



School of Computing, Engineering and Intelligent Systems

Annual Report for Research & Impact

August 2018 - July 2019



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1. Foreword:
Research Director
Professor Damien Coyle

In presenting the Annual Report for the School of Computing, Engineering and Intelligent Systems for the academic year 2018-2019, I am happy to report a very successful and busy year which saw major achievements arising from a range of research activities of our staff, postdoctoral researchers and PhD researchers, substantial enhancements to our research environment, a number of significant research grants secured and our research and impact being recognised nationally and internationally.

In the period, over 50 high quality research papers have been published in some of the world's top peer reviewed journals which represents an average of over two journal papers per staff member which is clear indication of the research and innovation intensity within the school. Publishing across many disciplines is indicative of the high-quality interdisciplinary research performed within the school. Our research quality goes from strength to strength each year with this year seeing a publication in Nature Communications (a leading journal) by a then PhD researcher from the school, Nadin Atiya, and supervisors. Other PhD researchers have had excellent achievements and successes this year, winning three of the four available Faculty prizes for Unit of Assessment 11 PhD Researchers (Mr Thomas Alderson – Best Paper, Mr Ciaran Cooney – Best Literature Review and Mr Shane Reid - Best poster). With 7 PhD researchers graduating this year and 6 additional recruited it has been a successful year for PhD research within the school.

By securing an additional £5.76M of research funding we have maintained our track record of successfully attaining year-on-year growth of research income. Building on the launch of the Cognitive Analytics Research Laboratory (CARL) in 2017, a significant endowment of £5M was provided by the Dr George Moore foundation to establish a Dr George Moore Chair in Data Analytics and a Dr George Moore Research Fellowship in Data Analytics. The funding will also support three PhD studentships in key areas of data science.

We continue to extend the impact of our data analytics and AI capability. For example, NeuroCONCISE Ltd., a spinout from the school won the IET and E&T Innovation of the year award for 2018. The innovative neurotechnology developed by NeuroCONCISE is now displayed on the 100 wall display at Savoy place in London, headquarters of the IET. Airbrio Ltd., another spinout company from the school, was nominated as finalist for the 2019 Invent Awards. These achievements are being followed by other new impactful research, including from a team who have licensed a new AI based technology to a local company, winning the Business Category Award (Under 50 employees) at the Ulster Impact awards. Another team won the most Innovative Award category at the Carnegie Mellon University IEA New Venture Competition for their bioinspired AI technology, Bionics.

It has been a busy and challenging year, compounded by extensive effort required by all staff and PhD researchers as we vacated our research space to undertake a complete refurbishment of the Intelligent Systems Research Centre building and develop a new Spatial Computing and Neurotechnology Innovation Hub (SCANi-hub) which will officially open in 2020. These are major improvements to our research

environment which will be further developed and expanded by funding through the Derry City and Strabane District Council City Deal, announced this year by the then Chancellor of the Exchanger, Phillip Hammond, when he visited the Intelligent Systems Research Centre in July.

As we publish this report, we look forward to another exciting year as we develop plans for this significant investment in the school, university campus and region.

Further details of our research, facilities, staff profiles and research expertise can be found at <https://www.ulster.ac.uk/faculties/computing-engineering-and-the-built-environment/computing-engineering-intelligent-systems/research>

or by contacting Louise Gallagher (Academic Excellence Executive Assistant) at Email: l.gallagher@ulster.ac.uk; Ph: [+44 28 7167 5148](tel:+442871675148).



Professor Damien Coyle
Research Director, School of Computing, Engineering and Intelligent Systems.

2. Research Students

The following research students were registered on research degree programmes during 2018-19.

Surname	Thesis Title
Atiya, Nadim	Computational modelling of decision uncertainty.
Behera, Chandan	Neuronal circuit model of emotional learning.
Bigirimana, Alain	Discrete emotion recognition for brain-computer interaction.
Bonham-Noyle, Kyrsti	Home health monitoring.
Boyle, Juanita	Intelligent Identity Authentication.
Cichy, Przemyslaw	Data Analytics: Deep learning – Combining Reinforcement Learning and Evolutionary Strategies.
Cooley, Christopher	Bio-KIP: Bio-inspired Kinect Image Processing.
Cooney, Ciaran	Decoding imagined semantic, syntactic and phonological speech processes from EEG.
Dhakan, Paresh	Motivated reinforcement learning in robots.
Duffy, William	Unobtrusive activity detection using a single wearable sensor.
Fegan, John	Multimodal robotic object recognition system.
Gillespie, James	Learning of bio-inspired movement in highly noisy environments.
Gorman, Mark	Utilising multivariate high frequency time series datasets for real-time decision making applications.
Haji Karim, Shvan	Brain inspired self repairing electronic systems.
Harrigan, Shane	Neuromorphic vision processing.
Javed, Aqib	Intelligent hot-spot prediction in networks-on-chip (NoC).
John Bensam, Christina Sherly	IDENTIFY: Robot Object Identification using Vision and Touch.
Johnston, Vivien	Big Data for MIDAS (Meaningful integration of data, analytics and services.
Khodadadzadeh, Massoud	Intelligent data analytics.
Madden, Kyle	Secure Networks-on-Chip (NoC) for cyber-physical systems.
McBrearty, Shaun	Result ranking for searchable symmetric encryption.
McCombe, Niamh	Data analytics and modelling in dementia (CPM-CLINICAL Decision Making Project).
McHugh, Catherine	Computational approaches to real-time energy trading.
McKinney, Joseph	VR/AR Upper Arm Rehabilitation: Personalised Upper Arm Rehabilitation within Virtual and Augmented Reality.
Melaugh, Ryan	Human-machine emotion interaction.
Millar, Christopher	Kinaesthetic learning for robotic object manipulation.
Reid, Shane	Social signal processing.
Roy, Sujit	Advanced MEG based brain-computer interface supported upper limb post-stroke rehabilitation.
Sharma, Pratikshya	Early Detection of Autistic Spectrum Disorder using Computer Vision Techniques.
Sweeney, Terence	Machine vision for automated inspection of hard drive components CAST.
Toman, Marinus	A Computational Model of Regulating Neuronal Excitability by GABA Neurons.

Graduated December 2018

Student Name	Thesis Title
Meena, Yogesh Kumar	Hybrid human-computer interfaces for effective communication and independent living.

Graduated July 2019

Student Name	Thesis Title
Breslin, Kevin Patrick	Ionic homeostasis at the perisynaptic cradle.
Korik, Attila	Brain-Computer Interface for Decoding Imagined 3D Arm Movements from EEG.
Martin, George	Scalable interconnect strategies for neuro-glia networks using networks-on-chip.
Wingfield, George	Using computational Intelligence for knowledge discovery from the human microbiome.
Cullen, Gary	Cooperatively applied positioning techniques utilizing range extension.
Holmes, Dominic	Upper Limb Movement Modelling for Adaptive and Personalised Physical Rehabilitation in Virtual Reality.

3. Publications

Details of all Publications by the School Computing, Engineering and Intelligent Systems are on the Ulster University's Institutional Repository- PURE <https://pure.ulster.ac.uk/>. This section reports those outputs published over the period of this report and classified as either journal articles, books/chapters in books and published conference papers.

3.1 Journal Article

Ab Ghani, NS, Ramlan, E & Firdaus-Raih, M 2019, 'Drug ReposER: a web server for predicting similar amino acid arrangements to known drug binding interfaces for potential drug repositioning', *Nucleic Acids Research*, vol. 47, no. W1, pp. W350-W356.

Ahmad, B, McClean, SI, Charles, DK & Parr, G 2018, 'Energy Saving Techniques Comparison for Green Computing in Cloud Server', *International Journal On Advances in Intelligent Systems*, pp. 192.

Alderson, T, Bokde, ALW, Kelso, JAS, Maguire, L & Coyle, D 2018, 'Metastable neural dynamics in Alzheimer's disease are disrupted by lesions to the structural connectome', *NeuroImage*, vol. 183, no. Dec 2018, pp. 438-455.

Atiya, N, Rano, I, Prasad, G & Wong-Lin, K 2019, 'A neural circuit model of decision uncertainty and change-of-mind', *Nature Communications*, vol. 10, no. 1, 2287, pp. 1-12.

Beveridge, R, Wilson, S, Callaghan, M & Coyle, D 2019, 'Neurogaming with motion-onset visual evoked potentials (mVEPs): adults versus teenagers', *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 27, no. 4, 8664451, pp. 572-581.

Blue, J, Condell, J & Lunney, T 2018, 'A Review of Identity, Identification & Authentication', *International Journal for Information Security Research*, vol. 8, no. 2, 561, pp. 794-804.

Bucholc, M, O'Kane, MJ, Mullan, C, Ashe, S & Maguire, L 2019, 'Primary care use of laboratory tests in Northern Ireland's

Western Health and Social Care Trust: a cross-sectional study', *BMJ Open*, vol. 9, no. 6, e026647.

Chowdhary, A, Raza, H, Meena, YK, Dutta, A & Prasad, G 2018, 'Online Covariate Shift Detection based Adaptive Brain-Computer Interface to Trigger Hand Exoskeleton Feedback for Neuro-Rehabilitation', *IEEE Transactions on Cognitive and Developmental Systems*, vol. 10, no. 4, pp. 1070-1080.

Chowdhury, A, Meena, YK, Haider, R, Bhushan, B, Uttam, AK, Pandey, N, Hashmi, AA, Bajpai, A, Dutta, A & Prasad, G 2018, 'Active Physical Practice Followed by Mental Practice Using BCI-Driven Hand Exoskeleton: A Pilot Trial for Clinical Effectiveness and Usability', *IEEE Journal of Biomedical and Health Informatics*.

Chowdhury, A, Nishad, SS, Meena, YK, Dutta, A & Prasad, G 2018, 'Hand-Exoskeleton Assisted Progressive Neurorehabilitation using Impedance Adaptation based Challenge Level Adjustment Method', *IEEE Transactions on Haptics*, pp. 1-1.

Chowdhury, A, Raza, H, Meena, YK, Dutta, A & Prasad, G 2019, 'An EEG-EMG Correlation-based Brain-Computer Interface for Hand Orthosis Supported Neuro-Rehabilitation', *Journal of Neuroscience Methods*, vol. 312, no. 1, pp. 1-11.

Cooney, C, Raffaella, F & Coyle, D 2018, 'Neurolinguistics Research Advancing Development of a Direct-Speech Brain-Computer Interface', *iScience*, vol. 8, pp. 103-125.

- Coulter, J, Moore, M, O'Driscoll, L, Flanagan, L, Bucholc, M & Sugrue, M 2019, 'Direct Peritoneal Resuscitation in Peritonitis: Time To Take Note – Technical Options', *European Journal of Trauma and Emergency Surgery*, vol. 45, no. Supp 1, pp. S89.
- Curran, K 2018, 'E-Voting on the Blockchain', *the Journal of the British Blockchain Association*, vol. 1, no. 2.
- Curran, K 2018, 'Forecasting Short-term Wholesale Prices on the Irish Single Electricity Market', *International Journal of Electrical and Computer Engineering*, vol. 8, no. 6, pp. 4060.
- Das, G, Vance, P, Kerr, D, Coleman, S, McGinnity, TM & Liu, J 2018, 'Computational Modelling of a Retinal Ganglion Cells' Receptive Field using Machine Learning Approaches', *Neurocomputing*.
- Dhakan, P, Rano, I & Siddique, N 2018, 'Intrinsic Rewards for Maintenance, Approach, Avoidance and Achievement Goal Types', *Frontiers in Neurorobotics*.
- Dowrick, T, McDaid, LJ & Hall, S 2018, 'Fan-In Analysis of a Leaky Integrator Circuit Using Charge Transfer Synapses', *Neurocomputing*, vol. 314, pp. 78-85.
- Duffy, W, Curran, K, Kelly, D & Lunney, T 2019, 'An investigation into smartphone based weakly supervised activity recognition systems', *Pervasive and Mobile Computing*, vol. 56, pp. 45-56.
- Ferry, FR, Ryan, A, McCauley, C-O, Laird, LEA, Gibson, A, Mulvenna, M, Bond, RR, Bunting, B & Curran, K 2018, 'Economic Costs and Health-Related Quality of Life Associated with Individual Specific Reminiscence: Results from the InspiredD Feasibility Study', *Dementia: The International Journal of Social Research and Practice*, pp. 1-18.
- Foley, D, Sugrue, M, Bucholc, M, Parlour, R, McIntyre, C & Johnston, A 2019, 'Should surgical site infection wound bundles become mandatory in colorectal surgery?—a meta-analysis.', *Mesentery and Peritoneum MAP*, vol. 3, no. 1.
- Gault, R, McGinnity, TM & Coleman, S 2018, 'A Computational Model of Thalamocortical Dysrhythmia in Tinnitus Sufferers', *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 26, no. 9, pp. 1867-1879.
- Howes, S, Charles, DK, Pedlow, K, Wilson, IM, Holmes, D & McDonough, S 2019, 'User-centred design of an active computer gaming system for strength and balance exercises for older adults', *Journal of Enabling Technologies*, vol. 13, no. 2, pp. 101-111.
- Kelly, D, Condell, J, Curran, K & Caulfield, BM 2020, 'A Multimodal Smartphone Sensor System for Behaviour Measurement and Health Status Inference', *Information Fusion*, vol. 53, pp. 43-54.
- King, R & Curran, K 2019, 'Predictive Maintenance for Vibration-Related failures in the Semi-Conductor Industry.', *Journal of Computer Engineering & Information Technology*, vol. 8, no. 1, 1000215, pp. 1.
- Laird, LEA, Ryan, A, Mc Cauley, C, Bond, RR, Mulvenna, M, Curran, K, Bunting, B, Ferry, FR & Gibson, A 2018, 'Using mobile technology to provide personalised reminiscence for people living with dementia and their carers: An appraisal of outcomes from a quasi-experimental study', *JMIR Mental Health*, vol. 5, no. 3, e57.
- Munoz Esquivel, K, Nevala, E, Alamäki, A, Condell, J, Kelly, D, Davies, RJ, Heaney, D, Nordström, A, Åkerlund Larsson, M, Nilsson, D, Barton, J & Tedesco, S 2018, 'Remote Rehabilitation: A solution to Overloaded & Scarce Health Care Systems', *Trends in Telemedicine & E-health*, vol. 1, no. 1, pp. 1-19.

- Liu, J, Huang, Y, Luo, Y, Harkin, J & McDaid, L 2019, 'Bio-inspired fault detection circuits based on synapse and spiking neuron models', *Neurocomputing*, vol. 331, pp. 473-482.
- Liu, J, McDaid, L, Araque, A, Wade, J, Harkin, J, Haji Karim, S, Henshall, D, Connolly, N, Johnson, AP, Tyrrell, A, Timmis, J, Millard, AG, Hilder, J & Halliday, DM 2019, 'GABA Regulation of Burst Firing in Hippocampal Astrocyte Neural Circuit: A Biophysical Model', *Frontiers in Cellular Neuroscience*, vol. 13, 335, pp. 1-14.
- Liu, J, McDaid, LJ, Harkin, J, Haji Karim, S, Johnson, AP, Millard, AG, Hilder, J, Halliday, DM, Tyrrell, AM & Timmis, J 2019, 'Exploring Self-Repair in a Coupled Spiking Astrocyte Neural Network', *IEEE Transactions on Neural Networks and Learning Systems*, vol. 30, no. 3, 8423789, pp. 865-875.
- Liu, J, Zhang, J, Luo, Y, Yang, S, Wang, J & Fu, Q 2019, 'Mass spectral substance detections using long short-term memory networks', *IEEE Access*, vol. 7, 8606092, pp. 10734-10744.
- Luo, Y, Wan, L, Liu, J, Harkin, J & Cao, Y 2018, 'An Efficient, Low-Cost Routing Architecture for Spiking Neural Network Hardware Implementations', *Neural Processing Letters*, vol. 48, no. 3, pp. 1777-1788.
- Luo, Y, Wan, L, Liu, J, Harkin, J, McDaid, LJ, Cao, Y & Ding, X 2018, 'Low Cost Interconnected Architecture for the Hardware Spiking Neural Networks', *Frontiers in Neurosciences*, vol. 12, 857, pp. 1-14.
- Malekian, R, Curran, K, Fischer, C, Cao, B & Qi, X 2018, 'Guest Editorial: Special issue on Sensor Technologies for Connected Cars: Devices, Systems and Modelling', *IEEE Sensors*, vol. 18, no. 12, pp. 4775.
- McGinnity, TM & Cosma, G 2019, 'Feature Extraction and Classification using Leading Eigenvectors: Applications in Biomedical and Multi-Modal mHealth Data', *IEEE Access*, vol. 7, no. 1, Access-2019-23455, pp. 17400-107412.
- McGinnity, TM, Cosma, G & Takerkhani, A 2019, 'Optimization of output spike train encoding for a spiking neuron based on its spatiotemporal input pattern', *IEEE Transactions on Cognitive and Developmental Systems*.
- McIntyre, C, Johnston, A, Foley, D, Lawler, J, Bucholc, M, Flanagan, L & Sugrue, M 2019, 'Readmission to Hospital Following Laparoscopic Cholecystectomy; A Meta-analysis', *Anaesthesiology Intensive Therapy*.
- Meena, Y, Cecotti, H, Wong-Lin, K & Prasad, G 2019, 'Design and evaluation of a time adaptive multimodal virtual keyboard', *Journal on Multimodal User Interfaces*, vol. 13, no. 4, pp. 343-361.
- Moore, M, Coulter, J, Bucholc, M, Walker, C-A & Sugrue, M 2019, 'Prevention of incisional hernia post emergency laparotomy: A time to change? A case series.', *European Journal of Trauma and Emergency Surgery*, vol. 45, no. 1, pp. S89-S90.
- Munoz Esquivel, K, Nevala, E, Alamäki, A, Condell, J, Kelly, D, Davies, RJ, Heaney, D, Nordström, A, Åkerlund Larsson, M, Nilsson, D, Barton, J & Tedesco, S 2018, 'Remote Rehabilitation: A solution to Overloaded & Scarce Health Care Systems', *Trends in Telemedicine & E-health*, vol. 1, no. 1, pp. 1-19.
- Nevala, E, Alamäki, A, Jalovaara, J, Munoz Esquivel, K, Condell, J, Heaney, D, Barton, J, Tedesco, S, Kelly, D, Davies, RJ, Nordström, A & Åkerlund Larsson, M 2018, 'SENDoc – to implement wearable sensors in rehabilitation practice for the elderly', *Age Now! - Online Journal of Ageing*, vol. 2, no. 2019.

- Pook, MF & Ramlan, E 2019, 'The Anglerfish algorithm: A derivation of randomized incremental construction technique for solving the traveling salesman problem', *Evolutionary Intelligence*, vol. 12, no. 1, pp. 11-20.
- Rathee, D, Chowdhury, A, Meena, Y, Dutta, A, McDonough, S & Prasad, G 2019, 'Brain-Machine Interface Driven Post-stroke Upper-limb Functional Recovery Correlates with Beta-band Mediated Cortical Networks', *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 27, no. 5, 8678461, pp. 1020-1031.
- Ryan, A, McCauley, C-O, Laird, LEA, Gibson, A, Mulvenna, M, Bond, RR, Bunting, B, Ferry, FR & Curran, K 2018, '"There is still so much inside": The impact of personalised reminiscence, facilitated by a tablet device, on people living with dementia and their family carers', *Dementia: the International Journal of Social Research and Practice.*, pp. 0-20.
- Sadek Mahmoud, M, Eltoweissy, M, Curran, K & Elmedany, W 2019, 'Introduction to special issue on smart systems facts, challenges and technologies', *International Journal of Computing and Digital Systems*, vol. 8, no. 2, 2, pp. 85-89.
- Samima, S, Sarma, M, Samanta, D & Prasad, G 2018, 'Estimation and quantification of vigilance using ERPs and eye blink rate with a fuzzy model-based approach', *Cognition, Technology and Work*, vol. 20, no. 79, pp. 1-17.
- Siddique, N, Alam, KMR & Adeli, H 2019, 'A Dynamic Ensemble Learning Algorithm for Neural Networks', *Neural Computing and Applications*.
- Sugrue, M, Coccolini, F, Bucholc, M & Johnston, A 2019, 'Intra-operative gallbladder scoring predicts conversion of laparoscopic to open cholecystectomy: a WSES prospective collaborative study', *World Journal of Emergency Surgery*, vol. 14, no. 1, 12, pp. 1-8.
- Wade, J, Breslin, K, Wong-Lin, K, Harkin, J, Flanagan, B, Van Zalinge, H, Hall, S, Dallas, M, Bithell, A, Verkhatsky, A & McDaid, LJ 2019, 'Calcium Microdomain Formation at the Perisynaptic Cradle Due to NCX Reversal: A computational study', *Frontiers in Cellular Neuroscience*, vol. 13, 185, pp. 1-13.
- Xia, C, Zhang, Y, Wang, L, Coleman, S & Liu, Y 2018, 'Microservice-based Cloud Robotics System for Intelligent Space', *Robotics and Autonomous Systems*, vol. 110, pp. 139-150.
- Yang, S, Wong-Lin, K, Andrew, J, Mak, T & McGinnity, TM 2018, 'A neuro-inspired visual tracking method based on programmable system-on-chip platform', *Neural Computing and Applications*, vol. 30, no. 9, pp. 2697-2708.
- Yao, Y, Cao, Y, Ding, X, Zhai, J, Liu, J, Luo, Y, Ma, S & Zou, K 2018, 'A paired neural network model for tourist arrival forecasting', *Expert Systems with Applications*, vol. 114, pp. 588-614.
- Zgonnikov, A, Atiya, N, O'Hora, D, Rano, I & Wong-Lin, K 2019, 'Beyond reach: Do symmetric changes in motor costs affect decision making? A registered report', *Judgment and Decision Making*, vol. 14, no. 4, 14: 4, pp. 455-469.

3.2 Books/Chapters in Books

Gibson, A, McCauley, C-O, Mulvenna, M, Ryan, A, Laird, L, Curran, K, Bunting, B, Ferry, FR & Bond, RR 2019, How Usable Are Usability Tests? Examining the Suitability of Standard Usability Testing Methods for the Assessment of Apps for People Living with Dementia. in HM Fardoun, AAM Hassan & ME de la Guía (eds), *New Technologies to Improve Patient Rehabilitation: 4th Workshop, REHAB 2016, Revised Selected Papers. Communications in Computer and Information Science*, vol. 1002, Springer, pp. 126-143, REHAB 2016, Lisbon, Portugal, 13/10/16.

Ramlan, E & Firdaus-Raih, M 2018, Engineering of Supramolecular RNA Structures. in S Ranganathan, M Gribskov, K Nakai & C Schönbach (eds), *Reference Module in Life Sciences: Encyclopedia of Bioinformatics and Computational Biology*. vol. 3, Elsevier, pp. 535-545.

3.3 Published Conference Papers

Black, M, Rankin, D, Wallace, JG, Bond, RR, Mulvenna, M, Cleland, B, Carlin, P, Fischhaber, S, Epelde, G, Nikolic, G, Pajula, J & Connolly, R 2019, Meaningful Integration of Data, Analytics and Services of Computer-Based Medical Systems: The MIDAS Touch. in *32nd IEEE CBMS International Symposium on Computer-Based Medical Systems. 32nd IEEE CBMS International Symposium on Computer-Based Medical Systems, Córdoba, Spain, 5/06/19.*

Bucholc, M, Ding, X, Wong-Lin, K, McClean, P, Todd, S & Maguire, L 2019, The impact of hearing loss and sensory intervention on the risk of progression to dementia in mild cognitive impairment cases. in *Alzheimer's and Dementia*. 7 ed, vol. 15, Elsevier, pp. 194-194, 2019 Alzheimer's Association International Conference, Los Angeles, United States, 14/07/19.

Bucholc, M, Titarenko, S, Maguire, L, McClean, P, Todd, S, Ding, X, Finn, D & Wong-Lin, K 2018, An efficient multiple time-point predictive model of Alzheimer's disease progression. in *Unknown host publication. 9th Annual Translational Medicine Conference, 12/09/18.*

Bucholc, M, Titarenko, S, Wong-Lin, K, Ding, X, McClean, P, Todd, S, Finn, D & Maguire, L 2019, Modelling of longitudinal cognitive profiles for predicting conversion from mild cognitive impairment to dementia. in *Unknown host publication. Alzheimer's Research UK Conference, Harrogate, United Kingdom, 19/03/19.*

Callaghan, M 2018, 'Voice Driven Tutor in Virtual Reality Game for Health and Safety Training' 12th European Conference on Games Based Learning, Sophia Antipolis, France, 3/10/18 - 5/10/18.

Cecotti, H, Meena, YK & Prasad, G 2018, A multimodal virtual keyboard using eye-tracking and hand gesture detection. in Proc. 2018 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC). 2018 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), Honolulu, HI, United States, 18/07/19.

Chowdhury, A, Dutta, A & Prasad, G 2019, Can Corticomuscular Coupling be Useful in Designing Hybrid-Brain Robot Interfaces Towards Hand Functional Recovery? in Proc. 2019 IEEE International Conference on Systems, Man and Cybernetics (SMC) October 6-9, 2019, Bari, Italy.. IEEE, 2019 IEEE International Conference on Systems, Man and Cybernetics (SMC), Bari, Italy, 6/10/19.

Cleland, B, Wallace, JG, Bond, RR, Muurais, S, Pajula, J, Epelde, G, Arrúec, M, Álvarez, R, Black, M, Mulvenna, M, Rankin, D & Carlin, P 2019, 'Usability Evaluation of a Co-created Big Data Analytics Platform for Health Policy-Making' Paper presented at International Conference on Human-Computer Interaction, Orlando, United States, 26/07/19 - 31/07/19, pp. 194-207.

Cooney, C, Raffaella, F & Coyle, D 2018, 'Mel Frequency Cepstral Coefficients Enhance Imagined Speech Decoding Accuracy from EEG' Paper presented at 29th Irish signals and Systems Conference 2018, Belfast, Northern Ireland, 21/06/18 - 22/06/18.

Curran, J & Curran, K 2019, Biometric Authentication Techniques in Online Learning Environments. in Biometric Authentication in Online Learning Environments. pp. 266-278.

Curran, K 2019, Smart Technologies and Innovation for a Sustainable Future. in Proceedings of the 1st American University in the Emirates International Research Conference.

Curran, K, Mansell, G & Curran, J 2018, An IoT Framework for detecting Movement within Indoor Environments. in International Conference on Machine Learning for Networking (MLN'2018). International Conference on Machine Learning for Networking (MLN'2018), Paris, France, 27/11/18.

Curran, K, McNamee, E, McCarroll, N, Chaurasiaa, P & McBrearty, S 2019, 'The Security Considerations in Cloud Adoption for Legal Firms' International Conference on Science, Engineering & Technology, Tel Aviv, Israel, 29/03/19 - 30/03/19, pp. 1.

Donnellan, E, Coulter, J, Mathews, C, McIntyre, C, Flanagan, L, Bucholc, M, Johnston, A & Sugrue, M 2019, 'A meta-analysis of the use of intraoperative cholangiography; time to revisit our approach to cholecystectomy?' Paper presented at World Congress of Surgery WCS 2019, Krakow, Poland, 11/08/19 - 15/08/19.

Duffy, W, Curran, K, Kelly, D & Lunney, T 2018, 'Addressing the Problem of Activity Recognition with Experience Sampling and Weak Learning'.

Duffy, W, Curran, K, Kelly, D & Lunney, T 2018, Reducing the intrusion of user-trained activity recognition systems. in 2018 29th Irish Signals and Systems Conference (ISSC). IEEE, 29th Irish signals and Systems Conference 2018, Belfast, Northern Ireland, 21/06/18.

Fegan, J, Kerr, D, Coleman, S & Scotney, B 2018, 'Fast, Multi-Scale Image Processing on a Square Spiral Framework' Paper presented at International Conference on Artificial Intelligence and Pattern Recognition, Beijing, China, 18/08/18 - 20/08/18.

Foley, D, Bucholc, M, Parlour, R, Johnston, A & Sugrue, M 2019, 'Should Surgical Site Infection Wound Bundles become Mandatory in Colorectal Surgery?' Paper presented at World Congress of Surgery WCS 2019, Krakow, Poland, 11/08/19 - 15/08/19.

Harrigan, S, Kerr, D, Coleman, S, Yogarajah, P, Fang, Z & Wu, C 2018, 'Neuromorphic Event-based Space-Time Template Action Recognition' Paper presented at Irish Machine Vision and Image Processing Conference, United Kingdom, 29/08/18 - 31/08/18.

Heyburn, R, Bond, RR, Black, M, Mulvenna, M, Wallace, JG, Rankin, D & Cleland, B 2018, Machine learning using synthetic and real data: Similarity of evaluation metrics for different healthcare datasets and for different algorithms. in Data Science and Knowledge Engineering for Sensing Decision Support. vol. 11, World Scientific Publishing, pp. 1281-1291.

Kaur, D, Bucholc, M, Finn, D, Todd, S, McClean, P & Wong-Lin, K 2018, Does your metabolic past predict your cognitive future? Active diabetes and inactive hypertension are predictive of dementia risk. in Unknown host publication. 9th Annual Translational Medicine Conference, 12/09/18.

Kaur, D, Bucholc, M, Finn, D, Todd, S, McClean, P & Wong-Lin, K 2019, Clinical index of metabolic risk factors for predicting disease progression in dementia. in Unknown host publication. British Neuroscience Association Meeting, Dublin, Ireland, 14/04/19.

Kaur, D, Bucholc, M, Finn, D, Todd, S, Wong-Lin, K & McClean, P 2019, Age and Time-Dependent Risk Model Associated with Progressing to Dementia. in Alzheimer's and Dementia. 7 edn, vol. 15, Elsevier, pp. 237-238, 2019 Alzheimer's Association International Conference, Los Angeles, United States, 14/07/19.

Kaur, D, Bucholc, M, Finn, D, Todd, S, Wong-Lin, K & McClean, P 2019, Age-dependent cardio-metabolic risk factors associated with progressing to dementia. in Unknown host publication. Alzheimer's Research UK Conference, Harrogate, United Kingdom, 19/03/19.

Laird, LEA, Ryan, A, McCauley, C-O, Gibson, A, Mulvenna, M, Bunting, B, Bond, RR, Curran, K & Ferry, FR 2019, 'Facilitating People living with a dementia and Their Families to engage in personalised reminiscence supported by an iPad app – a quasi-experimental study' All Ireland Gerontological Nurses Association Annual Conference, Limerick, Ireland, 2/05/19.

Lawler, J, Choynowski, M, Bucholc, M, Johnston, A & Sugrue, M 2018, Colorectal post-operative infective complications worsen oncological outcomes - a meta-analysis. in Unknown host publication. American College of Surgeons Clinical Congress, Boston, United States, 21/10/18.

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Walker, C-A, Flanagan, L, Parlour, R, Blake, K, Bucholc, M, Loughlin, P & Sugrue, M 2018, Developing an emergency surgery right iliac pain and appendicitis module. in Unknown host publication. 9th Annual Translational Medicine Conference, 12/09/18.

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Zhang, H, Wong-Lin, K, Ye, Q, Bucholc, M, Yang, H & Ding, X 2019, Speech-converted text analytics of Chinese-spoken language can distinguish Alzheimer's disease patients from healthy controls. in Unknown host publication. Alzheimer's Research UK Conference, Harrogate, United Kingdom, 19/03/19.

4. Research Funding

Ongoing and Active Research Projects, notably:

Unit of Assessment Member	Title of Award	Funding Body	Value
Dr K Wong-Lin Dr I Rano Dr D Wang	Brain Circuit Dynamic	The Royal Society	£ 8,935.00
Prof LJ McDaid Prof JG Harkin Dr G Marsciano Dr A Araque Dr H Hirase	Mitochondrial G Protein Signal	Human Frontier Science Prog	£ 151,800.00
Prof LP Maguire Prof D Coyle Mr R Johnston Mr P Devine	CARL Business Plan Development	Invest NI	£ 14,593.00
Dr JV Condell	Battery/compressed air storage	Invest NI-Centre for Advanced Sus Energy	£ 146,500.00
Dr JV Condell Dr P Chaurasia Dr K McCreadie	SoFIA	Interreg NPA Prep	£ 13,581.00
Dr I Rano Dr K Wong-Lin Dr M Khamassi	Highly Stochastic Learning	The Royal Society	£ 9,440.00
Prof LJ McDaid Dr JG Harkin	Self-repairing Hardware	EPSRC	£ 375,835.00
Dr D Kerr Prof S Coleman Dr P Vance Prof TM McGinnity	BIONICS	Invest NI - Proof of Concept	£ 96,938.00
Prof D Coyle Prof A Duffy	Feasibility of Cognitive CAED	EPSRC	£ 147,142.00
Dr JG Harkin Prof LP Maguire	iTEMPO	Invest NI - Proof of Concept	£ 105,993.00

Dr Michaela Black Dr D Rankin Prof MD Mulvenna Brian Murphy Dr R Bond Prof JG Wallace Dr D Weston Dr P Carlin Mr M Van Gils Mr J Paakkonen Mr D Bryce Mr R Kaikkohen Prof J Millar Dr I Macia Dr A Tanney Prof B De Moor Mr R Bilbao Dr P Davis Dr P O Sullivan Mr M Grobelnik	H2020 -MIDAS	CEC-H2020-SC Health	£ 660,325.00
Prof G Prasad Dr K Wong-Lin Prof AJ Bjourson Prof D Coyle Prof S Coleman Prof LP Maguire Dr H Cecotti Prof TM McGinnity	NI FUNCT BRAIN MAP FAC	Invest NI	£2,607,301.00
Dr K Wong-Lin Prof T Sharp Prof D Bannerman	Midbrain Raphe Microcircuitry	BBSRC	£ 192,572.00
Dr JV Condell Mr J Barton Mr A Tarkiainen Dr M O'Kane	SENDOC	CEC NPP Northern Periphery & Arctic Pro	£ 25,133.00
Dr JV Condell Mr M Callaghan Dr I Rano Dr SM Moffett	CINE	CEC NPP Northern Periphery & Arctic Pro	£ 131,258.00

Dr JV Condell Mr RJ Davies Dr D Kelly Ms M Saastmoinen Mr J Barton Ms S Timmons Ms A Nordstrom Mr J Connolly Mr A Niemi Ms AM Ulrik	SENDOC	CEC NPP Northern Periphery & Arctic Pro	£ 329,035.00
Prof G Prasad Prof SM McDonough Dr H Cecotti Prof A Dhutta	Advancing MEG-based BCI	UKIERI	£ 144,546.00
Prof S Coleman Prof TM McGinnity	Capital Markets Eng S-Ships	Various	£ 360,000.00
Prof D Coyle Prof LP Maguire Dr F Lotte	Human Machine Symbiosis	UK Government	£ 215,535.00
Dr JV Condell	IMUs measuring axSpa	Foundation for Research in Rheumatology	£ 91,523.00
Prof D Coyle Dr C Guger Dr A Del Felice Dr K Strauseer Dr O Lennon Prof F Molteni Prof S Murphy	PRO-GAIT: Physiological and Rehabilitation Outcomes Gains from Automated Interventions in Stroke Therapy	CEC-H2020- MSCA-RISE	£ 13,261.00

Portfolio of Research Grants awarded during period 1 August 2018 - 31 July 2019

Unit of Assessment Member	Title of Award	Funding Body	Value
Dr JV Condell Dr K McCreddie Dr P Chaurasia	Social Farming - Innovative Agriculture	Interreg NPA Prep	£13,581.00
Prof LP Maguire	Dr George Moore Chair in Data Analytics	Mrs Angela Moore	£3,000,000.00
Prof LP Maguire	Dr George Moore Research Fellowship in Data	Mrs Angela Moore	£2,000,000.00

<p>Dr D Kerr Dr B Gardiner Dr P Vance Mr EP Kerr Prof S Coleman Dr L Eadie, Uni of Aberdeen Prof C Wu, North Eastern University Prof P Wilson, Uni of Aberdeen Prof Z Fang, North Eastern University</p>	<p>Rural Assistive Living</p>	<p>Department for the Economy-GCRF</p>	<p>£15,545.00</p>
<p>Dr JG Harkin Prof LJ McDaid Mr J Liu Dr Y Luo, Guangxi Normal University Mr S Deng, Guilin Earthquake Admin Mr Z Liao, Guilin Prime Power Tech</p>	<p>Transforming the Future of Infrastructure with Smart Analytics of Sensory Data using more Physically Robust and Efficient Neural Network Computing Technology</p>	<p>Department for the Economy-GCRF</p>	<p>£19,755.00</p>
<p>Dr X Ding Dr PL McClean Dr K Wong-Lin Dr M BucholcGongde Guo, College of Mathematics Honggin Yang, College of Photonic Qinyong Ye, Fujian Medical University</p>	<p>Towards Improving Dementia Care Pathway in China: Data Extraction for Dementia Diagnosis</p>	<p>Department for the Economy-GCRF</p>	<p>£19,800.00</p>
<p>Dr D Charles Prof SM McDonough Dr AA Moore Dr K Pedlow</p>	<p>Magic - Glass Phase 3</p>	<p>CEC-H2020-VIA Magic PCP</p>	<p>£257,993.00</p>
<p>Dr M Bucholc Dr K Wong-Lin Dr X Ding Dr J Palczewski,UU Dr S Titarenko, UU</p>	<p>Development of the prognostic multiple point-time model for predicting conversation from mild cognitive impairment to Alzheimer's disease using cognitive and functional</p>	<p>Alzheimer's Research UK Small Grant Pump</p>	<p>£2,300.00</p>

Prof S Coleman Dr D Kerr	DFE CAST: Machine Vision for Automated Inspection of Hard Drive Components	Seagate Technology (Ireland)	£26,640.00
Prof D Coyle Dr K McCreadie	Spatial Computing & Neurotechnology Innovation Hub (Scan i-hub)	Department for the Economy-HERC Funding	£266,277.00
Dr K Wong-Lin Dr PL McClean Dr S Watterson Dr A Joshi	Computational modelling of novel serotonergic therapeutic mechanisms for the treatment of Alzheimer's disease	Alzheimer's REsearch UK Small Grant Pump	£3,000.00
Michaela Black Dr C Hughes Dr CIR Gill Prof HM McNulty Prof AJ Moore Dr D Rankin Prof JG Wallace	Time Series Geo-Referenced Health Care Analytics for Dementia	Health & Social Care Board	£7,451.00
Michaela Black Dr C Hughes Dr CIR Gill Dr L Hoey Prof HM McNulty Prof AJ Moore Dr D Rankin Prof JG Wallace Paul Carlin, SEHSC, Research	DARUG	NHSCT (HSC)	£99,904.81
Dr P Vance Dr D Kerr Prof S Coleman Dr B Wingfield	ICURE- BIONICS: BIO-Inspired surveillance System	Innovaate UK via ICURE Programme	£28,980.00
Dr P Dunlop Dr SP McDowell Sara Benetti Dr D Kerr Prof S Coleman Dr J Hanafin, National Uni of Ireland Dr R Noormets, The Uni Centre in Svalbar Mr C Kennedy, Derry City and Strabane Di Mr M McGarvey, Donegal County Council	Adaption and resilience tools for monitoring climate change impacts in NPA communities - Lead Partner	Interreg Northern Periphery & Arctic Programme	£12,908.00

Dr R Price Dr K Wong-Lin Dr L Dowey Dr F Duffy, NHST Mr B Crossey, Nightingale Analytics Mrs S Casey, AgeNI	Dementia Data Analytics Project	HSC R&D Public Health Agency	£100,000.00
Dr JG Harkin Mr M McElholm	iTEMPO - Track. Analyse. Optimize	Innovate UK/iCURE	£31,434.00