplifiers.
- Development of simulation and modeling techniques for application in radio frequency technology

- Synchrotron x-ray topography (SXRT) analysis of strained silicon for advanced low power CMOS integrated circuit applications
- Silicon varbide materials & processes for high-temperature optical sensing
- Novel ultra-violet optoelectronic devices based on copper halides (CuHa) lattice matched to silicon substrates

Selected Academic Linkages: University of Limerick, Trinity College Dublin, University College Dublin, Tyndall Institute, University of Rennes, University of Auckland, Lakehead University Ontario, National University of Ireland Maynooth, Helsinki University of Technology, University of Surrey, Freiburg University,

Selected Industrial/Other Linkages: Intune Networks, Eblana Photonics, Alcatel-Lucent, Intel Ireland, General Electric Global Research.

Educational/Outreach Programme:

HSDS is currently involved in a wide range of DCU educational & outreach programmes.

2nd Level: For the past 3 summers SFI Funded Secondary Teacher Assistant Researchers (STAR) have worked in the HSDS laboratories where they have learned new skills and knowledge which can be passed on to their students - the scientists and engineers of the future

3rd Level: EE409 Optical Communications Systems. This module concentrates on the key building blocks used in developing optical transmission systems, and also the general performance characteristics of optical networks.

Summer Internships: SFI UREKA (Undergraduate Research Experience & Knowledge Awards) and RINCE John Mallon Scholars have been incorporated into the research labs during the summers. This allows undergraduate students to get a feel for postgraduate research at an early stage during their education.

Graduate Education: A Major in Nano-Electronics and Photonics is now available as part of the taught Masters in Electronic Systems. This major will fill the requirement for graduates in the fields of nano-electronics and photonics, which are extremely important for future growth within the ICT sector. Students taking this Major will study the following core modules:

Fundamentals of Nanoelectronics Technology
Nano & Microelectronic Device Manufacturing
Characterisation Technology for Nanomaterials
Optical Communications System Design
Micro/Nano Electronic System Design

In addition to this major, the HSDS centre is also involved in one other taught modules within the Masters in Electronic Systems: Advanced RF Modelling.

Network Innovations Centre


Dr. Conor Brennan


Dr. Martin Collier


Dr. Jenni McManis


Dr. Gabriel-Miro Muntean


Dr. Xiaon Wang

The mission of the Network Innovations Centre is to contribute to the emergence of the next generation of networks and network applications by engaging in relevant research and promoting its findings.

Ever-increasing consumer interest in novel services such as Voice over IP and IPTV fuels the demand for next generation networks offering greater bandwidth as well as better support for real-time services and user mobility, enhanced reliability and integrated/converged network architectures. The development of these networks is supported by continuing growth in computing power, increased efficiency in the exploitation of radio spectrum, and advances in optical fibre solutions, as well as ongoing developments of traditional network technologies.

Key Expertise

The centre staff has significant expertise in switching theory, routing protocols, protocol implementation and network security, quality-oriented and power-aware adaptive multimedia delivery, quality of experience aware adaptive hypermedia systems, performance of wireless and mobile networks, numerical modelling of electromagnetic wave scattering and radiation problems, hardware description languages and low-power electronics.

Key Projects

Best Route Selection based on Existing Road Traffic Conditions via Mobile Ad-hoc Wireless Networks

Energy-Efficient Network Processor Design

Architecture and Compiler Optimisation for Power Reduction in High Performance Network Processors

Efficient implementation of large-scale switching networks using a multistage repackable topology

Efficient wide band analysis of electromagnetic and acoustic wave-scattering problems

Prioritised In-Home Adaptive Multimedia-based Service Delivery Scheme

Prioritised Adaptive Multimedia Streaming Scheme

Cost-effective Quality-oriented Delivery of Multimedia Content over Heterogeneous Wireless Networks

Efficient integral equation techniques for modelling scattering from complex perfectly conducting bodies

Wireless Sensor Networks

Modelling Ultra wide band communication systems with a 3D ray tracing propagation tool

Research on Optimised Processing in Network Processor Units for High- performance Routers

Performance Optimisation of Components

Automated Performance Analysis of EJB (Enterprise Java Beans) Application Servers

Academic Linkages

Delft University, The Netherlands; University of Warwick, UK; Brunel University, UK; University College Dublin, Ireland; University College Dublin, Ireland; National College of Ireland, Ireland; University of California at Los Angeles, USA; L'Ecole Politehnique Federale de Lausanne, Switzerland; Politehnica University of Timisoara, Romania; Tsinghua University, Beijing; Technological University of Poznan, Poland; China Three Gorges University; Hangzhou Dianzi University, China

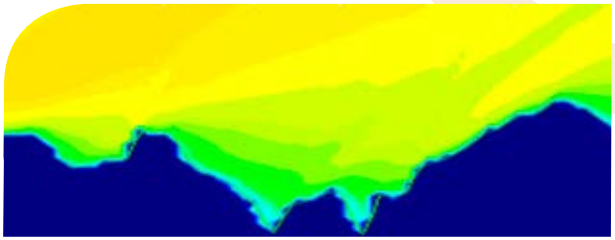
Company Linkages

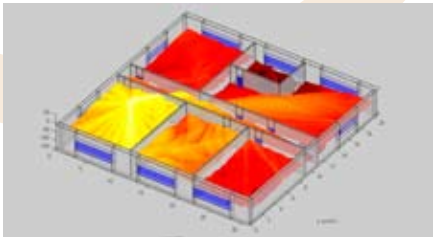
Recent collaborations have involved Eircom, Samsung, Industria, Vilicom and Lenovo.

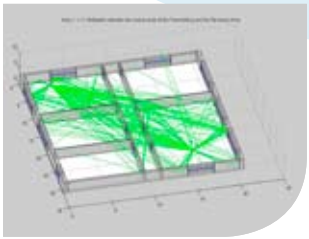
Teaching at postgraduate level

EE552 Broadband Networks (Dr. Martin Collier)
EE562 Network Programming (Dr. Martin Collier and Dr. Gabriel-Miro Muntean)
EE545: Data Network Protocols (Dr. Jennifer McManis)
EE561: Wireless Networks (Dr. Jennifer McManis and Dr. Gabriel-Miro Muntean)
EE558: Advanced RF Circuit Modelling (Dr. Conor Brennan)
EE540 HDL and High Level Logic Synthesis (Dr. Xiaojun Wang)

Contact: Dr. Martin Collier (martin.collier@rince.ie)








Prof. Berry McMullin


Dr. John McKenna


Dr. Darragh O'Brien


Dr. Ronan Scaife

Artificial Life Lab

Artificial Life (ALife) is concerned with the understanding and fabrication of complex artificial systems having "lifelike" properties such as self-maintenance, self-repair, adaptation to unknown environments, and evolvability. The RINCE Alife lab is focussed particularly on understanding the role of evolutionary or selectional processes, especially the emergence of new evolutionary "levels" (also called "major transitions"). We study these through computer models, or virtual worlds, in which simple computational agents can grow, decay, replicate, compete and co-operate.

Ultimately we are interested in one key open problem in ALife, originally formulated by John von Neumann in the late 1940's, which is to understand the necessary and sufficient conditions for spontaneous, open-ended, evolutionary growth of complexity in any "mechanistic" ("automaton") world. The ALife lab collaborates actively with other groups internationally, and is a founding member of the European Center for Living Technology (ECLT, Venice, Italy).

e-Accessibility Lab

e-Accessibility deals with the technical challenges of making information and communications technology (ICT) as accessible as possible to users affected by any kind of disability. Maximising accessibility of ICT products and services is clearly a desirable goal in itself on grounds of simple equity, fairness and social inclusion. It is also, in many jurisdictions (including Ireland), a matter of specific legal obligation. The RINCE e-Accessibility lab is focussed particularly on the accessibility of online (web-based) sites and services. We have carried out major surveys of web accessibility at both national and European levels. We participate, nationally and internationally, in developing guidelines, processes, tools and training in web accessibility. The Lab is a founding member of the Irish Design-for-all e-Accessibility network (IRL-Dean), and contributes actively to the Accessibility for All Standards Consultative Committee (AASCC) of the National Standards Authority of Ireland (NSAI). The lab also provides web accessibility consultancy services to a variety of clients in public, private and NGO sectors.

Speech Group

With an active team of 3 lecturers and 2 Ph.D. students, the Speech Group also has a regular complement of dissertation students from various taught Masters programmes within the Faculty of Engineering and Computing. The Group is active in Unit Selection Speech Synthesis and in Automatic Speaker Characterisation.

Unit-selection synthesis is synthesis by assembly of short segments of speech from a large (c. 1hr.) speech recording database and is overseen by Barry Kirkpatrick, Darragh O'Brien and Ronan Scaife. The current work is on automatically modelling human assessment of the audible effect of imperfect matching of the chosen segments to produce the best-sounding complete utterances.

Automatic Speaker Characterisation, overseen by Andrew Errity and John McKenna, is the extraction and description of features of speech specific to the speaker. Among the possible applications would be speech synthesis that can convey a range of emotional states (e.g. sympathetic or insistent) and automatic synthesis translated speech that still conveys the attributes of the original speaker.

Research Officer

Dr. Conor McArdle

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