**School of Computer, Data and Mathematical Sciences**

# HDR Seminar 10
# Program
## 28 July 2021

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|---|---|
| 4:00pm<br>-<br>4:10pm | **Briefing**<br>**Topic: Policy update and announcements**<br>A/Prof Dongmo Zhang |
| 4:10pm<br>-<br>4:40pm | **Invited speech**<br>**Topic:** Spatial reasoning from a first-robot perspective<br>**Speaker:** Dr. Paulo Santos, Flinders University, Adelaide, Australia. |
| 4:40pm<br>-<br>5:00pm | **Conference presentation**<br>**Topic:** A New Pathway to Approximate Energy Expenditure and Recovery of an Athlete<br>**Speaker:** Prathayne Nanthakumaran (PhD Candidate - 19625690)<br>**Supervisory panel:** Dr. Liwan Liyanage, Dr. Michael O' Connor |
| 5:00pm<br>-<br>5:20pm | **Candidature Research Presentation**<br>**Topic:** Hybrid differential gene analysis of RNA Sequencing Data.<br>**Speaker:** Girija Rani Karetla (PhD Candidate - 19791744)<br>**Supervisory panel:** Dr. Quang Vinh Nguyen, Prof. Simeon Simoff, Assoc. Prof. Daniel Catchpoole, Prof. Paul Kennedy |
| 5:20pm | **Closing** |

Venue: Parramatta South & Online Zoom

Zoom ID: 886 7872 4041

Next Event: HDR Forum – 25th August 2021

# Spatial reasoning from a first-robot perspective

**Speaker: Dr. Paulo Santos**

**Abstract:**
The ability to perceive space and reason about spatio-temporal relations is effortless for humans, but it has proved to be a challenge to computational systems that struggle to process the various nuances of our conceptualisation of the world. This talk presents two results on the development of qualitative spatial reasoning tools applied to multi-robot systems that aim to bridge the gap between the human and the machine way of interpreting and acting upon the external world. The first is a novel algorithm for Qualitative Case-Based Reasoning and Learning (QCBRL), which is a case-based reasoning system that uses qualitative spatial representations to retrieve and reuse cases by means of relations between objects in the environment. Combined with reinforcement learning, QCBRL allows the agent to learn new qualitative cases at runtime, without assuming a pre-processing step. Experimental evaluation of QCBRL was conducted in a simulated robot-soccer environment and in a real humanoid-robot. Results show that QCBRL outperforms traditional RL methods and state-of-the-art CBR systems. The second result is an algorithm for combining the information obtained from multiple (distinct and egocentric) viewpoints to infer the pose, the route and the actions to guide a sensory deprived agent toward a goal destination. The information from the multiple observers were fused in terms of a set of qualitative directions that could be easily interpreted by a human agent, but that can also be easily translated to low-level robot actions. Experimental evaluation was also conducted in a simulated and real robot-soccer environment.

**Biography:**
Paulo Santos received his PhD degree in artificial intelligence from Imperial College, London, UK in 2003, working on the development of spatial reasoning systems for mobile robots under the supervision of Murray Shanahan. He was a research assistant at the School of Computing, University of Leeds, UK (2003-2005), working on a European Union funded project for the development of Cognitive Vision Systems, under the supervision of Anthony Cohn and David Hogg. Dr. Santos led a research group in AI and Robotics in Sao Paulo, Brazil (2005-2019), conducting a number of research projects of industrial interest. During this period, Dr. Santos was also a visiting researcher at the following world-class institutions: University of Leeds, UK (2007, 2010); Ryerson University, Canada (2010), Bremen University, Germany (2012); Coruna University, Spain (2014). Currently Dr. Santos is a Senior Lecturer at Flinders University, Adelaide, Australia.

# Tree-based Models using Random Grid Search Optimization for Disease Classification based on Environmental Factors: A Case study on Asthma Hospitalizations

**Speaker:** Prathayne Nanthakumaran

**Abstract:** An understanding on the exposure to environmental factors aggravating global disease burden can aid mitigating it. Generally, a class of generalized linear models and generalized additive models are used in predicting disease burden whereas, tree-based models are underused. The objective of this paper is to evaluate the performance of different tree-based models namely decision tree, random forest, gradient boosted tree and stochastic gradient boosted trees in predicting asthma attack based on short-term exposure to environmental factors and to examine the environmental factors triggering asthma attack. The tree-based models were tuned using random grid search optimization with bootstrapping to address over-fitting. The models considered performed well in predicting asthma attacks in terms of area under the receiver operating curve (ROC AUC) ($> 0.82$). All the gradient boosted trees (accuracy = 76%; recall = 63%; F2-score = 64%) showed better overall prediction whereas decision tree (accuracy = 71%; recall = 75%; F2-score = 71%) outperformed other models in identifying the positive cases. Decision tree models revealed that O3 exposure consistently influence Asthma. Further, with high O3 exposure $> 13$ ppb, and with [SO2 exposure $< 0.5$ ppb and maximum wind speed $> 54.$ km/hr.] influenced Asthma. In addition, relative humidity and exposure to CO were also detected in other tree-based models as relevant predictors triggering asthma attacks.

# Hybrid differential gene analysis of RNA Sequencing Data.

**Speaker:** Girija Rani Karetla

**Abstract:** The application of Artificial Intelligence for RNA seq analysis are being an effective way to different clinical questions, from diagnosis, prognosis to prediction of treatment outcomes. The first challenge in analyzing gene expression reads is in differentiating actual reads from multiple mapping read(MMR). Secondly testing the reliability of gene expression from a high dimension space, and finally mapping the patient's differentially gene expressed genes to an effective treatment. To accurately predict patient specific treatment, we present a hybrid methodology, which can accurately estimate the reliability of each gene's expression level derived from an RNA-Seq dataset. The desirability scoring allows to determine reliable expression estimation of gene quality. A Machine learning technique classifies the boundaries of the gens and predict to which type the tumor the patient belongs to, upon that an Artificial Neural Network is built to predict the new instance individual genes and map them to a treatment based on how the gene is expressed.