

Thommen George Karimpanal

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Personal Profile

I am an Alfred Deakin Postdoctoral Research Fellow at the Applied Artificial Intelligence Institute at Deakin University, Australia. My current research focuses on the safe and sample-efficient training of reinforcement learning agents through the autonomous inference of domain priors, as well as other mechanisms that contribute towards an agent's domain-awareness.

Education

Doctor of Philosophy (2014-2019)

Engineering Product Development - Singapore University of Technology and Design

- Thesis title: *Towards Experience-Efficient Reinforcement Learning*
- **GPA:4.5/5**
- Visiting student at the Reinforcement Learning and Artificial Intelligence Laboratory (RLAI) at the University of Alberta (Jan-July, 2017) under the guidance of Professor Richard Sutton
- Successfully completed the projects:
 - Optimal Path Planning of an Energy-Starved Micro-robot in a Known Environment
 - Environment Mapping and Path Planning Using a Mobile Micro-robot

Master of Science (2012-2013)

Mechatronics - National University of Singapore

- **GPA:4.25/5** (Ranked 2nd in a class of 21 students)
- Successfully completed the projects:
 - Neural Network based Automatic Waste Sorting – SmartBin
 - Face recognition using Neural Networks in MATLAB
 - Real time Speed and Position Control of a DC Motor using a Computer
 - Stepper Motor Interfacing and Control

Bachelor of Technology (2006-2010)

Mechanical Engineering - National Institute of Technology, Jalandhar, India

- **GPA: 8.05/10** (Ranked 5th in a class of 60 students)
- Final year major project - *Bond Graph Modeling and Simulation of the Dynamics of the Quick-Return Mechanism*

Academic Publications

- Thommen George Karimpanal “Neuro-evolutionary Frameworks for Generalized Learning Agents”, 2020
- Thommen George Karimpanal, Santu Rana, Sunil Gupta, Truyen Tran, Svetha Venkatesh, “Learning Transferable Domain Priors for Safe Exploration in Reinforcement Learning”, International Joint Conference on Neural Networks, Glasgow, Scotland, July 2020 (accepted)
- Thommen George Karimpanal, “Towards Experience-Efficient Reinforcement Learning” PhD thesis, Singapore University of Technology and Design, 2019
- Thommen George Karimpanal, Roland Bouffanais, “Self-Organizing Maps for Storage and Transfer of Knowledge in Reinforcement Learning” Adaptive Behavior, 2019
- Thommen George Karimpanal “A Self-Replication for Designing Complex Agents” In Proceedings of the Genetic and Evolutionary Computation Conference Companion (GECCO '18), July 15-19, 2018, pp. 45-46
- Thommen George Karimpanal, Roland Bouffanais, “Self-Organizing Maps as a Storage and Transfer Mechanism in Reinforcement Learning” ALA workshop, AAMAS, 14-15 July, 2018
- Thommen George Karimpanal, Roland Bouffanais, “Experience Replay Using Transition Sequences” Frontiers in Neurorobotics, 12 (2018) :32
- Thommen George Karimpanal, Erik Wilhelm, “Identification and off-policy learning of multiple objectives using adaptive clustering”, Neurocomputing, Volume 263, 2017, Pages 39-47, ISSN 0925-2312, <http://dx.doi.org/10.1016/j.neucom.2017.04.074>
- Thommen George Karimpanal, Mohammadreza Chamanbaz, Wenzheng Li, Timothy Jeruzalski, Abhishek Gupta, Erik Wilhelm, “Adapting Low-Cost Platforms for Robotics Research” FinE-R@IROS, volume 1484 of CEUR Workshop Proceedings, page 16-26. CEUR-WS.org, 2015
- Thommen George Karimpanal, Harit Maganlal Gadhia, Ruben S/O Sukumar, John-John Cabibihan, “Sensing discomfort levels of standing passengers in public rail transportation systems through a smart phone” 10th IEEE International Conference on Control and Automation (IEEE ICCA 2013), HangZhou China, June 12-14, 2013, pp. 1509-1513
- Thommen George Karimpanal, Anand Vaz, “Modeling and Simulation of the Dynamics of the Quick Return Mechanism: A Bond Graph Approach”, in the Proceedings of 10th National Conference on Industrial Problems on Machines and Mechanisms (IPRoMM 2010), MNIT, Jaipur, Rajasthan, December 17-18, 2010, paper No. IPRoMM 2010-34, p. 23-30

Academic Activities

- Delivered a talk on: ‘Transfer in Reinforcement Learning: An Overview’, Bayesian Optimization Discussion Sessions, 12 February, 2020, Applied Artificial Intelligence Institute
- Delivered a talk on: ‘Model-based Reinforcement Learning: An Overview’, Bayesian Optimization Discussion Sessions, 27 November, 2019, Applied Artificial Intelligence Institute
- Delivered a talk on: ‘Priors and Their Effects on Learning’, Differential Machine Learning talks, 15 August, 2019, Deakin University
- Delivered a talk on: ‘Efficient Storage and Transfer of Reinforcement Learning Task Knowledge’, Reinforcement Learning Seminars, 11 July, 2019, Deakin University
- Delivered a talk on: ‘Priors for Artificial Learning Agents’, Postdoc Jam, 6 December, 2018, Singapore University of Technology and Design
- Delivered a talk on: ‘Towards Experience-Efficient Reinforcement Learning’, PhD Defence, 8 November, 2018, Singapore University of Technology and Design
- Served as a reviewer for IJCNN (International Joint Conference on Neural Networks) 2020, MRS (International Symposium on Multi-Robot And Multi-Agent Systems) 2019, CoDIT (International Conference on Control, Decision and Information Technology), 2019 & 2020

Teaching and Mentorship Experience

Mentorship

- PhD Co-supervision (current): Buddhika Laknath Semage, Thesis Topic: Learning physics based models for reinforcement learning, Deakin University
- Panel Member for the confirmation of PhD candidatures of: Mr. Trung Tin Pham (June, 2019), Mr. Dung Nguyen (November, 2019), Mr. Thao Le (November, 2019) at Deakin University
- Completed the supervisor training workshop, "Supervision Practices", by Dr. Amanda Mooney at Deakin University in October, 2019
- Internship co-supervision: Surya Palaniswamy, Online Reinforcement Learning for Robotics Applications (January 2020), Deakin University
- Actively participated in advertising, shortlisting and interviewing reinforcement learning PhD applicants (2020 intake) at the Applied Artificial Intelligence Institute

Teaching

- Graduate teaching assistant for the graduate course "30.501: Modeling of Multi-energy systems" during the period September-December, 2014
- Co-instructor and mentor for 7 multi-disciplinary teams for the two term undergraduate course "1.401 Capstone" during the period January-August, 2016

Employment History

Full-Time Engagements

Mar 2019 - Deakin University, Australia
till date *Associate Research Fellow, Reinforcement Learning*
Applied Artificial Intelligence Institute (A2I2)

- Project: Safe and sample-efficient training in reinforcement learning agents

Aug 2010 - Tata Motors Ltd., Pantnagar, Uttaranchal, India
Apr 2012 *Assistant Manager, Tool Engineering*

- Actively experienced job rotations in production, tool engineering (design and maintenance), customer service and material pricing functions of the company over a period of one year
- Designed and released a number of fixture designs and drawings using CATIA in the Tool Engineering Department
- Actively participated in Integrated Cost Reduction programs (for 'Magic Iris' and 'Ace Zip')
- Was selected to take part in the Kaizen event 'To Identify and Eliminate all Abnormalities from Every Stage of Main Line (Venture)', organized in TATA MOTORS, in association with Shingijutsu Global Consulting USA Inc., which has helped improve the production efficiency and quality

Part-Time Engagements

Aug - Singapore University of Technology and Design
Dec 2013 *Research Engineer at the Motion, Energy and Control (MEC) Lab*

- Exploring the applications of genetic programming for evolving the behavior and morphology of a swarm of micro-robots
- Design and development of the EvoBots, a micro-robotics platform intended for research in machine learning and evolutionary algorithms

- May - Jul 2013** Singapore-MIT Alliance for Research and Technology (SMART)
Graduate Student Researcher, Future Urban Mobility group
- Worked on Autonomous Navigation (Mapping, Localization and path planning) for indoor environments as part of the Future Urban Mobility group.
- Feb 2011 - Jul 2012** The Ann Foundation
Volunteer Design Consultant, United Nations online volunteer service
- Worked as a part of 'The Wheelchair Design Team' along with volunteers from Bangladesh, USA and India
 - Designed, fabricated and tested an inexpensive (under US\$100) wheelchair intended for use in developing nations

Internships and Professional Training

- Underwent a 'Value Engineering workshop' in Tata Motors in 2011
- Successfully completed a project in Mechanical Design at IDACS (Information Data Acquisition and Control Solutions), Bangalore during the period May-July, 2009
 - Enclosure for multi-function sensor module
 - Red Light Violation Camera Housing with two axis Servo Drive
 - Universal Miniature Gearbox for Servo Drive
 - Manual Over-ride for solenoid valve
- Industrial training in Moog Controls (I) Pvt Ltd., Bangalore in June 2008:
 - Design and analysis of aircraft control systems
 - Production of aircraft machine components

Scholarships and Awards

- Alfred Deakin Postdoctoral Research Fellowship, 2020 (total award amount ~A\$225000, including A\$15000 per annum research support funding)
- Graduate Teaching Excellence Award, 2017, Singapore University of Technology and Design
- President's Graduate Fellowship - Awarded for the period 2014-2019 to pursue my doctoral studies at the Singapore University of Technology and Design (total award amount ~S\$200000)
- Awarded certificates of merit for proficiency in Physics (2005 and 2006), Christ PU College, Bangalore

Additional Skills

- **Computer software**
Python, Keras, OpenAI gym, MATLAB, CATIA, Autodesk Inventor, MS Office, git, Latex
- **Languages**
English, Hindi, Malayalam

Referees

Name Roland Bouffanais
Company SUTD
Position Associate Professor
Contact bouffanais@sutd.edu.sg

Name Anand Vaz
Company NIT Jalandhar
Position Professor
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