

School of Computing



August 2020 – July 2021

**Annual Report
for Research & Impact**



Contents

1. Foreword	3
2. Research Students	5
3. Publications	8
3.1 Journal Articles	
3.2 Books/Chapters in Books	
3.3 Research Reports	
3.4 Published Conference Papers	
4. Research Funding	22





1. Foreword:
Research Director
Prof Luke Chen

In presenting the Annual Research Report for the School of Computing (SoC) for the academic year 2020-2021, I am pleased to report an extraordinary year of research and innovation with impressive performance. It is the first time in history staff have been working remotely for the entire duration of the academic year, with limited access to research resources and various forced changes to normal practice of research. And yet all members of staff have demonstrated a high level of resilience and professionalism, mitigating the disruptions of the pandemic by establishing new ways of effective research. Staff continue to excel in research - be productive in generating research outputs in top-tier journals, conferences and workshops, securing prestigious research grants from a wide range of funding bodies and industry, and delivering keynotes, talks and research presentations at local, national and international events. To highlight, the Pervasive Computing Research Centre continues to expand its excellent research and impact economy and society through research translation, completing a £3.3 million research deal with leading industry partner PwC to create the new Advanced Research Centre (ARC) in collaboration with QUB.

Ongoing research initiatives such as the Connected Health Innovation Centre (CHIC) and the BT Ireland Innovation Centre (BTIIC) have progressed well. CHIC now in its eighth year has been working to underpin the developments of the Belfast Region City Deal for the establishment of the visionary Centre for Digital Healthcare Technologies. During the reporting period it also worked with the Schools of Engineering and Biomedical Sciences to launch the Integrated Diagnostic Laboratory supported by HERC funding. BTIIC has successfully completed its fourth year, reaching a stage of maturity in which it is generating research impact, including technology down-streaming into BT products, systems and services, industry level Technical Reports and White Paper, patents and a string of prestigious awards, e.g. Outstanding Catalyst – Business Impact award and the “Emerging Technology of the Year” UK IT Industry Awards. Staff have also reached out to wider communities and industry within NI and beyond, to undertake knowledge transfer and research translation to impact economy and society in addition to public engagements to raise awareness of science and technologies. For example, the School has secured the organization of the IEEE WoWMoM2022 – a prestigious conference in its 23rd edition on pervasive and mobile computing in Belfast, and will co-host the 5th International Summer School on Connected Health, both in June 2022. This is excellent performance under the full impact of Covid-19 pandemic, demonstrating the quality, capabilities and dedication of all members of staff in the School.

The academic year 2020-2021 is a special year in which the REF2021 came to an end and the next REF cycle starts. A significant effort has been made towards the REF2021 preparation, mock review and final submission. The School had 38.7 FTE researchers, 92 research outputs and 5 Impact Case Studies returned to the REF2021 submission, in conjunction with the School of Computing Engineering and the Intelligent Systems, a significant improvement compared to REF2014, demonstrating the ever-growing research capacities, capabilities and quality over the REF2021 duration. With the REF2021 cycle coming to an end, the School has shifted its focus on its long term research development targeting on its next REF submission. Following the rebranding of research groups to research centres, this year the School initiated a comprehensive review of the School’s research topics along with a well-organised endeavour of international consultation, aiming to adapt and adjust the School’s research themes and emphasis to the

changing landscape of computing, with the ultimate purpose of developing an overall research strategy and long-term research agenda. While perspectives and suggestions have been received and are being reflected upon at present, the research strategy and agenda will be developed in the forthcoming academic year to guide future research.

The academic year 2020-2021 is also special in that it is the first year the new European research programme after Brexit, i.e., Horizon Europe, kicked off. The School has adapted to the impact of Brexit and fine-tuned its strategy of research grant application. While more attention is being directed towards national UKRI funding programmes we intend to maintain our strong track record and strengthen our participation in EU level funding applications. To this end, the School has forged a partnership with a successful consultancy company in mainland Europe to further develop the School's research profile and visibility. Research theme leads within the two Centres have collected, analysed and created all research theme profiles, and upon which two workshops led by the industry partner have been conducted to help identify each research theme's strengths and corresponding EU funding programmes. This has placed the School in a strong position in terms of both publicity and participation of project consortiums in the time to come.

The School has made significant efforts in the academic year 2020-2021 to address long existing or rising issues. The School has conducted an extensive review and undertaken discussions related to the difficulties of PhD researcher recruitment. A number of measures, including industrial stipend top-up and sponsorship, has been recommended to improve both the number and quality of potential PhD studentship applications. International collaborative PhD programmes have also been considered and initiated. The School has also examined closely the concept of a research seminar series. By taking advantages of virtual online delivery the School has facilitated a number of talks from internationally recognized speakers around the world. Based on a coordinated review the School has further developed a well-structured seminar series, which balances the needs of academics, researchers and PhD students, and maximizes participation and engagement. It is expected that the seminar series will foster a vibrant, open and sustainable research environment to benefit both individuals and the School in their research development. This academic year the School continues its support for ECRs, including preference in PhD studentship allocation and the use of research recovery funding, demonstrating its long-term commitment to younger researchers' career development.

In summary, the academic year 2020-2021 is unique – a year of transition in which REF2021 and EU Horizon2020 came to an end and EU Horizon Europe and a new cycle of REF started, and a year of dramatic changes of research practice and adaptation under the pandemic. The School has taken a proactive approach to embracing these changes and challenges, ensuring it has gone from strength to strength. While maintaining existing research practices and activities, the School has placed special emphasis on reflection, long-term research planning, and foundation consolidation, which will position the School in a solid footing and preparedness for research excellence in the many years to come.

Further details can be found on the SoC website [School of Computing](#) or by contacting Mrs Ursula MacDonald (Academic Excellence Executive Assistant) at Email: u.macdonald@ulster.ac.uk; Ph: [+44 28 9536 5759](tel:+442895365759).



Professor Luke Chen
Research Director - Computer Science and Informatics

2. Research Students

The following research students were registered on research degree programmes during 2020-21.

Name	Thesis title
Adams, Dawn	Wearable technologies for self-management of diabetes in pregnancy.
Ahmad, Abrar	Drone based hotspot: an internet-on-the-go service for disaster management.
Ahmad, Bilal	Resource optimisation for cloud-based digital gaming.
Ahmad, Salman	BTIIC-02: Novel data analytics to automatically detect patterns in diverse customer data.
Ajayi, Oluwashina	BTIIC-09: Securing Self-Organising IOT Ecosystems.
Alam, Gulzar	An Approach for Constructing and Sharing Open Data Sets in Experimental Pervasive Computing.
Asharindavida, Fayas	A New Approach to Spectral Data Analysis for Food Quality Control.
Black, Brendan	A meshed synchronous internet of medical things.
Blair, Stuart	Sentiment mining from social media using topic model ensembles.
Booth, Frederick	Analysis and Visualisation of Geo-Referenced Health Big Data.
Brisk, Rob	Intelligent systems to improve decision making in cardiovascular emergencies.
Burns, Matthew	Fusing sensor, video and depth data for analysis of ADLs and multiple occupancy tracking in a smart environment.
Chen, Xianjiang	Development of computational and statistical models for prediction of nitrogen and energy utilisation efficiencies and methane emissions in cattle.
Chen, Zhi	Big Data TV Analytics for service and customer improvement.
Clare, Conor	Bayesian optimization using Student-t processes with gradient information.
D'Arco, Luigi	CareBot: AI-powered Robot Care Systems in Smart Environments.
Davies, Richard	Gait and limb analysis for post stroke rehabilitation.
Ekerete, Idongesit	Non-obtrusive sensing to assist post-stroke sufferers in home-based settings.
Ennis, Andrew	Situation aware content provisioning in mobile environments.
Etumusei, Jonathan	Detecting Anomalies from Satellite and Terrestrial Data Sources by Data Analytics.
Gama, Clement	SATURN: Swarms, Autonomic Technologies, Ubiquitous Robotics & Nanotech software paradigms for future space exploration.
Gebresilassie, Samson Kahsay	BTIIC-10: Managing Identities and risk in an Internet of Insecure devices.
Haider, Abbas	Contextual Probability based Approach to Reinforcement Learning.
Hand, Rebecca	ThermAct: The use of thermal sensing technology to quantify wellbeing.
Hussain, Tazar	BTIIC-07: An IoT management framework for decision making in instances of unreliability.
Iftikhar, Aleeha	Mobile technology bases solutions for improving the interpretation of the 12-lead electrocardiogram and clinical decision making in cardiology.
Irvine, Naomi	An end-to-end framework for the optimisation of human activity recognition.
Jasinska-Piadlo, Alicja	Heart failure data analytics.
Kamal, Rashid	CHIC: Behavioural modelling based on opportunistic sensing techniques within IoT (Computing).
Kirk, Nathan	Sensing and Modelling Air Quality for Healthy Living (SMAQ).

Marshall, Fiona	Video analysis of abnormal behaviours within smart environments (VAAB).
McAllister, Anna	Computational and Mathematical Modelling of Predator-Prey Systems.
McCalmont, Graham	Wearable Technologies to Support the Assessment of Physical Activity Functions for Stroke Rehabilitation.
McGuigan, Liam	MAARRS: Multi-Agent Autonomic Robot/Rover Swarms.
McHugh, Orla	Decision Analytic with Combined Data Driven Models and Domain Knowledge for Sustainable Land Management.
Milliken, Michael	Intrusion detection from networks by using data mining and pattern recognition.
Moore, Samuel	BTIIC-06: Quantification of information reliability within IoT deployments.
Orr, Claire	A multi-agent based approach to activity recognition within smart environments.
Pavlovic, Maja	Anomaly Detection in MBES, SWARM and SENTINEL-3 Data using Data Analytics.
Potts, Courtney	Advanced analytics and machine learning of real-world.
Quigley, Bronagh	Computational monitoring and interpretation of social and communicative behaviours in autism.
Rabbani, Kashif	BTIIC-11: Information SLAs for IoT Systems.
Ramezani, Anousheh	BTIIC-04: Novel adaptive machine learning, for response to changes over time.
Rjooob, Khaled	Investigating how humans make decisions in cardiology and developing intelligent algorithms to improve decision making.
Saedi, Mohammad	BTIIC-12: Secure real-time communications over 5G- Using Big Date Analytics, Fuzzy Set Techniques and Fuzzy Roles to evaluate and optimize network's parameter in 5G.
Saunders, Catherine	Spaces: self-properties autonomic computing for exploring spaces.
Shewell, Colin	Context aware reminder delivery with Google glasses.
Sullivan, Keaton	Network Machine Learning Approach to Financial Crime Detection.
Tariq, Zeeshan	BTIIC-05: Process Analytics for predictive and self-correcting processes.
Torney, Hannah	Usability engineering methods for assessing and enhancing the human-machine interaction of automated external defibrillators.
Turkington, Robin	Machine learning of big data to discover mental health behaviour patterns.
Van Den Broek, Peter	Enhanced Augmented Reality with Data Engineering and AI for Smart Digital Education.
Vincent, Jordan	Spectral Pattern Recognition.
Wang, Mengyuan	Development of an integrated metagenomic analysis system using the microbial community, their genes and biological mechanisms to predict cattle phenotypes.
Yang, Lingkai	BTIIC-01: Autonomous abnormality detection for informed data-driven decision making.
Zi, Bingxin	AI Assistant Robots for Supporting Independent Living.
Zia, Syed Muhammad Unsub	BTIIC-08: Novel cryptographic solutions for IoT.

Graduated December 2020

Name	Thesis title
Christodoulou, Vyron	Development and application of collective anomaly detection methods to electromagnetic satellite data.
Cruciani, Federico	Personalisation of machine learning models for human activity recognition.
Shanavas, Niloofar	Graph-theoretic approaches to text classification.
Wan, Huan	Cluster-based supervised classification.

Graduated July 2021

Name	Thesis title
Ampomah, Issac	Sentence representation learning and generation for neural machine translation.
Currie, Jonathan	Temporal visual attention metrics reveal distinct behavior within demographic groups and performance levels of healthcare professionals when performing clinical tasks and procedures.
Hernandez-Cruz, Netzahualcoyotl	Improvement of Transfer Learning Techniques in Activity Recognition.
Xu, Chulin	Neural networks for text matching.

3. Publications

Details of all Publications by the School of Computing 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, research reports and published conference papers.

3.1 Journal Articles

Abu-Tair, M, Djahel, S, Perry, P, Scotney, B, Zia, SMU, Martinez Carracedo, J & Sadjad, A 2020, 'Towards Secure and Privacy-Preserving IoT Enabled Smart Home: Architecture and Experimental Study', *Sensors*, vol. 20, no. 21, 6131, pp. 1-14.

<https://doi.org/10.3390/s20216131>

Ali, A, Khan, N, Abu-Tair, M, Noppen, J, McClean, SI & McChesney, I 2021, 'Discriminating features-based cost-sensitive approach for software defect prediction', *Automated software engineering*, vol. 28, no. 11.

<https://doi.org/10.1007/s10515-021-00289-8>

Ampomah, I, McClean, SI, Lin, Z & Hawe, G 2020, 'Every Layer Counts: Multi-Layer Multi-Head Attention for Neural Machine Translation', *The Prague Bulletin of Mathematical Linguistics*, vol. 115, pp. 51-82.

<https://doi.org/10.14712/00326585.005>

Bai, L 2021, 'A Sensor Based Assessment Monitoring System for Patients with Neurological Disabilities', *Journal of Robotics and Control*, vol. 2, no. 6, pp. 489-495.

<https://doi.org/10.18196/jrc.26127>

Bai, L, Pepper, MG, Yan, Y, Phillips, M & Sakel, M 2021, 'Quantitative measurement of Upper limb motion pre- and post-treatment with Botulinum Toxin', *Measurement*, vol. 168, 108304, pp. 1-16.

<https://doi.org/10.1016/j.measurement.2020.108304>

Biglarbeigi, P, Ng, KY, Finlay, D, Bond, RR, Jing, M & McLaughlin, J 2021, 'Sensitivity analysis of the infection transmissibility in the UK during the

COVID-19 pandemic', *PeerJ*.

<https://doi.org/10.7717/peerj.10992>

Bond, RR & Peace, A 2021, 'Towards a Digital Health Future', *European Heart Journal Digital Health*. <https://doi.org/10.1093/ehjdh/ztab023>

Boyd, K, Bond, RR, Ryan, A, Goode, D & Mulvenna, M 2021, 'Digital Reminiscence App Co-created by People Living with Dementia and Carers: Usability and Eye Gaze Analysis', *Health Expectations*, pp. 1-13.

<https://doi.org/10.1111/hex.13251>

Brisk, R, Bond, RR, Finlay, D, McLaughlin, J, Jasinska-Piadlo, A, Leslie, SJ, Gossman, DE, Menown, I, McEneaney, DJ & Warren, S 2021, 'The effect of confounding data features on a deep learning algorithm to predict complete coronary occlusion in a retrospective observational setting', *European Heart Journal Digital Health*, pp. 1-8.

<https://doi.org/10.1093/ehjdh/ztab002>

Cao, F, Xu, Y, Liu, J, Chen, S & Yi, J 2021, 'A multi-clause dynamic deduction algorithm based on standard contradiction separation rule', *Information Sciences*, vol. 566, pp. 281-299.

<https://doi.org/10.1016/j.ins.2021.03.015>

Chan, S, Dittakan, K & Garcia-Constantino, M 2020, 'Image Texture Analysis for Medical Image Mining: A Comparative Study Direct to Osteoarthritis Classification using Knee X-ray Image', *International Journal on Advanced Science, Engineering and Information Technology*, vol. 10, no. 6, pp. 2189-2199.

<https://doi.org/10.18517/ijaseit.10.6.8279>

Chaurasiaa, P, McClean, SI, Nugent, CD, Cleland, I, Zhang, S, Donnelly, MP, Scotney, B, Sanders, C, Smith, K, Norton, MC & Tschanz, J 2021, 'Modelling mobile-based technology adoption among people with dementia', *Personal and Ubiquitous Computing*, pp. 1-20.
<https://doi.org/10.1007/s00779-021-01572-x>

Chen, LL, Ning, H, Nugent, CD & Yu, Z 2020, special issue on Hybrid Human-Artificial Intelligence. *Computer*, no. 8, vol. 53, vol. 53, 8 edn. <https://doi.org/10.1109/MC.2020.2997573>

Chen, S, Glass, DH & McCartney, M 2020, 'How Opinion Leaders Affect Others on Seeking Truth in a Bounded Confidence Model', *Symmetry*, vol. 12, no. 8, 1362.
<https://doi.org/10.3390/sym12081362>

Chen, S, Liu, J & Xu, Y 2021, 'A logical reasoning based decision making method for handling qualitative knowledge', *International Journal of Approximate Reasoning*, vol. 129, pp. 49-63.
<https://doi.org/10.1016/j.ijar.2020.11.003>

Cruciani, F, Nugent, CD, Medina Quero, J, Cleland, I, McCullagh, P, Synnes, K & Hallberg, J 2020, 'Personalizing Activity Recognition With a Clustering Based Semi-Population Approach', *IEEE Access*, vol. 8, 9258905, pp. 207794-207804.
<https://doi.org/10.1109/ACCESS.2020.3038084>

Cui, X, Wang, Z, Tan, Y, Chang, S, Zheng, H, Wang, H, Yan, T, Guru, T & Hou, F 2021, 'Selenium Yeast Dietary Supplement Affects Rumen Bacterial Population Dynamics and Fermentation Parameters of Tibetan Sheep (*Ovis aries*) in Alpine Meadow', *Frontiers in Microbiology*, vol. 12, pp. 663945.
<https://doi.org/10.3389/fmicb.2021.663945>

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Population Dynamics and Fermentation Parameters of Tibetan Sheep (', *Frontiers in Microbiology*, vol. 12, 663945.
<https://doi.org/10.3389/fmicb.2021.663945>

Dhelim, S, Ning, H, Farha, F, Chen, L, Atzori, L & Daneshmand, M 2021, 'IoT-Enabled Social Relationships Meet Artificial Social Intelligence', *IEEE Internet of Things*.
<https://doi.org/10.1109/JIOT.2021.3081556>

Duffy, O, Synnott, J, McNaney, R, Brito Zambrano, P & Kernohan, WG 2021, 'Attitudes Toward the Use of Voice-Assisted Technologies Among People With Parkinson Disease: Findings From a Web-Based Survey', *JMIR*, vol. 8, no. 1, e23006, pp. 1-13. <https://doi.org/10.2196/23006>

Epelde, G, Beristain, A, Álvarez, R, Arrúe, M, Ezkerra, I, Belar, O, Bilbao, R, Nikolic, G, Shi, X, De Moor, B & Mulvenna, M 2020, 'Quality of Data Measurements in the Big Data Era: Lessons Learned from MIDAS Project', *IEEE Instrumentation and Measurement Magazine*, vol. 23, no. 7, 9234761, pp. 18-24.
<https://doi.org/10.1109/MIM.2020.9234761>

Etumusei, J, Martinez Carracedo, J & McClean, SI 2021, 'A Novel Detection Technique using Martingales For Optimal Parameters in Time Series', *Journal of Information Assurance and Security (JIAS)*, vol. 16, no. Issue 2, pp. 59-72.
<http://www.mirlabs.org/jias/secured/Volume16-Issue2/vol16-issue2.html>

Fallmann, S, Chen, LL & Chen, F 2020, 'Enhanced multi-source data analysis for personalized sleep-wake pattern recognition and sleep parameter extraction', *Personal and Ubiquitous Computing*.
<https://doi.org/10.1007/s00779-020-01445-9>

Farha, F, Ning, H, Ali, K, Chen, LL & Nugent, CD 2020, 'SRAM-PUF Based Entities Authentication Scheme for Resource-constrained IoT Devices',

IEEE Internet of Things, vol. 0, pp. 1-10.

<https://doi.org/10.1109/JIOT.2020.3032518>

Fu, H, Wu, G, Liu, J & Xu, Y 2020, 'More efficient stochastic local search for satisfiability', Applied Intelligence, vol. 0, no. 0, pp. 1-20.

<https://doi.org/10.1007/s10489-020-01983-y>

Fu, H, Xu, Y, Wu, G, Liu, J, Chen, S & He, X 2021, 'Emphasis on the flipping variable: Towards effective local search for hard random satisfiability', Information Sciences, vol. 566, pp. 118-139.

<https://doi.org/10.1016/j.ins.2021.03.009>

Galushka, M, Swain, C, Browne, F, Mulvenna, M, Bond, RR & Gray, D 2021, 'Prediction of chemical compounds properties using a deep learning model', Neural Computing and Applications, vol. 33, no. 20, pp. 13345–13366.

<https://doi.org/10.1007/s00521-021-05961-4>

Gao, L, Sun, K, Zheng, H & Zhao, Y 2021, 'A Deep-Learning Approach to the Dynamics of Landau–Zener Transitions', Advanced Theory and Simulations, vol. 4, no. 7, 2100083, pp. 1-14.

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Gaur, P, Gupta, H, Chowdhury, A, Mc Creadie, K, Pachori, RB & Wang, H 2021, 'A Sliding Window Common Spatial Pattern for Enhancing Motor Imagery Classification in EEG-BCI', IEEE Transactions on Instrumentation and Measurement, vol. 70, 9326392.

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<https://doi.org/10.1007/s10614-020-10049-7>

Glass, C & Glass, DH 2021, 'Opinion dynamics of social learning with a conflicting source', Physica A: Statistical Mechanics and its Applications, vol.

563, 125480.

<https://doi.org/10.1016/j.physa.2020.125480>

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<https://doi.org/10.1016/j.mbs.2020.108472>

Haider, A, Hawe, G, Wang, H & Scotney, B 2021, 'Gaussian Based Non-linear Function Approximation for Reinforcement Learning', SN Computer Science, vol. 2, no. 3, 223, pp. 223.

<https://doi.org/10.1007/s42979-021-00642-4>

Hussain, T, Nugent, C, Moore, A, Liu, J & Beard, A 2021, 'A Risk-Based IoT Decision-Making Framework Based on Literature Review with Human Activity Recognition Case Studies', Sensors, vol. 21, no. 13, e4504.

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Iftikhar, A, Bond, RR, McGilligan, VE, Leslie, S, Knoery, C, Shand, JA, Ramsewak, A, Sharma, D, Canning, A, McShane, A, Rjoob, K & Peace, A 2021, 'Human–Computer Agreement of Electrocardiogram Interpretation for Patients Referred to and Declined for Primary Percutaneous Coronary Intervention: Retrospective Data Analysis Study', JMIR Medical Informatics, vol. 9, no. 3, e24188, pp. 1-11.

<https://doi.org/10.2196/24188>

Iftikhar, A, Bond, RR, McGilligan, VE, Leslie, SJ, Knoery, C, McShane, A, Quigg, C, Campbell, R, Boyd, K, Rjoob, K & Peace, A 2021, 'Digital Forms in Healthcare: Comparing the Usability of Single-Page, Multi-Page and Conversational Forms', JMIR Human Factors, vol. 8.

<https://doi.org/10.2196/25787>

Jia, C, Wang, L, Meng, E, Chen, L & Liu, Y 2021, 'Combining LIDAR and LADRC for Intelligent Pitch Control of Wind Turbines', Renewable Energy, vol. 169, pp. 1091-1105.

<https://doi.org/10.1016/j.renene.2021.01.065>

- Jing, M, Bond, R, Robertson, L, Moore, J, Kowalczyk, A, Price, RK, Burns, W, Nesbit, MA, McLaughlin, J & Moore, TCB 2021, 'User experience analysis of AbC-19 Rapid Test via lateral flow immunoassays for self-administrated SARS-CoV-2 antibody testing', *Scientific Reports*, vol. 11, 14026, pp. 1-13.
<https://doi.org/10.1038/s41598-021-93262-0>
- Kelly, D, Munoz Esquivel, K, Gillespie, J, Condell, J, Davies, RJ, Karim, S, Nevala, E, Alamäki, A, Jalovaara, J, Tedesco, S, Barton, J & Nordström, A 2021, 'Feasibility of Sensor Technology for Balance Assessment in Home Rehabilitation Settings', *Sensors*.
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- Liu, Y, Wei, G, Abdullah, S, Liu, J, Xu, L & Liu, H 2021, 'Banzhaf–Choquet-copula-based aggregation operators for managing q-rung orthopair fuzzy information', *Soft Computing*, vol. 25, no. 10, pp. 6891-6914.
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<https://doi.org/10.3390/s20174756>
- Lubinda, J, Bi, Y, Hamainza, B, Haque, U & Moore, AJ 2021, 'Modelling of Malaria Risk, Rates, and Trends: A Spatiotemporal approach for identifying and targeting sub-national Areas of High and Low Burden', *PLoS Computational Biology*, vol. 17, no. 3, e1008669.
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- Lubinda, J, Haque, U, Bi, Y, Busiku, H & Moore, AJ 2021, 'Near-term climate change impacts on sub-national malaria transmission', *Scientific Reports*, vol. 11, no. 1, 751, pp. 1-13.
<https://doi.org/10.1038/s41598-020-80432-9>
- Lubinda, J, Haque, U, Bi, Y, Shad, MY, Keellings, D, Hamainza, B & Moore, AJ 2021, 'Climate change and the dynamics of age-related malaria incidence in Southern Africa', *Environmental Research*, vol. 197, 111017, pp. 1-12.
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<https://doi.org/10.1109/JSTSP.2021.3092136>
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<https://doi.org/10.1016/j.jalgebra.2021.02.003>
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<https://doi.org/10.3390/sym13020332>
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- technology and a decision support tool', *Radiography*, vol. 27, no. 2, pp. 505-511. <https://doi.org/10.1016/j.radi.2020.11.002>
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4. Research Funding

Ongoing and Active Research Projects, notably:

Unit of Assessment Member	Title of Award	Funding Body	Value
Prof B Scotney Prof CD Nugent Prof SI McClean Prof Luke Chen Dr Shuai Zhang Dr Jorge Martinez Dr Darryl Charles Dr Joe Rafferty Dr AA Moore Dr Philip Perry	BT-Ireland Innovation Centre (BTIIC). An International Centre of Excellence for Industrial Research and Engineering	British Telecom	£6,193,427.00
Prof JAD McLaughlin Dr N Soin Prof D Finlay Dr I Cleland Dr PJ McCullagh Prof CD Nugent Dr J Synnott	CHIC Phase 2 Research - Connected Health Innovation Centre	Invest NI	£2,917,596.00
Dr M Huang Prof N Hewitt Dr Y Bi A Joyce, Laboratorio Nacional de Energia B Fox, LF Fasthouse C Walsh, Energy Co-Operatives Ireland E Strazzer, Uni Degli Studi Di Cagliari E Torralba Callega, Acondicion Tarrasens K Moosdorf, Assoc Portuguesa Das Empresa M Bottarelli, Uni Degli Studi Di Ferrara P Duff, Power Capital Renewable Energy P Lavin, APK Architects & Engineering P McHale, Mayo County Council Prof S Vranes, Institute Mihajlo S McCormack, Trinity College Dublin Z Ure, Phase Change Material Products	IDEAS	CEC-H2020-LC-SC3-RES-4-2018	£510,330.00

Portfolio of Research Grants awarded during period 1 August 2020 - 31 July 2021

Unit of Assessment Member	Title of Award	Funding Body	Value
Dr C Rainey Dr S McFadden Dr R Bond Prof Ciara Hughes Dr J McConnell, NHS Glasgow and Clyde	An observational study to investigate the impact of AI feedback on image comment, decision switching and trust perception in student and experienced radiographers	The College of Radiographers	£10,000
Dr HY Wang Prof H Zheng	DFE CAST: Network Machine Learning Approach to Financial Crime Detection	Datatics Ltd	£27,540
Prof AJ Moore Mr J Lubinda Dr S Bhatti Dr Y Bi Dr R McNabb Dr D Rankin Prof JG Wallace Dr M Black Mr J Matoba, Macha Research Trust Prof J Wright, University of Southampton Prof C Schiff, Johns Hopkins University Dr B Hamainza, National Malaria Elimination Prof J Rigby, Nat Centre for Geocomputation	MalarInfo: A machine learning information toolset for predicting malaria risk, rates and trends in intervention planning - A pilot project in Zambia	Department for the Economy-GCRF	£37,125
Prof H Wang Prof JAD McLaughlin Prof CD Nugent Prof PD Maguire Dr C MCCaughey, BHSC Prof U Powe, QUB Prof H Byrne, Technological University Dublin	VIPIRS - Virus Identification via Portable InfraRed Spectroscopy	UKRI EPSRC - Covid 19 call	£410,730
Prof SM O'Neill Prof CP Walsh Dr E Murray Mrs M McLafferty Dr R Bond Dr E Ennis Prof MD Mulvenna	Additional CoA funding for Future Minds NI (linked to project 84183R)	UKRI CoA Funds	£7,980

Prof H Wang Dr R Bond Prof B Scotney Prof MD Mulvenna	MVSE Multimodal Video Search by Example	EPSRC	£720,502
Dr J Liu Dr G Hawe Dr P Joseph-Richard Dr J Uhomuibhi	KTP Programme between University of Ulster and Semple & McKillop Limited	Innovate UK/INI and Semple & McKillop Li	£186,773
Prof B Scotney Dr D Kerr Dr R McAlister Prof S Coleman Artur Degteariov Cyber Crime Moldova Ana Revenco International Center La Strada Moldova Jorn van Rij Dutch Police, Den Haag	Supporting sustainable development in LMICs: a pilot study on human trafficking and organised crime in Moldova	Department for the Economy-GCRF	£29,775
Prof A McIlhagger Dr A Golbang Prof JAD McLaughlin Dr G Hawe Prof E Harkin-Jones Dr C Ralph Dr E Archer Prof D Finlay	Decarbonisation of Maritime Transportation: A Return to Commercial Sailing	UKRI - Strength in Places	£2,123,721
Tanya McCance Dr D Brown Prof CD Nugent Dr B Lynch Mr A Ennis Dr I Cleland	iMPAKT App 2 Development	Dept of Health	£50,000
Prof AJ Bjourson Dr PL McClean Dr S Watterson Dr P Shukla Dr V McGilligan Prof LP Maguire Dr T Singh Rai Dr C Kelly Dr R Bond Dr D Gibson Dr E Murray Dr G Fleming, NHSCT	Northern Ireland Multimorbidity Research and Discovery (NIMRAD) Consortium	NIHR	£117,076

Prof M Scott, NHSCT Mrs J Rhodes, Health Innovation Research			
Tanya McCance Dr D Brown Prof CD Nugent Dr B Lynch Mr A Ennis Dr I Cleland	iMPAKT App 2 Development	South Australia Health (SA.GOV.AU)	£27,105
Dr R Bond Prof MD Mulvenna Prof AA Ryan Mr J Rafferty	KTP Programme between University of Ulster and Chroma Lighting (NI) Ltd	Innovate UK/INI and Chroma Lighting (NI)	£185,172
Mr J Rafferty Prof CD Nugent	KTP Programme between University of Ulster and BT Group plc	Innovate UK/INI and BT Group plc	£185,172
Ms C Reid Dr R Bond Dr J Bustard Prof MD Mulvenna	KTP Programme between University of Ulster and Profile Tree LLP	BEIS and Profile Tree LLP	£180,412
Prof AJ Bjourson Dr PL McClean Dr K Wong-Lin Dr V McGilligan Prof LP Maguire Dr M Bucholc Prof VE Coates Dr R Bond Prof G Prasad Prof D Coyle	Centre for Personalised Medicine	INTERREG VA	£66,737

