Tom Stewart | Curriculum Vitae

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I'm originally from Australia but I've been living in Tokyo for the last four years after being awarded a MEXT Scholarship to study my Masters at the University of Tsukuba. My background is in Mechatronic Engineering and I'm particularly interested in robotics and programming. I worked on a flying car straight after finishing my undergraduate and I studied the brain as part of my Master's degree. The combination of those two experiences led me to become fascinated with the way that the brain solves motion control problems. I believe that by drawing on concepts from brain science and by extension bio-inspired learning algorithms (particularly reinforcement learning), robots can self-learn complex motion tasks that currently can only be performed by humans.

tldr; Mechatronic Engineer with a strong programming background, interested in applying reinforcement learning to robotics

Technical Background in a Nutshell

○ **Robotics:**
  – 3 years experience developing practical robotic systems including a flying car and an autonomous drone system.
  – Experience with robot middleware frameworks including ROS and Player/Stage.
  – Familiar with programming for embedded systems (mainly Cortex-M and AVR architectures), FreeRTOS and low level peripheral interface over CAN, I2C, UART etc.
  – Comfortable with implementing and tuning feedback control algorithms including PID and state space controllers.

○ **Programming:**
  – Very comfortable with C++ including most of the C++11 standard
  – Proficient in Python including the common modules for data processing and visualisation (NumPy, Tensorflow, Matplotlib)
  – Familiar with the implementation, memory and time complexities of common data structures and algorithms (linked lists, search trees, hash maps, quicksort etc)
  – Miscellaneous experience with Matlab, C#, Java, Objective-C and Visual Basic

○ **Machine Learning:**
  – Implemented a Deep Q-Network and Deep Deterministic Policy Gradients to solve classic control problems from the OpenAI gym.
  – Implemented a Self Organising Map to cluster photographs into a collage based on average colour
  – Knowledgeable about neuroscience through participation in the RIKEN Brain Science Training Program as well as a considerable amount of spare time spent Exploring the Brain.

Education

○ **University of Tsukuba**   **Ibaraki, Japan**
  Masters of Engineering (Intelligence and Interaction Technologies)   *2014–2017*

○ **Curtin University**   **Perth, Australia**
  Bachelor of Engineering (Mechatronic Engineering) with First Class Honours   *2006–2011*

Career History

○ **Rapyuta Robotics**   **Tokyo, Japan**
  Mechatronic Engineer & Team Lead, Embedded Software Systems Team   *March 2017–Present*

Rapyuta Robotics is a Tokyo-based start up aimed at developing a cloud computing platform for controlling and automating robots. I lead a team of six engineers developing a model application of the cloud platform; a drone system capable of autonomously flying predefined missions, reporting sensor data to the cloud and precisely landing on a docking station for recharging.

- Coordinated the development and release of new features including automated drone assembly diagnostics and enhancements to auto-landing.
- Identified and troubleshot bugs across the entire spectrum of the drone system; from high level orchestration logic written in Python to smart battery firmware written in C.
- Re-architected the data pipeline between the drone and its ground station to incorporate a radio module which tripled the drone's communication range.
- Wrote Python and C++ ROS nodes to interface with sensors and actuators in the drone's docking station

RIKEN Brain Science Institute — **Saitama, Japan**
Research Associate, Laboratory for Advanced Signal Processing — *January 2016–February 2017*

The Advanced Brain Signal Processing Laboratory developed and applied machine learning techniques to analyse brain activity data collected using EEG (brainwaves), fMRI and microscopy.

- Applied Non-negative Matrix Factorisation to extract neurons and their firing behaviour from videos taken of the brains of mice with Alzheimer's disease.
- Extracted features from EEG data using Common Spatial Patterns and used Linear Discriminant Analysis to label them as indicative of a different states of sensory attention.

Quisitive Pty Ltd — **Perth, Australia**
Mechatronic Engineer, Flight Control Team — *January 2012–February 2014*

Quisitive developed flight control software for the Hoverpod; a single-seated flying vehicle designed to vertical takeoff and and maneuver at an altitude of 5 metres. As one half of the flight control team, I wrote control algorithms to stabilise the craft during flight.

- Designed an optimal state space controller with state estimation to control the craft's attitude during flight
- Implemented and tuned PID control loops for yaw and rotor speed control
- Wrote baremetal C++ on an LPC1769 cortex-m3 microcontroller to interface the flight computer with the craft's sensors and actuators.

Open Source Contributions

- **Arduino:** Contributed the following libraries which are available through the library manager
  - StateSpaceControl : an implementation of a multi-input, multi-output state space feedback controller with state estimation, reference tracking and integral control
  - BasicLinearAlgebra: a template library for representing matrices and performing simple linear algebra.
  - Geometry: a set of classes to represent and manipulate 3D rotation matrices and coordinate transformations to simplify algorithms involving inertial sensors and robot arms.
  - Callback: an implementation of the Signals and Slots pattern to allow multiple delegates to subscribe to a single callback function.
- **OpenViBE:** Contributed a driver plugin called gtec-bcilab which adds Linux support for the g.USBAmp, a common research grade EEG amplifier.

Publications

- Stewart, T, Rutkowski T. M. (2016) Motor Priming as a Brain Computer Interface. The 23rd International Conference on Neural Information Processing (ICONIP)

Languages

- **English:** : Native
- **Japanese:** JLPT N3