# 2016/17 Vacation Scholarships

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| **Job Title:** | CSIRO Undergraduate Vacation Scholarships – Health and Biosecurity |
| **Reference No:** | 24362 |
| **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.
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| **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.* |

Projects

Deep learning to obtain spatial correspondences in pre- and post-surgery images

Fetal brain imaging

Improving target accuracy for genome engineering applications

Iron quantification and validation on MRI data

Extracting Hepatic Vascular Architecture using Advanced Segmentation

Measuring Brain Changes with MRI

Genome analysis on Amazon Elastic Cloud (EC2) compute

Protein biomarker feature selection for Alzheimer’s disease.

Segmenting deep grey-matter structures from MRI data

Identifying risk factors for heart diseases and major adverse cardiac events from electronic medical records

Clinical Analytics and Reporting Visual Explorer (CARVE)

Clinical information extraction using deep learning

A Clinical Trials Search Engine

Predictive Models for Improved Patient Flow.

Improving Patient Flow through Public Hospitals.

Interactive web-based annotator for clinical information abstraction

Structural and functional changes to the eye in Alzheimer’s disease

3D retinal image analysis for age-related eye disease detection

BLE-based obstacle avoidance kit for smart home robot

Smartphone based artificial intelligence chatbot to improve delivery of educational program for the management of chronic obstructive pulmonary disease

Evaluate/Implement Automated Methods for the Processing of Color Fundus Images

An energy efficient GPS tracking bracelet for dementia patients

Classification and Feature Engineering of Movement of People with Parkinson’s Disease Using Wearable Inertial Movement Units

A mobile interaction tool for real-time information sharing in multidisciplinary medical team meeting

Automated Methods to Describe Retinal Bifurcation Points

Measure food nutrients from SCiO, a pocket molecular sensor

Speech disorder screening for young children

Understanding Fitness App Users – Log Analysis and User Modeling

Using ResearchKit and CareKit in e-Health research

User-Centered Interface Design for Big Data Analysis

[Health & Bio 1](#_Toc457469049)

[Health & Bio 2](#_Toc457469051)

[Health & Bio 3](#_Toc457469052)

[Health & Bio 4](#_Toc457469053)

[Health & Bio 5](#_Toc457469054)

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[Health & Bio 27](#_Toc457469076)

[Health & Bio 28](#_Toc457469077)

[Health & Bio 29](#_Toc457469078)

[Health & Bio 30](#_Toc457469079)

Select the **Project Numbers** above to take you directly to the project details, including relevant fields of study, Project Duties/Tasks and Locations. Pease read though these and decide which **2 projects** are your preferred choices as you will need to enter these into your application. If you require more information please contact the person listed for each project.

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| Project No | **Health and Biosecurity - Vacation Scholarships Project Details** |
| Health & Bio 1 | **Project Title**Deep learning to obtain spatial correspondences in pre- and post-surgery images.**Project Description**This vacation project is the next step in a larger project that aims to understand where and why regions inside brain tumours evolve over time in response to treatment. Brain tumours are of particular interest, because almost no progress has been made against this devastating disease in 20 years. Critical to this, is establishing matching points within the tumour before and after surgery – a currently unsolved problem. In this project, two initial approaches to obtain these point correspondences automatically using deformable registration and deep learning will be developed. If you want to use state-of-the-art algorithms to solve an important problem, then this project is for you.**Project Duties/Tasks*** Develop script to run 2-3 non-rigid registration algorithms (Demons, SyN, nifty\_reg) after tuning on data (multiple patients with 3 time-points).
* Develop deep learning approach to compute correspondences based on multi-scale descriptor and surrounding correspondences.
* Compare algorithms to ground-truth (points annotated by humans)
* Annotate additional points for testing
* Write report on results

**Relevant Fields of Study*** Engineering, Computer Science, Mathematics or Health
* Skills in scripting in Python/Matlab and C++ programming.

**Location:** Herston, QLD**Contact:** Nicholas Dowson via phone on (07) 3253 3641 or email nicholas.dowson@csiro.au |
| Health & Bio 2 | **Project Title**Fetal brain imaging.**Project Description**Non-invasive magnetic resonance imaging (MRI) of the fetal brain can provide valuable insight into normal and abnormal brain development. Structural MRI allows investigation of the brain macrostructure, while diffusion MRI can be used to study into brain microstructure and structural connectivity. Maternal breathing, together with fetal movement, significantly impact the quality of fetal brain MRI. As part of this project, the prospective vacation student will gain an understanding of the challenges associated with performing and analysing fetal brain MRI, and develop and implement methods for the robust correction of motion-induced image artefacts.Essential skills: * C++
* Python
* Linux

**Project Duties/Tasks*** identify existing methods for motion correction from literature
* develop novel methods for motion correction
* implement and test above methods

**Relevant Fields of Study*** Computer Science
* Mathematics
* Physics

**Location:** Herston, QLD**Contact:** Kerstin Pannek via email kerstin.pannek@csiro.au  |
| Health & Bio 3 | **Project Title**Improving target accuracy for genome engineering applications.**Project Description**Modifying genomic information has the potential to revolutionize biomedical science, but requires that changes are introduced with pinpoint accuracy. This project will seek to optimize this selection of location within the genome. Specifically, the CRISPR-Cas9 engineering machinery is guided by so-called sgRNAs to its target, which both rely on RNA structure and the chromatin environment influence for on-target efficacy. This project aims to build an on-target predictor that is more efficient and accurate than other published methods by including biological features and harnessing modern compute paradigms. **Expected outcomes:** a model for predicting sgRNA activity along with documentation of its performance in comparison to other publically available models**Project Duties/Tasks*** Identification of the best machine learning method for building the model (SVM, linear model, etc)
* Construction of model using publically available datasets
* Comparison of model with other publically available models
* Incorporation of the model into our CRISPR-predictor

**Relevant Fields of Study*** Bioinformatics
* Machine learning

**Location:** North Ryde, Sydney **Contact:** Laurence Wilson via phone on (02) 9325 3039 or email Laurence.Wilson@csiro.au |
| Health & Bio 4 | **Project Title**Iron quantification and validation on MRI data.**Project Description**Accurate quantification of brain tissue iron in aging and Alzheimer’s disease is helpful for understanding brain development and function. Recent development in magnetic resonance imaging (MRI) now provide the possibility to non-invasively obtain quantitative measurements of particular tissue properties. This project will investigate iron quantification from MRI data by using optimisation techniques. The candidate will explore the challenges associated with such quantification methods, and develop new techniques for a robust iron estimation controlling for the image acquisition noise.Essential skills* C++
* Linux

Expectation:* Writing code
* Running computational experiments

**Project Duties/Tasks*** Identify the well-established and fast numerical approach for optimisation
* Identify the nature of the noise and integrate it to the numerical equation
* Compare the estimated values with actual measurements
* Provide a report and well-documented code

**Relevant Fields of Study*** Image processing / computer vision
* Biomedical engineering

**Location:** Herston, QLD**Contact:** Dr. Amir Fazlollahi via phone (07) 3253 3618 or email Amir.Fazlollahi@csiro.au |
| Health & Bio 5 | **Project Title**Extracting Hepatic Vascular Architecture using Advanced Segmentation.**Project Description**This vacation project will help surgeons to avoid complications in patients undergoing partial-hepatectomy. This will be achieved by using a segmentation algorithm to extract the vascular tree of the liver and the local vessel characteristics from MRI images. This will be used to identify at-risk patients. If you want to use state-of-the-art algorithms to help solve an important problem, then this project is for you.**Project Duties/Tasks*** Further develop existing approach relying on Frangi vesselness filter and Dijkstra path extraction algorithm to extract the vessel tree.
* Extract local vessel characteristics (radius & curvature)
* Label the vessel paths and locations
* Test on available data, and write report on results

**Relevant Fields of Study*** Engineering, Computer Science, Mathematics or Health
* Skills in scripting in Python/Matlab and C++ programming are key

**Location:** Herston, QLD**Contact:** Nicholas Dowson via phone (07) 3253 3641 or email nicholas.dowson@csiro.au |
| Health & Bio 6 | **Project Title**Measuring Brain Changes with MRI.**Project Description**Non-invasive magnetic resonance imaging (MRI) of the brain can provide detailed information about the brain. We have developed methods to measure how the brain’s ‘wiring’ changes when people learn new skills. Understanding these changes may reveal means by which recovery from brain injury can be enhanced. As part of this project, the prospective vacation student will gain an understanding of the challenges associated with measuring minute signals in longitudinal medical image analysis. The prospective student will further develop cutting-edge technology and potentially apply this technology to reveal brain changes that occur with learning.Essential skills:* C#, or any low-level programming language, such as C++

Plus knowledge of, or experience with, one of the following:* Linux, or
* Open CL, or
* Signal processing / data compression / information theory, or
* Machine learning

**Project Duties/Tasks*** Identify existing methods from the literature in diffusion MRI
* Extend the capabilities of existing software that measures brain changes
* Implement, test, and compare the above methods to existing methods

**Relevant Fields of Study*** Computer Science, or
* Physiology / Neuroscience / Medicine, or
* Mathematics, or
* Physics

**Location:** Herston, QLD**Contact:** Lee Reid via email lee.reid@csiro.au  |
| Health & Bio 7 | **Project Title**Genome analysis on Amazon Elastic Cloud (EC2) compute.**Project Description**Genomic information is increasingly incorporated into medical practice for diagnosis and personalized treatment. However, processing genomic information at a scale relevant for the health-system remains challenging due to computational requirements. The aim of this project is to break down the barrier to entry for smaller labs by releasing CSIRO's high-performance compute framework for genomic data analysis, NGSANE, as an Amazon Machine Image (AMI). To demonstrate the capabilities and record performance the student will analyse the genome-in-a-bottle dataset of 7 whole genome sequencing data.**Expected outcomes:** publicly available AMI for NGSANE along with documentation and demonstrated performance on publicly available datasets.**Project Duties/Tasks*** Update currently available NGSANE-AMI with the latest version of NGSANE
* Address git-hub user requests around this, e.g. <https://github.com/BauerLab/ngsane/issues/51>
* Identify and document best way to access publicly available data in S3 buckets
* Conduct and document performance testing on the setup using real data

**Relevant Fields of Study*** Software engineering
* Bioinformatics
* Information Technology

**Location:** North Ryde, Sydney**Contact:** Denis Bauer via phone on (02) 9325 3174 or email Denis.Bauer@CSIRO.au  |
| Health & Bio 8 | **Project Title**Protein biomarker feature selection for Alzheimer’s disease.**Project Description**The current project will assess thousands of protein isoforms to determine their connectivity and their relationship to Alzheimer’s disease. Using graph- based statistical methods, the candidate will construct statistical models to align individual protein isoforms into possible groups, then link these groups across thousands of other protein isoform groups that may be related to Alzheimer’s disease.**Project Duties/Tasks*** Find most appropriate statistical methods to assess relationships between protein isoforms
* Apply these statistical techniques to large scale biological data
* Write up results and present to group

**Relevant Fields of Study*** Biostatistics/ mathematics
* Computational Biology

**Location:** Herston, QLD**Contact:** Dr James Doecke via phone on (07) 3253 3697 or email james.doecke@csiro.au |
| Health & Bio 9 | **Project Title**Segmenting deep grey-matter structures from MRI data.**Project Description**Automated segmentation of different brain regions on magnetic resonance images (MRI) is essential for diagnosis, therapy planning and advanced modelling. Structural MRI is commonly used for automated anatomical segmentation, however, deep grey-matter areas appear with indistinguishable contrast.This project involves using additional MRI images along with structural imaging to improve segmentation of deep grey-matter regions. The candidate will develop a deformable shape-based model using multiple MRI images (anatomical T1-weghited and FLAIR/QSM images) using prior information on the average shape of the brain structures.Essential skills* C++
* Linux

Expectation:* Writing code
* Running computational experiments

**Project Duties/Tasks*** Generate deep grey-matter priors for FLAIR- and QSM-MRI data
* Adapt shape-based hybrid models knowing the average shape and modes of variation from priors
* Provide a report and well-documented code

**Relevant Fields of Study*** Image processing / computer vision
* Biomedical engineering

**Location:** Herston, QLD**Contact:** Dr. Amir Fazlollahi via phone (07) 3253 3618 or email Amir.Fazlollahi@csiro.au |
| Health & Bio 10 | **Project Title**Identifying risk factors for heart diseases and major adverse cardiac events from electronic medical records.**Project Description**Chest pain is one of the most common presentations in adults to the Emergency Departments (ED). As atypical and unusual presentations of serious disease are common, careful thought is required in ensuring each patient is placed on the correct treatment path.This project will use text mining techniques to identify risk factors for heart diseases and major cardiac events from electronic medical records. This information will help the ED inform the development of further refinements to the Chest pain pathway protocol. The data gathered from this study will also help develop a clinical data registry for future research.**Project Duties/Tasks*** Develop text mining techniques to extract clinical information from free text (using Java).
* Modify text mining algorithms to improve the quality of extraction methods.
* Automatically extract heart disease risk factors and major cardiac events from free-text medical records.
* Populate risk factors and cardiac events in a clinical database

**Relevant Fields of Study*** Computer Science
* Electrical Engineering
* Information Technology

**Location:** Herston, QLD**Contact:** Anthony Nguyen via phone on (07) 3253 3637 or email anthony.nguyen@csiro.au |
| Health & Bio 11 | **Project Title**Clinical Analytics and Reporting Visual Explorer (CARVE).**Project Description**Electronic medical record repositories contain valuable clinical data recorded with fine-grained standardized codes representing diagnoses, procedures, and medications. However, due to the number of different codes (~500,000 in SNOMED CT) this leads to sparse data and makes analytics and reporting difficult.The project will focus on designing and implementing a web application that allows the construction and visualisation of *aggregation categories* that group sets of codes for reporting and analytic tasks.The UI will be built using AngularJs and the back end will use the new FHIR standard, exploiting CSIRO’s Ontoserver technology that underpins the National Clinical Terminology Service recently launched by the Australian Digital Health Agency.The initial focus will be on supporting the query-based allocation of codes to distinct aggregation categories. This carries the opportunity to influence and improve the FHIR standard itself. For extra credit, the student will also support visualisation of aggregate patient date using the SMART on FHIR.**Project Duties/Tasks*** Design and implement the web Aggregation Category Explorer tool to allow:
	+ Import and creation of aggregation categories, represented as a FHIR CodeSystem
	+ Linking of categories to SNOMED CT Expression Constraints
	+ Use FHIR Terminology Services APIs ($expand, $translate, $lookup) via Ontoserver
	+ Unit and regression testing of functionality
* Source code will be managed using Git
* An agile approach will be using with tasks, etc managed using JIRA

**Relevant Fields of Study*** Computer Science
* Electrical Engineering
* Information Technology

**Location:** Herston, QLD**Contact:** Michael Lawley via email michael.lawley@csiro.au |
| Health & Bio 12 | **Project Title**Clinical information extraction using deep learning.**Project Description**Electronic medical record repositories often contain valuable clinical information stored in free text which is unstructured and ambiguous. The abstraction of clinical concepts such as problems, tests and treatments from these records is important for supporting clinical decision making. This project will develop machine learning techniques using deep learning algorithms (the latest in Artificial Intelligence that has revolutionized the application of machine learning techniques in speech, image and text processing) to automatically extract clinical problem, test and treatment statements from clinical documents recorded in free text.**Project Duties/Tasks*** Develop machine learning techniques using the latest deep learning algorithms (using Python/Java).
* Investigate deep learning techniques that are suitable for information extraction from text.
* Modify deep learning algorithms to improve the quality of information extraction methods.
* Automatically extract clinical problems, test and treatments from free-text medical records.

**Relevant Fields of Study*** Computer Science
* Electrical Engineering
* Information Technology

**Location:** Herston, QLD**Contact:** Anthony Nguyen via phone on (07) 3253 3637 or email anthony.nguyen@csiro.au |
| Health & Bio 13 | **Project Title**A Clinical Trials Search Engine.**Project Description**Our team is developing search engine technology specifically designed for medical data. As part of this student project, you will help build a search engine to allow doctors, researchers and patients to find clinical trials. You will be a full-stack developer, building the backend search engine with ElasticSearch and web frontend with AngularJS.Come join a team of researchers and engineers in building state-of-the-art search engine technology in the important domain of medical search.**Project Duties/Tasks*** Setup the ElasticSearch search engine and index a collection of clinical trials.
* Extend the basic search engine results to include interactive plots and visualisations providing summaries of search results.
* Adapt the search engine ranking mechanism to favour specific clinical trials.
* Evaluate the effectiveness of different scenario specific rankings.

**Relevant Fields of Study*** Good programming skills (preferable in Java, Python or C++)
* Knowledge of algorithms, data structures
* Front-end web UI skills (e.g., AngularJS)
* Web services, including REST, JSON, etc.
* Natural language processing and some statistics experience would be helpful

**Location:** Herston, QLD**Contact:** Dr Bevan Koopman via phone on (07) 3253 3635 or email bevan.koopman@csiro.au |
| Health & Bio 14 | **Project Title**Predictive Models for Improved Patient Flow.**Project Description**The tools developed in this work area provide information on some of the key parameters of patient flow through hospitals including predicting bed demand, length of stay within hospital, patients at risk of readmission to hospital and the cost of patient stays. This information can help with improving the timeliness and quality of care delivered and the outcomes for patients.The student will need to be able to interrogate large, time-stamped databases and develop and validate statistical models to improve hospital patient flow. Knowledge and skills in statistical modelling, machine learning and operations research would be highly desired. Working knowledge of the R statistical package is mandatory. The project will require the ability to investigate complex problems and develop appropriate responses by adapting/creating and testing alternative solutions. High level written and oral communication skills are also required.**Project Duties/Tasks*** Data cleansing and preparation.
* Data exploration and analysis.
* Develop statistical models.
* Produce analysis insights and summary of findings.

**Relevant Fields of Study*** Statistics
* Machine Learning
* Operations Research

**Location:** Herston, QLD**Contact:** Norm Good via phone on (07) 3253 3606 or email Norm.Good@csiro.au |
| Health & Bio 15 | **Project Title**Improving Patient Flow through Public Hospitals.**Project Description**The Health Data Analytics multidisciplinary team conducts statistical research in areas of the health system such as hospital flow targets, individual risk prediction and workforce planning. They develop operational decision support tools to identify and eliminate bottlenecks in patient flow and improve the management of hospital resources, and thus deliver significant improvements to patient care and patient experience. The project aims to collate large administrative hospital datasets to undercover statistical relationships within the data and obtain insight into hospital bed management.  Knowledge and skills in statistical modelling, machine learning and operations research would be highly desired.  Working knowledge of the R statistical package is mandatory. The project will also require the ability to investigate varied and complex problems and develop suitable solutions by adapting/creating and testing alternatives. High level written and oral communication skills are also required.**Project Duties/Tasks*** Data cleansing and preparation.
* Data exploration and analysis.
* Develop statistical models.
* Produce analysis insights and summary of findings.

**Relevant Fields of Study*** Statistics
* Machine Learning
* Operations Research

**Location:** Herston, QLD**Contact:** Sankalp Khanna via phone on (07) 3253 3629 or email Sankalp.Khanna@csiro.au |
| Health & Bio 16 | **Project Title**Interactive web-based annotator for clinical information abstraction.**Project Description**Electronic medical record repositories contain valuable clinical information stored in free text and have tremendous potential for clinical care, personalised medicine, and biomedical research. The abstraction of clinical information is important for supporting clinical decision making. The project will focus on designing and extending a web application that allows annotation of medical records with both concepts in ontologies (e.g. from standard terminologies using AEHRC terminology server) and predefined clinical annotation types.The components developed for the web application will need to be designed with reusability in mind. For example, the component used to draw the annotations should be reusable in the UI of a semantic search engine to highlight the annotations in the search results.**Project Duties/Tasks*** Design and extend the web annotation tool to allow:
	+ New functionality such as loading pre-annotations for review and/or adjudication, online annotation markup e.g. annotate new text with past annotations, and annotation search.
* Unit and regression testing of functionality

**Relevant Fields of Study*** Computer Science
* Electrical Engineering
* Information Technology

**Location:** Herston, QLD**Contact:** Anthony Nguyen via phone on (07) 3253 3637 or email anthony.nguyen@csiro.au |
| Health & Bio 17 | **Project Title**Structural and functional changes to the eye in Alzheimer’s disease.**Project Description**Changes to the eye in Alzheimer’s disease are showing promise for early detection of this form of dementia, making early intervention a real possibility and contributing toward the development of a successful treatment. The aim of the project is to analyse existing ocular imaging data from Alzheimer’s patients and controls, including optical coherence tomography (OCT) and pupil response. **Project Duties/Tasks*** Literature review (will be guided)
* Extract medical imaging parameters from OCT and pupil data
* Statistical analysis
* Write report

**Relevant Fields of Study*** Computer Science
* Electrical Engineering
* Applied Mathematics
* Statistics

**Location:** Perth, WA**Contact:** Dr Shaun Frost via phone on (08) 9333 6137 or email shaun.frost@csiro.au |
| Health & Bio 18 | **Project Title**3D retinal image analysis for age-related eye disease detection.**Project Description**In this project, we will be developing image processing and segmentation algorithms for retinal optical coherence tomography (OCT) images. The algorithms developed and properly validated will be further applied for age-related eye disease analysis and integrated into a telemedicine system for use in the field in hospitals to screen for sight threatening eye diseases.**Project Duties/Tasks*** Develop image pre-processing, image segmentation and machine learning algorithms for retinal layer segmentation and pathology detection (using Python/C++/Matlab)
* Validate algorithms based on OCT dataset
* Build APIs which can be called by our telemedicine system

**Relevant Fields of Study*** Computer science
* Information technology and electrical engineering

with interests in signal processing, image processing and biomedical engineering.**Location:** Floreat, WA**Contact:** Dr. Di Xiao via phone on (08) 9333 6147 or email Di.Xiao@csiro.au |
| Health & Bio 19 | **Project Title**BLE-based obstacle avoidance kit for smart home robot.**Project Description**Robots are introduced as the promising assistive technology for future smart home. There are several challenges on using this assistive technology in smart home application. One of the main challenges is to guide robots in different areas of the home. This project aims to develop a BLE based kit which can help robots to avoid obstacles around the home. In other words, whenever there is an obstacle in the robot path, this kit commands the robot to stop and change the path.**Project Duties/Tasks*** A literature review on related technologies
* Finding the required components for this kit.
* Developing an efficient embedded system for the kit
* Test and experiment the kit.

**Relevant Fields of Study*** Electrical engineering.

Knowledge and/or experience on embedded system is an advantage. **Location:** Herston, QLD**Contact:** Ghassem Mokhtari via phone on (07) 3253 3626 or email ghassem.mokhtari@csiro.au |
| Health & Bio 20 | **Project Title**Smartphone based artificial intelligence chatbot to improve delivery of educational program for the management of chronic obstructive pulmonary disease.**Project Description**Patients with chronic obstructive pulmonary disease (COPD) often require to learn some essential knowledge to effectively manage COPD conditions, but existing paper or web based educational programs provided to the patients are generally underutilized mainly due to the inconvenience to use and steep learning curve which patients usually need to face. This project will use smartphone and artificial intelligence (AI) technologies to develop a chatbot. The chatbot will contain structured educational materials from the Lung Foundation Australia, focusing on risk factors, inhaler techniques, physical exercise, and COPD action plan. Additionally, the chatbot can review daily healthcare data to motivate individual patients to adhere to the recommendations by the guidelines. Accordingly, patients can simply “chat” with the bot in their personal smartphone to obtain a certain level of the information or knowledge for their ongoing management of COPD. The development will leverage two recent smartphone systems studied at CSIRO. One is a mobile health system for delivery of cardiac rehabilitation program, called MoTER. This system is being extended for the management of COPD and diabetes. The other one is an AI chatbot, named Harlie (Human and Robot Language Interaction Experiment), which was developed to assess patients with Parkinson’s disease. The aim of this project is to evaluate the feasibility of using an AI chatbot to improve the management of COPD.**Project Duties/Tasks*** Work with CSIRO supervisors and clinicians to develop a chatbot educational program according to COPD guidelines, focusing on physical activity, risk factors, inhaler techniques, and COPD action plan. The major tasks include 1) Literature review of the current status of artificial intelligence (AI) chat-bots in clinical studies, 2) Specify contents/educational materials needed for the COPD program, and 3) Develop a work flow and decision tree for chatting interactions.
* Develop an Android chat-bot application to practically deliver the chat-bot program. Tasks: 1) Write AIML codes for language processing, and 2) Implement these codes in an Android application.
* Evaluate the chatbot application through a pilot study (if possible) and contribute to a conference paper (HIC 2017).

**Relevant Fields of Study*** Software engineering or computer sciences
* Some level of experience on development of smartphone applications (Android)
* Natural language processing.

**Location:** Herston, QLD**Contact:** David Ireland via phone on (07) 32533604 or email d.ireland@csiro.au |
| Health & Bio 21 | **Project Title**Evaluate/Implement Automated Methods for the Processing of Color Fundus Images**Project Description**Nonuniform illumination is a potential problem for automated analysis of images. Several illumination correction techniques are have been proposed. The project aims to evaluate and implement some of the state-of-the-art illumination correction methods in the context of fundus image registration. The findings may also lead to come up with a novel illumination correction method for fundus images. **Project Duties/Tasks*** Algorithm development (using Python/ C++/ Matlab)
* Writing reports

**Relevant Fields of Study*** Computer Science
* Electrical Engineering
* Applied Mathematics

**Location:** Perth, WA**Contact:** Dr Sajib Kumar Saha via phone on (061) 893336116 or email Sajib.Saha@csiro.au  |
| Health & Bio 22 | **Project Title**An energy efficient GPS tracking bracelet for dementia patients.**Project Description**GPS tracking has been widely used to help family members and carers of dementia patients to ensure the safe and security of their’ loved ones. However, GPS trackers consume a large amount of energy that means that existing small wearable GPS tags typically only last 3-4 hours before having a flat battery. Even devices with larger battery, such as smart phones, will still need to be recharged every night to ensure a reasonable durations of daily GPS usages. This adds an extra burden to dementia patients who usually suffer various levels of short-term memory loss.In this project, we plan to develop an energy efficient GPS tracking bracelet dedicated for dementia patients. With advanced activity recognition algorithms, the objective is develop a GPS bracelet that continuously last for up to 7 days, while providing Geofence, accurate GPS localization functions as needed. **Project Duties/Tasks*** Understand theory of GPS tracking and activity recognition through accelerometer;
* Design PCB boards with GPS and accelerometer module;
* Implementing algorithms and fine tuning devices to minimize its energy cost.

**Relevant Fields of Study*** Electrical engineering
* Computer science

**Location:** Herston, QLD**Contact:** Qing Zhang via phone on (07) 3253 3630 or email qing.zhang@csiro.au |
| Health & Bio 23 | **Project Title**Classification and Feature Engineering of Movement of People with Parkinson’s Disease Using Wearable Inertial Movement Units.**Project Description**Perform machine learning and feature engineering of a dataset collected from people with Parkinson’s disease engaging in a variety of physiotherapy tasks. This project seeks to to identify what limbs, sensor type and tasks provide the best indication of disease severity. **Project Duties/Tasks*** Perform a literature review on the state of the art machine learning classification and feature engineering algorithms.
* Implement algorithms to identity the most important features and develop a classification algorithm.
* Test algorithm using dataset of 14 people with Parkinson’s disease.

**Relevant Fields of Study*** Machine learning
* Software engineering (C/C++)
* Signal processing

**Location:** Herston, QLD**Contact:** Dr. David Ireland via phone on (07) 32533604 or email d.ireland@csiro.au  |
| Health & Bio 24 | **Project Title**A mobile interaction tool for real-time information sharing in multidisciplinary medical team meeting.**Project Description**Multidisciplinary medical team meetings are for clinicians from different disciplines to discuss patient records (e.g. medical images) and decide on the management of patients. Multidisciplinary cancer team meetings supported by collaboration technologies has been held regularly in hospitals to support the real-time discussion between cancer experts from different hospitals. This project will involve the development of a mobile interaction tool to be integrated into the existing collaboration platform that we have developed to support the mobile interaction with information on the shared workspace. The tool will allow individual participants to participate in the discussion and analysis in a large multidisciplinary medical team meeting.**Project Duties/Tasks*** A literature review on related technologies
* Designing the mobile interaction tool
* Integrating the prototype with the existing collaboration platform
* Test and evaluation of the mobile tool

**Relevant Fields of Study*** Computer science
* Software engineering and human computer interaction.

Skills or experience in programming Android device is desirable. **Location:** Marsfield, NSW**Contact:** Jane Li phone on (02) 93714163 or email Jane.Li@csiro.au  |
| Health & Bio 25 | **Project Title**Automated Methods to Describe Retinal Bifurcation Points.**Project Description**Bifurcation points are potential landmarks to register (alignment of 2 or more images collected from different views or over time) retinal images. Unique and robust description of bifurcation points is crucial for accurate matching of bifurcation points between images. The aim of the project is to develop a feature descriptor to robustly describe bifurcation points from fundus images.Relevant paperChen, Li, Yang Xiang, YaoJie Chen, and XiaoLong Zhang. “Retinal image registration using bifurcation structures.” In *Image Processing (ICIP), 2011 18th IEEE International Conference on*, pp. 2169-2172. IEEE, 2011.**Project Duties/Tasks*** Literature review (will be guided)
* Algorithm development (using Python/ C++/ Matlab)
* Writing reports

**Relevant Fields of Study*** Computer Science
* Electrical Engineering
* Applied Mathematics

**Location:** Perth, WA**Contact:** Dr Sajib Kumar Saha via phone on (061) 893336116 or email Sajib.Saha@csiro.au |
| Health & Bio 26 | **Project Title**Measure food nutrients from SCiO, a pocket molecular sensor.**Project Description**Diet is a major lifestyle-related risk factor of many chronic diseases. Thus, monitoring food and intake nutrients has attracted much interests in recent years. Mobile devices are advantageous for this task due to their ease of use and ubiquity.This project will investigate the potential of using a small palm size SCiO molecular sensor, for recognizing foods types and quantitatively measuring food nutrients. It aims at developing a mobile app that allows user to simply scan the food with SCiO sensor to accurately understand its nutrition, which can help manage chronic conditions such as diabetes and obesity through physical activity and diet intake.**Project Duties/Tasks*** A literature review on related technologies
* Collect sensor data from a wide range of food including raw fruits and cook/mixed foods
* Develop mobile application and Implement data mining algorithms to understand food nutrient facts

**Relevant Fields of Study*** Computer science
* Software engineering.

Knowledge and/or experience on machine learning and mobile app development is an advantage.**Location:** Herston, QLD**Contact:** Thuong Nguyen via phone on (07) 3253 3664 or email thuong.nguyen@csiro.au  |
| Health & Bio 27 | **Project Title**Speech disorder screening for young children.**Project Description**One in 20 Children have some sort of speech disorder and for some the wait for accessing professional services can be up more than one year. Therefore we have started to develop tools helping in early assessment of potential speech development problems in children. We currently use speech/phoneme models and speech pathology procedures to develop a new system aimed at automatically assessing speech problems. The goal is to develop a mobile tool that can be used by non-experts for early and broad speech pathology screening in an engaging way for children.The successful candidate for this project will work with CSIRO researchers in the Australian e-Health Research Centre and Data 61 and speech pathologist to collect and prepare speech data, conduct research on and develop tools for audio and speech signal processing, develop and adapt models (on a word and phoneme basis), design decision support functionality and mobile prototype design and development.**Project Duties/Tasks*** Define research scope with supervisors and background research
* Data preparation
* Develop and/or adapt existing audio signal processing tools
* Develop and/or adapt models to detect pronunciation problems in children's speech
* Develop prototype application to demo on mobile device

**Relevant Fields of Study*** Computer science or engineering with an interest in:

Machine learning, signal processing and/or application development**Location:** Hobart, Tasmania**Contact:** Andreas Duenser via phone (03) 6237 5678 or email andreas.duenser@csiro.au  |
| Health & Bio 28 | **Project Title**Understanding Fitness App Users – Log Analysis and User Modeling.**Project Description**Mobile fitness apps have flooded the market in recent years, and the uptake of innovative services aimed at delivering behavior change is increasing. While app download numbers are high, many services fail to engage users sufficiently to see true behavior change and fitness changes. Sustained engagement with fitness services is not only vital in ensuring users achieve their fitness goals, but is often a key component in the business model of the service provider. The key step in delivering engaging services is to understand the user group, and their interaction with the service. This understanding can then be taken to provide personalised, more engaging services.The successful candidate for this project will work with CSIRO researchers in the Australian e-Health Research Centre and Data 61, in collaboration with an Australian app company to analyse statistics, data, and interaction logs gathered through a real-life fitness app with over 200,000 downloads to date. The analysis will investigate app usage trends, user retention and user behaviours to provide a better understanding of current usage and to inform strategies to sustain user engagement. **Project Duties/Tasks*** Define research scope with CSIRO and industry partner
* Data cleansing and preparation for analysis
* Conduct analysis using behavioural data analytics tools
* Produce analysis insights and deliver to stakeholders
* Design strategies to increase user engagement

**Relevant Fields of Study*** Computer science
* Data Analytics
* Statistical Analysis
* Machine Learning

**Location:** Marsfield, Sydney**Contact:** Jill Freyne via phone (02) 9372 4452 or email jill.freyne@csiro.au  |
| Health & Bio 29 | **Project Title**CSIRO Undergraduate Vacation Scholarship - Using ResearchKit and CareKit in e-Health research.**Project Description**CSIRO’s research in e-Health aims to improve healthcare services (e.g., chronic disease management, rehabilitation, aged care), and the delivery of lifestyle programs using information and mobile communication technologies. This project will investigate the use of Apple ResearchKit and CareKit to run research studies in digital health services, as well as to create personal care applications (apps). A sample study will be designed with domain experts/scientists to develop a prototype app for IOS. The app will have the flexibility to cater for research in a variety of health and personal care services.**Project Duties/Tasks*** Investigate ResearchKit and CareKit software framework.
* Work with domain experts to design a sample study in health services.
* Develop a prototype (i.e. app) for IOS using the study design.
* Conduct software testing.

**Relevant Fields of Study*** Computer science
* Software Engineering
* Human Computer Interaction

Skills or experience in Swift and Objective-C is desirable.**Location:** Marsfield, Sydney**Contact:** M. Sazzad Hussain via phone on 02 9372 4177 or email sazzad.hussain@csiro.au |
| Health & Bio 30 | **Project Title**User-Centered Interface Design for Big Data Analysis.**Project Description**We are awash in a flood of data today. In a broad range of application areas, data is being collected at unprecedented scale. While the potential benefits of Big Data are real and significant, there are still many technical challenges that must be addressed to fully realize this potential. And one of the key challenges is how to construct queries and search data with different granularities generated by heterogeneous systems. The project aims to design and implement an user-centered interface that enable users with different business goals to construct their own queries at different levels guided by domain knowledge and retrieve results that semantically satisfy the query.**Project Duties/Tasks*** Design: interface design to accommodate the above requirements
* Implementation: prototype
* Evaluation: usability testing and Documentation

**Relevant Fields of Study*** Computer Science

**Location:** Hobart, Tasmania**Contact:** Dr Qing Liu via phone (03) 6237 5698 or email Q.Liu@csiro.au |