Department of Systems Engineering
香港城市大學
City University of Hong Kong

# SYE Seminar Series

## Where AI meets IoT: A Case study in human activity recognition in smart environments

**22 May 2023**
**10:00 - 11:30 am**
**YEUNG-P7303**


**Professor Chris Nugent**
Ulster University, UK



**Abstract**
The Internet of Things has provided many opportunities to leverage highly interconnected sensing devices in a range of application domains. In all applications vast amounts of data are being generated which subsequently require intelligent techniques to process.
In this presentation a case study of understanding human behaviour within smart environments will be considered. More specifically, the opportunities to use data driven AI based solutions within the context of the IoT paradigm will be discussed. Solutions for edge computing and cloud computing will initially be introduced followed by new approaches utilizing federated learning.
The issues of high quality data required for data driven solutions for activity recognition will also be considered. Whilst this has been a historical issue within the field, it has been further compounded over the last 36 months with data collection studies within smart environments involving human participants being limited. One potential solution to this challenge is to leverage the paradigm of the Digital Twin and their usage of synthetic data. Whilst this goes somewhat towards solving the problem, the generalization of synthetic data can be compromised due to its inability to fully represent the range of variation in human activity.
The presentation will conclude with an overview of a suite of tools have been developed which can assist in the modelling of the physical environment, an agent based digital twin for the production of data, sharing of data according to an openly available shared data format and creation of an online repository to make all datasets produced openly available.


## Trust and Explainable AI Systems for Autonomous Decision Making


**Dr. Jun Liu**
Ulster University, UK



**Abstract**
In today's world, building trustworthy AI systems is paramount as AI becomes more prominent across the globe. Trustworthy AI represents the evolution of AI, and offers opportunities for industries to create AI system that are transparent, explainable, fair, robust, trust and reliable, especially in high-risk and safety-critical applications. This actually concerned two challenges: trustworthy AI model and trustworthy AI system, which are different problems and have to be handled in different ways, but they are closely related and both have to be achieved for the real applications, especially in safety-critical application. The talk aims to cover both aspects in a coherent but high level way: their motivation, the key ideas insight and the state-of-the-art, followed by our group's research work illustrated with case studies in the explainable AI model and trustworthy system based on automated reasoning.


## Pervasive Computing and Artificial Intelligence Research in Ulster, Belfast, Northern Ireland


**Dr. Jose A. Santos**
Ulster University, UK



**Abstract**
The School of Computing at Ulster University, Belfast, Northern Ireland, UK conducts internationally excellent and world-leading research in assistive technologies, next generation networks, and semantic analytics, within our two highly active research centres: Pervasive Computing Research Centre (PCRC) and Artificial Intelligence Research Centre (AIRC). PCRC focuses on multi-disciplinary and collaborative research in sensor-based technologies, and applications in behavioural analysis, activity recognition, and assistive technologies for healthcare and independent living. AIRC aims to develop cutting-edge AI theories, algorithms and tools, and to create state of the art AI solutions for practical problems through engagement with stakeholders and users, and alignment with University, local, national and international initiatives. This talk will provide a general overview of the PCRC and AIRC's Research, Innovation, and Impact Nexus, as well as a few case studies.




*Enquiry: 3442 8422 | All are welcome*

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## Professor Chris Nugent

Chris is currently the Head of the School of Computing at Ulster University, director of the Pervasive Computing Research Centre, Principal Investigator of the PWC Advanced Research and Engineering centre at Ulster University and co-Principal Investigator of the Connected Health Innovation Centre. Chris was awarded a first class honours in BEng Electronic Systems and a PhD in Biomedical Engineering entitled An intelligent framework for the classification of the 12-lead ECG, both from the University of Ulster in 1995 and 1998, respectively. He has held visiting Professorships at Halmstad University (Sweden) and the University of Florence (Italy) and is currently a visiting Professor in Pervasive and Mobile Computing at Lulea Technical University (Sweden).

His research interests include the development and evaluation of technologies to support pervasive healthcare within smart environments. Specifically, this has involved research in the topics of mobile based reminding solutions, activity recognition and behaviour modelling and more recently technology adoption modelling. He has published over 700 papers in these areas and currently has an h-index of 54. He is currently ranked 248 in the UK for Research in Computer Science (Research.com) and is highest ranked member of staff from Ulster to have been included in the rankings.

He has been instrumental in initiating, preparing, supporting and managing a number of externally funded Research Projects. In general the research efforts have been aligned with the EPSRC's Ageing Research programme and EU initiatives in Personal Health and Wellbeing and Ambient Assisted Living. The total funding allocated to Ulster as a result of these projects is in excess of £33M. He has been a Principle Investigator for funding which has been secured from the EPSRC, ESRC, European Union, InvestNI, DEL, Alzheimer's Association, HSC R&D Office and the AAL Program.

## Dr. Jun Liu

Dr Jun Liu is currently a Reader in CS, Director of Artificial Intelligence Research Center (AIRC) at School of Computing, Ulster University, Northern Ireland, UK. He received BSc. and MSc. degrees in Applied Mathematics, and PhD. degree in Information Engineering from Southwest Jiaotong University, China, in 1993, 1996, and 1999, respectively. He worked in the field of AI for many years. His current research is focused on two themes: 1) trust and explainable data-knowledge integrated AI decision model/system with applications in management, engineering, and industry field etc. (e.g., safety and risk analysis; policy decision making; security/disaster management; anomaly detection and behavioural analysis for fin-crime; and heath care and smart home); 2) logic and automated reasoning methods for intelligent systems including software verification and automated theorem proving. In particular: resolution-based automated reasoning methods, algorithm and tools with applications (including software verification and automated theorem proving); lattice-valued logics with focus on handling incomparability, inconsistency and imprecision. He has authored or co-authored over 250 publications. He has been awarded over £8 Million of research funding from various funding bodies. He is the current Chair of IEEE CIS Emergent Technologies Technical Committee (ETTC), also the Chair of IEEE System, Man and Cybernetics (SMC) Ireland Chapter (SMC28). He serves as an Associated Editor of IEEE Transaction on Fuzzy Systems, Knowledge-Based Systems, Human-Centric Computing and Information Sciences, and International Journal of Computational Intelligence Systems; also an Editor of Information Fusion, Journal of Universal Computer Science, and International Journal of Knowledge and Systems Science.

## Dr. Jose A. Santos

Dr. Jose A. Santos (PhD-FHEA-FCHERP) was born in Maracay, Venezuela in 1973. He received his Electronic Engineering Degree from the Electronics Department, Universidad Simon Bolivar, Caracas, Venezuela in 1998, and his PhD in Electronic Engineering from the School of Electrical and Mechanical Engineering, University of Ulster, Northern Ireland, UK in 2003.

He has been a Lecturer in Computer Science at Ulster University since 2002 and Course Director for the undergraduate computing programmes in the School of Computing from 2018 to 2023, he was also the acting Associate Head of School from 2020 to 2022 and the Associate Head of School since October 2022; He has 69+ peer-reviewed publications and is a member of the School of Computing's Pervasive Computing Research Group. He has led the development of 2 MSc programmes in Internet of Things (IoT) and Artificial Intelligence (AI). His current research interests lie in the fields of IoT, Sensor Technology, Robotics and AI.

**Seminar 2022-2023, SYE19**

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