# 2016/17 Vacation Scholarships

|  |  |
| --- | --- |
| **Job Title:** | Data61 Undergraduate Vacation Scholarships |
| **Reference No:** | 26424 |
| **Classification:** | CSOF1.1  |
| **Stipend:** | $1462.77 per fortnight (before tax) |
| **Location:** | Please refer to the list of ***Projects*** at the end of this document |
| **Tenure:** | 8 to 12 weeks from November 2016 to February 2017 |
| **Role Purpose:** | The 2016/17 Vacation Scholarship Program is designed to provide students with the opportunity to work on real-world problems in a leading R&D organisation.Participation in the Vacation Scholarship Program has influenced previous scholarship holders in their choice of further study and future career options. Many have gone on to pursue a PhD in CSIRO or to build a successful research career within CSIRO, a university or industry. |
| **Project Description:** | Please refer to the list of ***Projects*** at the end of this document. *If you require more information please contact the person listed for the project.* |
| **Eligibility/** **Pre-Requisites:** | To be eligible to apply you must be an Australian or New Zealand Citizen, Australian Permanent Resident or an international student who has full work rights for the 8 to 12 weeks duration (does not require visa sponsorship).Vacation scholarships are for students who:* are currently enrolled at an Australian university;
* have completed at least three years of a full-time undergraduate course (however exceptional second year students may be considered);
* have a strong academic record (credit average or higher); and
* intend to go on to honours and/or postgraduate study.
 |
| **How to Apply:**  | **You will be required to:**1. select your **top 2 research projects** in order of preference;
2. submit a **resume/cover letter** (as one document) which includes:
* the reasons why the research project/s you have selected are of interest to you; and how your previous skills/knowledge and experience meets the project requirements; and
* an outline of your longer-term career aspirations and detail how this program will help you achieve them.
1. upload your **academic results** in the ‘***Requested Information’*** field.

**Referees:** If you would like to include referees (either work or university lecturers/ tutors)in your application, please add their name and contact details into your resume**.** If you experience difficulties applying online call 1300 984 220 and someone will be able to assist you. Outside business hours please email: csiro-careers@csiro.au. *Please do not email your application. Applications received via this method may not be considered.* |

|  |  |  |
| --- | --- | --- |
| **Project No.** | **Location** | **Project Title (see the following pages for more information)** |
| **Data61 77** | Brisbane, QLD | Automatic plant stress detection using hyperspectral imagery |
| **Data61 78** | Brisbane, QLD | Robotic Motor Control |
| **Data61 79** | Brisbane, QLD | Machine learning for bioacoustics |
| **Data61 80** | ATP, Eveleigh, Sydney | Research and development of a testbed for the Internet of Things |
| **Data61 81** | ATP, Eveleigh, Sydney | Seamless Detection and Blocking of Web Trackers |
| **Data61 82** | ATP, Eveleigh, Sydney | A Quantitative Approach to On-line Information Privacy based on Data Analytics |
| **Data61 83** | ATP, Eveleigh, Sydney | Securing Bitcoin Wallets through Strong Authentication |
| **Data61 84** | ATP, Eveleigh, Sydney | Timing Attacks on Observation Resistant Password Systems |
| **Data61 85** | ATP, Eveleigh, Sydney | Fine-grained Group Activity Detection using Wearable Devices |
| **Data61 86** | ATP, Eveleigh, Sydney | Low-Power-Wide-Area-Network for Internet of Things |
| **Data61 87**  | ATP, Eveleigh, Sydney | Mobile-assisted Caching at Small Cells in 4G/5G Cellular Networks |
| **Data61 88** | ATP, Eveleigh, Sydney | Policy-Driven Communication for Internet of Things |
| **Data61 89** | ATP, Eveleigh, Sydney | Connected Vehicles Network Performance Investigation |
| **Data61 90** | ATP, Eveleigh, Sydney | Zero-Copy DNS Server |
| **Data61 91**  | ATP, Eveleigh, Sydney | Study on Sensor Accuracy |
| **Data61 92**  | ATP, Eveleigh, Sydney | Pedantic Analytics |
| **Data61 93**  | ATP, Eveleigh, Sydney | The Application of Game Theory in Distributed Wireless 5G Networks and Networks for Disaster Response |
| **Data61 94** | ATP, Eveleigh, Sydney | Wearables Technology: Optimisation of Communications across Multiple Wireless Body Area Networks |
| **Data61 95** | ATP, Eveleigh, Sydney | Identifying Security Vulnerabilities in iOT Devices |
| **Data61 96**  | ATP, Eveleigh, Sydney | Detection of Counterfeits in Mobile App Stores |
| **Data61 97** | ATP, Eveleigh, Sydney | Auctioning Personal Data: Putting Users in Control of their Personal Information |
| **Data61 98** | ATP, Eveleigh, Sydney | Extracting meaningful information from an large scale IoT system |
| **Data61 99** | Brisbane, QLD | Presence Detection Robot |
| **Data61 100** | Brisbane, QLD | Low Power WSN Radio Tomography |
| **Data61 101** | Brisbane, QLD | Hyperspectral image super-resolution via convex optimization |
| **Data61 102** | Melbourne (Clayton) | Mobile IDE for OpenIoT platform |
| **Data61 103** | Melbourne (Clayton) | Scalability of OpenIoT platform |
| **Data61 104** | Brisbane, QLD | Efficient training for deep learning |

Pease read though the projectdetails belowand decide **which 2 projects are your preferred choices** (i.e. Data61 77, Data61 78, etc) as you will need to enter these into your application. If you require more information please contact the person listed for each project.

|  |  |
| --- | --- |
| Project No. | **Data61 - Vacation Scholarships Project Details** |
| Data61 77 | **Project Title**Automatic plant stress detection using hyperspectral imagery **Project Description**The use of hyperspectral imagery for plant stress detection has become increasingly popular in modern precision agriculture.Armed with far more wavelengths than conventional cameras, hyperspectral imagery provide very large amounts of data that can be harnessed using advanced machine learning methods such as deep learning. The possibility of automatic crop stress detection has a tremendous impact on the Australian agriculture sector. Hyperspectral cameras are become more affordable Combining CSIRO/DATA61 strengths in hyperspectral imaging, machine learning and robotics, you will be working directly with our team of experts to develop technology for plant stress detection. Such system could be put on a UAV or ground robot for autonomous farm management.**Project Duties/Tasks*** Deploy a hyperspectral imaging setup in greenhouse and farm trials for automatic/semi-automatic data collection
* Develop, evaluate and compare machine learning algorithms for early stress detection.

**Relevant Fields of Study*** Electrical Engineering
* Computer Science
* Software Engineering
* Machine Learning
* Computer Vision
* Predictive analytics

**Location:** Brisbane – QCAT, Eco Sciences Precinct**Contact:** Srimal Jayawardena via phone on (07) 3327 4633 or email: Srimal.Jayawardena@data61.csiro.au  |
| Data61 78 | **Project Title**Robotic Motor Control**Project Description**CSIRO’s legged robots are transitioning to more complex control methods and are placing higher demands on communications buses reducing their overall performance and capabilities.You will be tasked with finishing and testing ROS drivers for current and future motors used in legged robotics, and investigating faster ways of communicating with them. This includes the creation of a bus agragrator and software that will permit faster control loops.All work will be tested on CSIRO’s current Hexapod robots in the field.**Project Duties/Tasks*** Complete ROS Driver for Motors (C++)
* Design PCB for agragator (Altium, AVR Studio)
* Implement Realtime control on hexapod robot.(C++)

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Mechatronics
* Electrical Engineering (control systems)
* Software Engineering

**Location:** Queensland QCAT, Brisbane**Contact:** Ryan Steindl via phone on (07) 3327 4054 or email ryan.steindl@csiro.au |
| Data61 79 | **Project Title**Machine learning for bioacoustics**Project Description**We live in a rich acoustic environment and a vast amount of information about our surroundings can be gained by processing and analysing audio data. One major area of interest is detecting and classifying wildlife with acoustic sensors. This project will focus on the design and implementation of audio data summarisation and classification techniques that have low computational complexity.**Project Duties/Tasks*** Perform signal processing on large real-world audio datasets.
* Develop characterisation and classification techniques to identify species of interest.
* Evaluate the effectiveness of developed techniques on real-world audio datasets.

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer Science
* Software Engineering
* Desired skills are: Highly proficient in programming in either C++ or Python, Good knowledge of machine learning algorithms, Knowledge of Signal Processing methods.

**Location:** Queensland QCAT, Brisbane**Contact:** Dr. Navinda Kottege phone on (07) 3327 4054 or email ryan.steindl@csiro.au |
| Data61 80 | **Project Title**Research and development of a testbed for the Internet of Things**Project Description**An Internet of Things (IoT) system may be defined as a collection of millions of network-enabled sensors and actuators (i.e. nodes), which are embedded to various objects and have limited battery, computing and storage capabilities. These nodes cooperate with each other and the outside world to achieve specific goals in many application domain such as healthcare, supply chains, or transport and logistics. However, connecting these millions of devices raises a number of technical challenges and many open research issues. We are in the process of building a small scale lab testbed to investigate these connectivity challenges, based on a LoRa and LoRaWAN technologies. The objectives of this project are to:* contribute technically to the development of this testbed

conduct experiments on this testbed to explore some of research challenges associated with LoRa, LoRaWAN, and similar IoT networking solutions**Project Duties/Tasks*** Contribute to the setting up of a small scale IoT testbed (e.g. configuring, installing IoT nodes, writing small scripts to utilise the nodes)
* Perform experiments on this testbed as discussed with the supervisors
* Write documentation to report and discuss the results

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer or software engineering
* Electrical engineering, with a focus on data communication and networks

**Location:** ATP, Eveleigh, Sydney**Contact:** Thierry Rakotoarivelo and Kanchana Thilakarathna via phone on (02) 9490 5699 or email thierry.rakotoarivelo@data61.csiro.au  |
| Data61 81  | **Project Title**Seamless Detection and Blocking of Web Trackers**Project Description**Web browsing is increasingly becoming subject to third-party tracking whereby third parties, including analytics and advertisement services, monitor users’ browsing activities which is often used to deliver customised advertisements. Through third-party tracking, user data is stealthily collected enabling identification of users, inference of sensitive private information and even online price discrimination. To combat tracking, privacy-preserving tools such as NoScript, Ghostery and Adblock Plus are available as plugins for popular web browsers. Despite their presence, very few users install these plugins (only about 3 to 20% users on the web). The major reason for the lack of adoption of these plugins is their ineffectiveness and poor usability. Existing plugins employ a manual list of web-trackers to filter whose maintenance is hard and require much user intervention to strike a reasonable balance between blocking trackers and breaking useful functionality of a web page.The aim of this project is to develop and evaluate a user-friendly and accurate privacy-preserving browser plugin, which will be built upon our theoretical framework. This framework, uses machine learning algorithms and leverages syntactic, semantic and structural features extracted from the source code of web-components to classify web components as functional or tracking without user intervention. Our previous theoretical study shows that this approach achieves higher accuracy than existing privacy-preserving plugins. The resulting plugin will help to evaluate the performance and accuracy of the framework in the real setting.**Project Duties/Tasks*** Task 1: Development of a Firefox browser plugin including machine-learning classification within the plugin.
* Task 2: Development of machine-learning training module at the backend.
* Task 3: Performance evaluation of the plugin through time taken to load webpages benchmarked against other privacy-preserving plugins.
* Task 4: Analysis of performance-accuracy trade-off of the plugin.

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer Science
* Software Engineering

**Location:** Data61, CSIRO, ATP Eveleigh**Contact:** Hassan Jameel Asghar, Dali Kaafar via phone on (02) 9490 5889 or email hassan.asghar@data61.csiro.au |
| Data61 82 | **Project Title**A Quantitative Approach to On-line Information Privacy based on Data Analytics**Project Description**The new field of Privacy Engineering is emerging from the plethora of policies and processes that is evolving in response to threats to privacy from the explosive growth of on-line personal data. While the current focus on procedures is heavily influenced by software engineering, it is recognised that a quantitative characterisation of privacy will be essential in making the inevitable compromises between the privacy of personal information and the utility of on-line databases containing that personal information. This project is part of ground breaking research to develop mechanisms for quantifying privacy and will use statistical analytics techniques to construct a privacy risk scale from on-line data in the specific area of identity theft. The Vacation Student will work in collaboration with and under the guidance of the research team.**Project Duties/Tasks*** Task 1: Investigate potential data sources and process the resulting information into a form that enables the research team to design the analytics technique to be employed.
* Task 2: Investigate in detail the selected technique, design the software structure and obtain/write the required code.
* Task 3: Apply the analytics technique to the empirical data and, under the guidance of the research team, make an initial assessment of the resulting risk scale.
* Task 4: Write a technical report describing the analytics software and some preliminary results.

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer Science
* Software Engineering

**Location:** Data61, CSIRO, ATP Eveleigh**Contact:** Glynn Rogers, Jonathan Chan, Dali Kaafar via phone on (02) 9490 5649 or email jonathan.chan@data61.csiro.au |
| Data61 83 | **Project Title**Securing Bitcoin Wallets through Strong Authentication**Project Description**Today’s smartphones contain a number of apps that contain highly sensitive information about their users, e.g., a banking app. Another such app is a Bitcoin wallet. Bitcoins are the modern equivalent of cash and many merchants have start accepting them as an alternative payment system. Currently Bitcoin has a market capital of more than 10 billion USD and on average there are more than 9,000 transactions taking place per hour somewhere in the world. To use Bitcoin, some sort of wallet is needed. A wallet is the Bitcoin equivalent of a bank account, which allows the user to receive Bitcoins, store them and then send them to others. Just like a wallet in real life, Bitcoin wallet needs to be properly secured.For usability reasons, many bitcoin mobile wallets in the market have the commonplace password or PIN system to authenticate user. If the user loses his/her smartphone, the only thing stopping someone from stealing the user’s bitcoins is a four-digit PIN or password. Passwords/PINs are well known to be susceptible to observation, whereby an attacker overlooking a user or serendipitously recording the user through a smart device can snoop the password or PIN. The aim of this project is to design a simplified version of our previously proposed observation-resistant user authentication scheme, and apply it as an authentication mechanism on top of a Bitcoin wallet (app), e.g., airBitz. Our authentication approach can mitigate password observation attacks and provide reasonable usability considering the risk associated with the resource. This security enhanced bitcoin wallet can then be used as a real-life application of our authentication scheme as a secure alternative to passwords.**Project Duties/Tasks*** Task 1: Optimise our observation-resistant user authentication system for better usability, allowing users with little or no experience to be able to use it.
* Task 2: Analyse the security/usability trade-off of the modified user authentication system.
* Task 3: Integrate this authentication system as a software module into airBlitz Bitcoin wallet app.
* Task 4: Evaluate the usability of this new bitcoin wallet and modify the authentication steps if desirable.
* Task 5: (optional) Analyse the attack surface of this new bitcoin wallet and propose possible mitigations.

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer Science
* Software Engineering

**Location:** Data61, CSIRO, ATP Eveleigh**Contact:** Jonathan Chan, Hassan Jameel Asghar, Dali Kaafar via phone on (02) 9490 5649 or email jonathan.chan@data61.csiro.au |
| Data61 84 | **Project Title**Timing Attacks on Observation Resistant Password Systems**Project Description**Mainstream passwords are susceptible to observation attacks, i.e., someone watching a user, either directly or through a hidden camera, typing his/her password can successfully impersonate the user. Observation Resistant Password Systems (ORPS) aim to remove this drawback of mainstream passwords. In a nutshell, these systems generate dynamic passwords from a main password such that the dynamic passwords do not leak sufficient information about the main password before a large number of login session have been observed. ORPS generally present a cognitive challenge to the user, whose response ranges between a fixed set of possibilities. Depending on the complexity of the cognitive challenge, the time taken by the user response may vary. Such timing information may give the observer (attacker) more information to deduce the main password.The aim of this study is to investigate timing attacks on ORPS. This involves analysing video transcripts of login sessions of an ORPS to develop a timing attack on the ORPS, and using a human performance modelling tool, such as CogTool, to simulate user response times. The behaviour model will prove useful for checking the susceptibility of timing attacks on other ORPS. The study will result in**Project Duties/Tasks*** Task 1: Build a theoretical model of password leakage from differences in response times.
* Task 2: Using machine-learning techniques, deduce the likelihood of passwords given response times
* Task 3: Using CogTool, build a user behaviour model that predicts the response times from the video transcripts
* Task 4: Deduce a set of principles for the design of user interface that make ORPS resistant to timing attacks

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer Science
* Software Engineering
* Probability and Statistics

**Location:** Data61, CSIRO, ATP Eveleigh**Contact:** Hassan Jameel Asghar, Dali Kaafar via phone on (02) 9490 5889 or email hassan.asghar@data61.csiro.au |
| Data61 85 | **Project Title**Fine-grained Group Activity Detection using Wearable Devices**Project Description**Wearable devices show promise in taking human life experience way beyond expectations as a result of the number of attractive services provided by them. Even today, wearable devices such as smart-watches and fitness bands are extremely popular as personal health and fitness tracking devices, but the true potentials of wearable devices are yet to discover. These wearables can be effectively used for the identification of fine-grained user groups who perform the same activity at the same location using wearable sensors. These sub-groups will have applications in many domains such as emergency response, disaster recovery, and sports activities, in addition to the resource optimizations within the wearable device. Guiding people towards emergency exits in case of a fire evacuation and identifying the group of supporters of a particular team in a sports game are two examples from different domains. In addition, if the device identified that the user is running together with a partner, the fitness tracking apps on the two devices can collaborate each other to save the energy of the devices. The primary aim of this project is to identify the user groups with similar activity at the same location using sensors data that can be extracted from smartwatches.**Project Duties/Tasks*** Develop an experimental measurement framework to collect and exchange wearable sensor data from Android or iOS wearable devices.
* Develop a prototype smart-watch/smart-phone app (Android or iOS) to demonstrate the practical feasibility of the solution. The vacation student will work closely with a group other students working on a machine learning model to identify the group behaviour.
* Contribute to a research publication containing the design and validation of the machine learning model and the experimental app.

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer Science and Engineering
* Electrical Engineering

**Location:** ATP, Sydney**Contact:** Kanchana Thilakarathna via phone on (02) 9490 5631 or email kanchana.thilakarathna@data61.csiro.au |
| Data61 86  | **Project Title**Low-Power-Wide-Area-Network for Internet of Things**Project Description**It has been predicted that there will be over 50 billion connected things that sense and measure variety of attributes in the physical world, seamlessly bridging the physical and the cyber worlds. In application domains such as border control and protection, environmental monitoring, agriculture, disaster recovery, etc. these smart sensing devices play a vital role in better decision-making and responses. However, inter connecting these billions of devices, which are often remotely located and low-powered, arise number of technical challenges. Classic networking and communication technologies and approaches will not be sufficient to solve these unprecedented issues. LPWAN (Low Power Wide Area Networks) is an emerging networking technology that is capable of filling the gap in the wireless communication technologies transmitting over long range and powered by a battery that can last for years. However, the true potential as well as true challenges are yet to be discovered as there is a very limited number of practical deployments of LPWANs.The primary objective of this project is to experimentally investigate the practical and research challenges associated with LPWANs by initially setting up a LoRa test-bed containing LoRa gateway and sensors and then by conducting a measurement study of the performance of LoRaWAN.**Project Duties/Tasks*** Set-up an experimental LoRa network at ATP, Sydney with one LoRa gateway node and two LoRa enabled sensors.
* Conduct a pre-defined set of experiments to practically measure the performance of LoRaWAN protocol.
* Contribute to a research publication containing the measurement and analysis of LoRaWAN protocol.

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer Science and Engineering
* Electrical Engineering
*

**Location:** ATP, Sydney**Contact:** Kanchana Thilakarathna and Thierry Rakotoarivelo via phone on (02) 9490 5631 or email kanchana.thilakarathna@data61.csiro.au |
| Data61 87  | **Project Title**Mobile-assisted Caching at Small Cells in 4G/5G Cellular Networks**Project Description**Despite the continuous efforts, mobile network operators are struggling to cope with the exponential growth in the mobile data traffic. Among the candidate technologies, creating “ultra-dense” cellular networks with massive deployment of small-cells is expected to be the foundation for 5G technologies. One key challenge here is an appropriate provisioning of backhaul networks that connect the small-cells to the macro-cells. Content caching at small-cells has been proposed to effectively reduce the traffic load in backhauls due to the significant fraction of duplicated downloads of a small portion of popular content. The mobile-assisted caching proposed in this proposal is a novel mechanism to populate the caches at small-cells while offloading traffic from backhauls, i.e. macro-cells to small-cells. As a result, the network capacity will be increased and the QoE will be increased.The aim of this project is to emulate an ultra-dense network using a set of Raspberry-Pi devices as cache storage units and small-cells. An android app will also be developed based on the previous work at Data61 to emulate the user device functionality.**Project Duties/Tasks*** Emulate an ultra-dense cellular network by a set of Raspberry-Pi devices as small-cells and WiFi networks as macro-cells.
* Develop a working prototype of an Android app to demonstrate the user-assisted caching in ultra-dense network utilizing Raspberry-Pi devices as cache storage units.
* Contribute to a research publication contacting the details of the developed solution.

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer Science and Engineering
* Electrical Engineering

**Location:** ATP, Sydney**Contact:** Kanchana Thilakarathna and Ming Ding via phone on (02) 9490 5631 or email kanchana.thilakarathna@data61.csiro.au |
| Data61 88 | **Project Title**Policy-Driven Communication for Internet of Things**Project Description**It has been predicted that there will be over 50 billion connected things by 2020 creating the so called “Internet of Things” (IoT) that sense and measure variety of attributes in the physical world, seamlessly bridging the physical and the cyber worlds. Inter connecting these billions of devices, which are often remotely located and low-powered, arise number of technical challenges. Thus, classic networking and communication technologies and approaches will not be sufficient to solve these unprecedented issues. Moreover, it has been observed that 70% of current IoT devices contain security vulnerabilities. Thus, providing seamless and secure connectivity for IoT devices is expected to be one of the primary objectives of the next generation (5G) communication technologies. In light of this, the primary objective of this proposal is to investigate “Policy-Driven IoT Communication” for the purposes of efficient utilization of network resources and to ensure the data privacy and security in a smart home containing number of IoT devices.**Project Duties/Tasks*** Investigate the protocol level support for policy-driven IoT communication in emerging networking technologies such as SigFox, LoRa and NB-IOT (Narrow Band – IoT) that are being specifically developing IoT communication.
* Develop an experimental network to emulate a smart home at the research laboratory.
* Develop an experimental prototype to demonstrate the efficient and secure scheduling, aggregation of IoT messages and utilization of heterogeneous networks. The vacation student will closely work with a group of students and researchers at Data61 in developing these algorithms and protocols.

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer Science and Engineering
* Electrical Engineering

**Location:** ATP, Sydney**Contact:** Kanchana Thilakarathna via phone on (02) 9490 5631 or email kanchana.thilakarathna@data61.csiro.au |
| Data61 89 | **Project Title**Connected Vehicles Network Performance Investigation**Project Description**Data61 has access to communications data from an ongoing connected vehicles testbed in Australia. This data includes all messages that are transmitted and received by vehicles in the testbed and those messages include location information. This project will examine this data to characterise the distance messages travel from selected locations of the testbed. The work will include designing a suitable database structure, processing the data into the database and matching received transmissions locations to the broadcast location. If time permits, where signal strength is available, that too may be incorporated in the investigation.**Project Duties/Tasks*** Examine the raw data and survey database options and design a suitable database & process the raw data into the database
* Help identify suitable locations for analysis & then analyse position for the reception of messages originating from each location (and optionally signal strength)
* Write a report capturing important learnings from tasks and the investigation.

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer science
* Electrical Engineering

(with coding and/or data handling course exposure) **Location:** Data61, Eveleigh**Contact:** Paul Tyler via phone on (02) 9490 5908or email Paul.Tyler@data61.csiro.au |
| Data61 90  | **Project Title**Zero-Copy DNS Server**Project Description**Networking applications relies on the Berkeley socket model to interface with a networking stack that resides in the operating system kernel. This model requires costly context switching between applications and the kernel, as well as memory copies on both the sending and receiving path. Context switches require flushing the TLB and caches and can severely degrade instructions per cycle (IPC) for tens of thousands of cycles. This model imposes a limitation on performance which becomes even more apparent with the doubling of bandwidth of network bandwidth every 17-18 months, compared with CPU and DRAM performance doubling only every 26-27 months. For example The Memcached application spends over 80% of CPU time in the kernel networking stack, using less than 5% of the available networking bandwidth. Low level packet processing frameworks such as netmap and Intel DPDK attempt to address this mismatch by bypassing the kernel Berkeley socket interface, using zero copy techniques and directly accessing the NIC to avoid context switches. This approach can achieve over 10 times higher throughput: 14 million packets per second on a single 900MHz core, vs less than 1 million packets per second using the Linux kernel. In his project, we aim at implementing a complete DNS and DNSSec Server on top of Intel DPDK, providing high level protocols such as UDP and TCP while avoiding memory copies and context switches but leveraging multiples cores architecture.**Project Duties/Tasks*** Implement a DNS-Server in C
* Micro and macro benchmark solution
* Analyse results and compare to state of the art solutions

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer Science
* Network
* Telecommunications

**Location:** Eveleigh**Contact:** Guillaume Jourjon via phone on (02) 9490 5611 or email guillaume.jourjon@data61.csiro.au |
| Data61 91  | **Project Title**Study on Sensor Accuracy**Project Description**The latest models of autonomous vehicles are usually equipped with sensors, e.g., lasers, radars, cameras, etc., to detect various inter-object distances for the applications of collision avoidance, auto-cruising in traffic jams, etc. However, the accuracy of sensors is highly susceptible to large distance, rough terrains, bad weather, etc. On the other hand, distributed sensors with short distances to the target always enjoy good accuracy. Even for the distributed sensors that are not very close to the target, they can provide valuable diversity gains to the measurement. Therefore, we can use smart data fusion techniques to combine data from on-board sensors and distributed sensors to come up with more accurate measurement results for the application of autonomous vehicles. To that end, it is urgent to develop a comprehensive understanding on the sensor accuracy in practical environment, which is the focus of the proposed study project.**Project Duties/Tasks*** Survey the state-of-the-art sensors to find out the accuracy degradation due to large distance, rough terrains, bad weather, etc.
* For each type of the widely used sensors, e.g., lasers, radars, cameras, conduct simulations to verify the theoretical results in the existing works, and compare such results with the real-life measurement data
* [Optional] Develop a general model for sensor accuracy in practical environment
* [Optional] Conduct real-life experiments to validate the proposed model

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Wireless Sensor Networks
* Wireless Channel Measurement
* Statistical Data Analysis

**Location:** ATP, Sydney**Contact:** Ming Ding via phone on (02) 9490 2252 or email Ming.Ding@data61.csiro.au |
| Data61 92  | **Project Title**Pedantic Analytics**Project Description**In today's digital space, debates no longer appears exclusively in very selective aristocratic circles but are open to everyone on online social networks platforms such as Facebook or reddit. With this democratization of public online debate also emerged new dialectical methods such as the famous Godwin’s Law. Recently, the emergence of big data analytics opened a new door for all the pedantic commenters as we can observe an increase in the use of irrelevant statistics, such as the number of posts, in ad hominem stratagems. The main objective of this project is not to try to prevent nor combat this kind of behavior but to develop and offer new innovative tools to perform more complex text analytics. In parallel to this tool, this project aims to investigate the feasibility of a crowd driven sentiment and political analysis framework. This second objective is tightly related to the wild penetration of the original tool while maximizing the privacy of each user. Therefore, this project will also use state of the art privacy preserving mechanisms. There have been numerous research works addressing the characterization and analysis of complex text corpuses. However, most of these works focused on limited number of corpuses where this work will have to handle a lot of short comments as opposed to large speeches. This corpuses multiplication makes text and sentiment analysis very difficult.**Project Duties/Tasks*** Implement solution as a Chrome/Firefox plugin
* Develop text mining algorithm to analyse sentiment
* Analyse result and write a report/article

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer Science
* Natural Language Processing

**Location:** Eveleigh**Contact:** Guillaume Jourjon via phone on (02) 9490 5611 or email guillaume.jourjon@data61.csiro.au |
| Data61 93  | **Project Title**The Application of Game Theory in Distributed Wireless 5G Networks and Networks for Disaster Response**Project Description**This project will investigate application of tools of game theory in wireless communications networks. Game theory is a study of strategic decision making, using mathematical models of conflict and cooperation between intelligent rational decision-makers. Non-cooperative games are a powerful tool in distributed optimisation, and are suitable to be applied to, and have found much application in, wireless networks where there is no central coordination and communicating devices can operate independently and selfishly.5G represents the next generation of cellular mobile networks (after 4G/LTE) and currently potential technology for 5G, to be first deployed in 2020, is being widely researched worldwide and will introduce many breakthrough radio technologies. The distributed resource allocation, using non-cooperative games, investigated in this project will be one part of those efforts. The resource allocation will principally be with respect to radio transmit power control and scheduling/coordinating of transmissions amongst distributed wireless nodes not directly coordinated by a base station. Such investigation will not only be applicable to 5G, but could be applied in wireless personal area networks to respond to disasters, where there is no central infrastructure available, and resource allocation games can help ensure high quality, high reliability, long-lifetime communications.**Project Duties/Tasks*** Modelling
* Novel theoretical analysis and design
* Simulation (principally using Matlab)
* Potential of peer-reviewed international publication of the outcomes

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Electrical/Telecommunications/Electronic Engineering
* Computer Science
* Mathematics majors

**Location:** Data61 Eveleigh NSW**Contact:** David Smith via phone on (02) 9490 5690 or email David.Smith@data61.csiro.au |
| Data61 94  | **Project Title**Wearables Technology: Optimisation of Communications across Multiple Wireless Body Area Networks**Project Description**Wearable technology (with devices placed on the human body), and particularly wireless connection of wearable computing technology, represents a hot-topic, with much commercial, research and popular interest world-wide. Moreover sensing and actuating devices are now sufficiently small to allow multiple sensors to be attached to the human body for wearable computing. A radio network of such sensors placed around the body is referred to as a wireless body area network (BAN), and these form a vital aspect of current and future wearables implementations, and are seen as a key part for future health-care demands and provision, as well as meeting consumer demands, for activity monitoring, for instance.There are many challenges for wireless body area networks (BANs) design and implementation, which has attracted a lot of worldwide research interest in recent years, including the release of an IEEE BAN Standard called IEEE 802.15.6. One of the key challenges is the operation of a lot of body area networks closely located to each other, as there can be significant radio interference amongst networks. Another of the challenges, is that at typical radio operation frequencies, the human body represents a very difficult communications medium. To overcome these problems, advanced research solutions are required and are being sought. This project will investigate and propose an advanced solution for radio communications amongst multiple BANs where there is some limited body-to-body communication to enable coexistence of closely located networks. Techniques of relay-assisted cooperative communications, sensor radio transmit power control, transmission scheduling and routing will be integrated leading to powerful and novel cross layer solutions to optimise communications and mitigate interference. Many hours of real-world BAN open-access radio channel data captured by Data61 (NICTA) will be utilised to aid design and verify solutions.**Project Duties/Tasks*** Familiarisation with radio channel data and its’ application
* Extensive modelling, theoretical analysis and design
* Simulation and evaluation (using Matlab)
* Potential of peer-reviewed international publication of the outcomes

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Electrical/Telecommunications/Electronic Engineering
* Computer Science

**Location:** Data61 Eveleigh NSW**Contact:** David Smith via phone on (02) 9490 5690 or email David.Smith@data61.csiro.au |
| Data61 95  | **Project Title**Identifying Security Vulnerabilities in iOT Devices**Project Description**iOT devices of various kinds (sensors, wireless cameras, and security systems) are becoming increasingly popular. These devices connect to home or enterprise networks and might expose vulnerabilities that an attacker can exploit to break into the network. Also, these devices knowingly or unknowingly leak information about the users or the network. In this project, you will be exploring security vulnerabilities in number of consumer iOT devices by looking into their operating systems, network communication and wireless protocols. **Reference Materials** 1. Rahman, Mahmudur, Bogdan Carbunar, and Madhusudan Banik. ”Fit and vulnerable: Attacks and defenses for a health monitoring device.” arXiv preprint arXiv:1304.5672 (2013). 2. Zhou, Wei, and Selwyn Piramuthu. ”Security/privacy of wearable fitness tracking IoT devices.” Information Systems and Technologies (CISTI), 2014 9th Iberian Conference on. IEEE, 2014. **Project Duties/Tasks*** Perform various types of security vulnerability tests on consumer IOT devices including traffic analysis, MITM attacks, packet sniffing etc.
* Compare IOT devices with respect to the available security measures.
* Document the findings

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Electrical Engineering
* Computer Science and Engineering
* Information Technology

**Location:** ATP (Eveleigh)**Contact:** Suranga Seneviratne via Email: suranga.seneviratne@data61.csiro.au |
| Data61 96 | **Project Title**Detection of Counterfeits in Mobile App Stores**Project Description**It is common in app markets to have a range of counterfeit (copycat) products to successful apps. Such products reduces the users quality if experience as they might install apps by misguidance and also market operators might face legal challenges due to copy right issues. Thus, it is essential to automatically detect these counterfeit apps from app markets. In this project, you will be investigating a large dataset that contains app metadata and creatives and will be developing algorithms to identify visually and lexically similar apps using a various reverse image search techniques and methods of calculating lexical similarity. **Reference Materials** 1. Crussell, Jonathan, Clint Gibler, and Hao Chen. “Scalable semantics-based detection of similar Android applications.” In Proceedings of ESORICS. Vol. 13. 2013.**Project Duties/Tasks*** Explolatory analysis of a larger dataset that contains mobile apps’ metadata and creatives.
* Test number of supervised and unsupervised machine learning algorithms to detect similarities between apps and evaluate their performance.
* Document the findings

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Electrical Engineering
* Computer Science and Engineering
* Information Technology

**Location:** ATP (Evelegih)**Contact:** Suranga Seneviratne via Email: suranga.seneviratne@data61.csiro.au |
| Data61 97 | **Project Title**Auctioning Personal Data: Putting Users in Control of their Personal Information.**Project Description**Smart devices are aggregators of personal information. This information is accessed and monetised by third parties for free, often without the consent of the individual. This project aims to develop a mobile OS supported service that allows individuals to control and monteize their information via a novel combinatorial auction mechanism.The novel combinatorial auction involves sellers of personal information, which in our case is an individual, and buyers of personal information, such as advertisers or app developers. An individual controls the type and granularity of information by setting a reserve price on each datum. A buyer is then able to bid on a combination of an individual's information. The auction aims to maximise both the long term revenue of the individual and social welfare.**Reference Materials** 1. Carrascal, Juan Pablo, et al. ``Your browsing behavior for a big mac: Economics of personal information online.’’ Proceedings of the 22nd international conference on World Wide Web. Inter- national World Wide Web Conferences Steering Committee, 2013.**Project Duties/Tasks*** Testing various auction models and evaluate their performance according to the suitability of personal data auctioning.
* Evaluate some selected models on real data collected from Android mobile devices.
* Document the findings

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Electrical Engineering
* Computer Science and Engineering
* Statistics

**Location:** Eveleigh ATP**Contact:** Suranga Seneviratne via Email: suranga.seneviratne@data61.csiro.au |
| Data61 98  | **Project Title**Extracting meaningful information from an large scale IoT system**Project Description**Data61 has been researching, developing and deploying networked systems to monitor the structural health of civil and industrial assets (e.g. bridges, mining machines, trucks). These systems allow the continuous collection of data from a large number of distributed sensors, the analysis of these data to extract meaningful knowledge, and the presentation of this information to asset managers and engineers for decision support. One example of such deployed system is the monitoring of hundreds of jack arches under the bus lane of the Sydney Harbour Bridge. The objective of this project is to analyse some of the collected data to get insights into issues such as:* Data quality (e.g. qualify/quantify errors, detect anomalies due to system failures, effect of noise) and potential mitigation method
* How do environmental factors (e.g. wind, temperature, background vibrations) affect the results of some of the algorithms already developed by the team? Are there any short/long or periodic/seasonal pattern?

Can we detect damages in components of the assets based on the data? Can we classify and track the inputs to the system?**Project Duties/Tasks*** Perform literature review of data analytics techniques
* Perform data analysis using previously selected methods
* Write documentation to report and discuss the results

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Mathematics, or physics
* computer science, or electrical engineering

**Location:** ATP, Eveleigh, Sydney**Contact:** Thierry Rakotoarivelo via phone on (02) 9490 5699 or email thierry.rakotoarivelo@data61.csiro.au |
| Data61 99 | **Project Title**Presence Detection Robot**Project Description**CSIRO have developed a small omni directional drive robot that is based on Robotic Operating System (ROS) middleware and is small enough to go under equipment.This project will be to develop the navigation and control of the robot with a new sensor payload to detect people in a manufacturing environment.**Project Duties/Tasks*** Get familiar with the robot operation and software. ROS, 2D SLAM, Machine control and path planning.
* Investigate and develop a presence detection payload

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer Science & Engineering
* Mechatronic Engineering

**Location:** Brisbane (Pullenvale)**Contact:** Paul Flick via phone on 07 33274032 or email paul.flick@csiro.au |
| Data61 100 | **Project Title**Low Power WSN Radio Tomography**Project Description**The TI SensorTag is a sensor rich low power wireless device with Bluetooth and 802.15.4 radio capability. This project seeks to investigate the feasibility and ideally develop a system that utilizes a network of SensorTags to estimate the number and location of people within the network area. The Tags will require tight time syncronisation and periodically transmit and receive RSSI between each other. The recorded information will then be processed to determine whether people were present and ideally their locations.**Project Duties/Tasks*** Program a Contiki OS application for a network of Sensortags that produces tight time syncronisation across the network, schedules bursts of packets based on low power sensors, records RSSI from neighbouring nodes and transmits the recorded data (or processed data) to mobile phones via bluetooth
* Implement radio tomography algorithms
* Evaluate the accuracy in real-world deployments (CSIRO QCAT Site).

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Electrical Engineering
* Computer Science
* Software Engineering
* Desired skills are: Highly proficient in programming in C and Python. Knowledge of Signal Processing methods beneficial.

**Location:** Queensland QCAT, Brisbane**Contact:** Dr. Philip Valencia, Dr. Brano Kusy via Phone: (07) 3327 4136Email: philip.valencia@csiro.au or brano.kusy@csiro.au  |
| Data61 101 | **Project Title**Hyperspectral image super-resolution via convex optimization**Project Description**Finely-resolved hyperspectral images are in high demand but hard to acquire. Most current spectral imaging systems are able to capture multispectral images with high spatial resolution. However, due to existing technical limitations, they can capture hyperspectral images only with relatively lower spatial resolution. A multispectral image contains a few (often three to seven) integrated measurements representing the reflectance spectrum of each pixel of the captured scene while a hyperspectral image can comprise hundreds of narrow sections of each pixel’s reflectance spectrum. An efficient way to obtain a high-resolution hyperspectral image of a scene is to fuse the spatial and spectral information of a high-resolution multispectral image with that of a lower-resolution hyperspectral image, both captured from the same scene.In this project, we are interested in developing a new algorithm for fusing differently-resolved multispectral and hyperspectral images using advanced mathematical optimization techniques. The new algorithm will be capable of handling very large images with efficient memory utilization and processing requirements.**Project Duties/Tasks**The student will* carry out literature survey to understand the problem and find out the existing solutions;
* implement the new multispectral/hyperspectral image fusion algorithm in Python or MATLAB;
* evaluate the performance of the new algorithm in comparison with the state-of-the-art.

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Electrical/Computer Engineering
* Computer Science
* Applied mathematics

Required skills:* Basic methematics and matrix algera; Functional programming and scripting in Python or MATLAB.

**Location:** Pullenvale QLD (QCAT)**Contact:** Reza Arablouei via phone: (07) 3327 4147, email : reza.arablouei@csiro.au |
| Data61 102 | **Project Title**Mobile IDE for OpenIoT platform**Project Description**The existing IDE for OpenIoT middleware platform request definition and presentation is web-based. This limits deployment of user-driven workflow development interfaces. Porting of OpenIoT IDE to Android-based mobile platform will widen the scope of OpenIoT applications and make the platform more appealing. The student will study zero-programming principles of OpenIoT IDE, design adaptive IDE for Android-based platforms, ingest the data from a smartphone into OpenIoT, fetch relevant data streams and visualise the results of analytics on the smartphone.**Project Duties/Tasks*** **Task 1**. Study zero-programming drag&drop principles of OpenIoT IDE
* **Task 2**. Design and implement adaptive OpenIoT IDE for Android-based platforms
* **Task 3.** Develop and implement algorithms for ingesting the data from a smartphone into OpenIoT, fetch relevant data streams and visualise the results of analytics on the smartphone.

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer Science & Engineering
* Internet of Things platforms and middleware
* Android programming, sensors, data streams

**Location:** Melbourne (Clayton)**Contact:** Arkady Zaslavsky via phone on 03 95458016 or email arkady.zaslavsky@csiro.au |
| Data61 103 | **Project Title**Scalability of OpenIoT platform**Project Description**OpenIoT is an advanced Internet of Things middleware open source platform developed by the EU FP7 OpenIoT project with CSIRO’s participation. The platform addresses a number of research challenges, eg, IoT data in the Cloud, deploying semantic technologies for discovery of sensors and data, offering Sensing-as-a-Service. Scalability was, however, left out of the scope and could potentially be a stumbling block in commercial/industrial deployments of OpenIoT. The student will study the data patterns for selected use cases, eg, agriculture and/or manufacturing, synthesize high velocity & volume data streams, ingest them into the platform and evaluate scalability with subsequent identification of bottlenecks. Identified bottlenecks will be prioritised and fixed/re-developed.**Project Duties/Tasks*** **Task 1**. Study the data patterns for selected use cases, eg, agriculture and/or manufacturing
* **Task 2**. Synthesize high velocity & volume data streams, ingest them into the OpenIoT platform
* **Task 3. E**valuate OpenIoT platform scalability with subsequent identification of bottlenecks. Identified bottlenecks will be prioritised and fixed/re-developed. Test results will be deposited back into the OpenIoT open source Github repository.

**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer Science & Engineering
* Internet of Things platforms and middleware
* Sensors, data streams, big data

**Location:** Melbourne (Clayton)**Contact:** Arkady Zaslavsky via phone on 03 95458016 or email arkady.zaslavsky@csiro.au |
| Data61 104  | **Project Title**Efficient training for deep learning**Project Description**Recently, the deep learning paradigm has rekindled the interests in artificial neural networks and revived the hopes to achieve human-like artificial intelligence. Deep learning algorithms have been shown to produce state-of-the-art results in various tasks relevant to computer vision, speech/audio recognition, natural language processing, bioinformatics, etc. However, the magical power of deep learning comes at the expense of complex training. Any deep learning algorithm typically requires a very large training dataset and immense processing power to accomplish the training in a reasonable time period.In this project, we will investigate several reduced-complexity techniques for training deep learning architectures such as deep convolutional neural networks, deep belief networks, and recurrent neural networks. Some of the methods are inspired from the realms of adaptive and statistical signal processing.**Project Duties/Tasks**This project is most suitable for students in the following field/s of study:* Computer Science
* Electrical/Computer Engineering
* Applied mathematics

Required skills:Basic methematics and matrix algera; Functional programming and scripting in Python or MATLAB.**Relevant Fields of Study**This project is most suitable for students in the following field/s of study:* Computer Science & Engineering
* Internet of Things platforms and middleware
* Sensors, data streams, big data

**Location:** Pullenvale QLD (QCAT)**Contact:** Reza Arablouei via phone: (07) 3327 4147, email : reza.arablouei@csiro.au |