

KRISHAN RANA

Deep Learning Researcher | Robotics Engineer

@ krishan.rana@hdr.qut.edu.au

+61 431583292

in linkedin.com/in/krishanrana

github.com/krishanrana

krishanrana.github.io

ABOUT

PhD student with a demonstrated history of working in various multi-disciplinary projects within the field of robotics. I am particularly interested in methods and techniques that can allow reinforcement learning agents to effectively leverage prior knowledge for sample efficient training and safe, real-world deployment of robotic systems.

EDUCATION

PhD | Robotics and Deep Learning

Thesis Topic: Incorporating Prior Knowledge in Deep Reinforcement Learning for Real-World Robot Navigation

Supervisors: Dr. Niko Sünderhauf & Prof. Michael Milford

Queensland University of Technology  Feb 2019- Present

Bachelor of Engineering (Honours) | Mechatronics

Thesis Topic: Semantic Descriptors for Robust Place Recognition

GPA: 6.87/7

Queensland University of Technology  Jun 2014- Nov 2018

Deep Learning and Neural Networks

deeplearning.ai | Coursera  July 2019

IGCSE and Cambridge 'AS' and 'A' Levels

Rank: 1/90 ('A' Level Honours Award Recipient)

Hillcrest College, ZW  Oct 2013

PUBLICATIONS

K. Rana, B. Talbot, V. Dasagi, M. Milford and N. Sünderhauf, "Residual Reactive Navigation: Combining Classical and Learned Navigation Strategies For Deployment in Unknown Environments," 2020 *IEEE International Conference on Robotics and Automation (ICRA)*

K. Rana, V. Dasagi, B. Talbot, M. Milford, and N. Sünderhauf, "Multiplicative Controller Fusion: Leveraging Algorithmic Priors for Sample-efficient Reinforcement Learning and Safe Sim-To-Real Transfer," 2020 *IEEE International Conference on Intelligent Robots and Systems (IROS)*

D. Palmer, T. Coppin, K. Rana, D. G. Dansereau, M. Suheimat, M. Maynard, D. A. Atchison, J. Roberts, R. Crawford, and A. Jaiprakash, "Glare-free retinal imaging using a portable light field fundus camera," 2020 *Biomed. Opt. Express* 9

K. Rana, V. Dasagi, M. Milford, and N. Sünderhauf, "Guided Policy Optimisation: Closing the Performance Gap in Robot Control," [In Preparation]

PATENTS

- Ophthalmic Imaging Apparatus and System**
Patent Number au2017901153
A. Jaiprakash, D. Palmer, D. G. Dansereau, T. Coppin, K. Rana, J. Roberts, R. Crawford
- Method and System for Calibrating an Ophthalmic Imager**
Patent Number au2018900513
D. Palmer, T. Coppin, K. Rana

ACHIEVEMENTS




- QUT Postgraduate Research Award**
 2019-2022
- Australian Centre for Robotic Vision PhD Scholarship**
 2019-2022
- Bachelor of Engineering | First Class Honours**
 2018
- QUT International Merit Scholarship**
 2014 - 2018
- QUT Dean's List Award**
 2015 - 2017
- Outstanding Cambridge Learners Award - Physics**
 2013

SKILLS









Interests

Deep Reinforcement Learning | Robot Control | Machine Learning | Safety | Robot Navigation | Computer Vision

Programming

Python 
MATLAB 
C 
C++ 

Tools


ROS 
PyTorch 
OpenCV 
Unix 
Solidworks 
GitHub 
Adobe Illustrator 
Latex 

EXPERIENCE

Co-founder and Engineer

Integral Scopes Pty Ltd
 Oct 2018 - Nov 2020


Robotics Engineer

P3A Star
 Feb 2018 - July 2018

Mentor - Mechatronics Design I

Queensland University of Technology
 Feb 2017 - July 2017

Sessional Academic - Dynamics

Queensland University of Technology
 July 2016 - Nov 2016

TECHNICAL PROJECTS

- **Deep Reinforcement Learning for Efficient Robot Learning**
Python | OpenCV | PyTorch | ROS | Multiprocessing | TD3 | SAC
Focuses on utilising existing algorithms and control strategies in robotics and improving upon the areas which were difficult to model or hand-craft analytically, using deep reinforcement learning. Developed a robust sim-to-real transfer algorithm which could leverage these classical controllers as risk averse alternatives. More details can be found at <https://sites.google.com/view/srrn/home> and <https://sites.google.com/view/mcf-nav/home>.
- **Real-Time Place Recognition using Convolutional Neural Networks**
Python | OpenCV | PyTorch | ROS | YOLOv3
Developed a computer vision framework based on the YOLOv3 object detector to extract salient features of stable landmarks in order to build a place descriptor for localisation.
- **Retinal Feature Depth Estimation**
Python | P5.js | OpenCV
Developed a computer vision system that could estimate the relative depth of retinal features using lightfield imaging.
- **Depth Mapping Dioptric Space**
Python | OpenCV
Developed a calibration procedure to map 2D pupil gaze location to a precise 3D point in the real world using an Intel Realsense. The gaze location was tracked using a Pupil-Labs eye tracker system.
- **Strain Gauge Signal Processing**
C | C++
Developed a signal processing algorithm which utilises a strain gauge as a cost effective touch based sensor to control the functionality of a hidden kitchen workbench power socket. The product is now commercially available at <https://pointpod.com/>.
- **Light Painting Robot - World Science Festival 2016/17**
P5.js | Javascript | OpenCV
Development of a light emitting differential drive robot whose motion could be programmed by kids using the Scratch interface. A computer vision system then tracked the motion of this system and created a virtual painting on a large display screen. This was done for a workshop hosted by the World Science Festival.
- **Visual Simultaneous Localisation and Mapping**
MATLAB | Python
Implemented an Extended Kalman Filter and computer vision system to successfully localise a robot within its environment and navigate to given locations with centimetre accuracy.
- **Line Following Robot**
C
Designed and developed a differential drive, IR-based line following robot using an Atmel Atmega32 micro-controller chip.
- **Soccer Playing Robot**
Python | OpenCV | Multiprocessing | RaspberryPi
Multidisciplinary project which involved the design of mechanical, electrical and software components to successfully enable a robot to avoid obstacles, dribble and kick a ball in a competitive environment. I primarily focussed on the integration and software component of this project.

GRANTS

- UA-DAAD Australia-Germany Joint Research Cooperation Scheme
Project: *Sample-efficient learning for autonomous agents in complex hierarchical, and sparse environments*
📅 Nov 2020

VOLUNTARY EXPERIENCE

- **Student Volunteer**
International Conference on Robotics and Automation (ICRA), Brisbane, Australia
📅 May 2018
- **Workshop Facilitator**
World Science Festival, Brisbane, Australia
📅 Feb 2017
- **Vice President | President**
QUT Robotics Club
📅 Feb 2017 - Jun 2017 | Jun 2017 - Nov 2017
- **Peer Career Mentor**
QUT Career Mentor Scheme
📅 Jul 2016 - Nov 2016
- **Member**
Golden Key Society
📅 Jun 2015 - Present
- **Peer Learning Facilitator**
QUT STIMulate
📅 Feb 2015 - Nov 2015

REFEREES

Niko Sünderhauf
@ niko.suenderhauf@qut.edu.au
✉ Principal PhD Supervisor

Michael Milford
@ michael.milford@qut.edu.au
✉ Associate PhD Supervisor

Anjali Jaiprakash
@ anjali.jaiprakash@qut.edu.au
✉ Integral Scopes

Peter Nink
@ peter@p3astar.com.au
✉ P3A Star

Jonathan Roberts
@ jonathan.roberts@qut.edu.au
✉ Robotics and Autonomous Systems