THE UNIVERSITY OF WESTERN AUSTRALIA

Summer Down Under: Research Internship

2020 Online Projects

2020 UWA SUMMER DOWN UNDER: RESEARCH INTERNSHIP INFORMATION

Application Procedure

Applications extended to 21 June 2020

Review this list of projects and select up to 2 preferred projects

Use this link to apply: 2020 UWA Summer Down Under Research Internship Application or QR code

Application preparation:

You will need to attach the most up to date

- Transcript
- CV (no more than 1 page)
- English results (not required for native speakers)

You will also be required to answer the following questions:

- Explain why your previous experience makes you suited to this project? In particular, address any prerequisites that have been outlined by the supervisor. (max 200 words)
- Outline any previous research or laboratory experience that you have. Please name that research group and the leader of that research group at your home university. (max 100 words)
- Why are you interested in this program? (max 200 words)
- What are your future career plans? (max 200 words)

You may contact the supervisor(s) if you have questions regarding the project(s). Please note: as student selection is based on a competitive process, please do not discuss acceptance.

Contact your university's international/mobility office to let them know of your plans

Program details see Summer Down Under: Research Internship

2020 Projects (Online):

Faculty of Arts, Business, Law and Education

Oceans governance ---------- *5*

Socialising conflict transformation towards resilient peace-building in planning and governance: transferrable lessons and lingering challenges ---------- *6*

Wise city planning for healthy Local Urban Nightscapes across Australasia: the pathways, policies and priorities for sustainable Artificial Lighting Regimes (LUNAR) ---------- *7*

Challenging geographies of super-rich urban development by infrastructuring an ethics of care over time and place ---------- *8*

Parents, communities and public schools ---------- *9*

Ageing and New Media ---------- *10*

Internationalisation at Home - Student Research Project ---------- *11*

YMAP Youth Mobilities ---------- *12*

Faculty of Science

Genomics of Plant Pathogen Interactions ---------- *13*

The photoperiod regulon of dormancy transitions in grapevine ---------- *14*

Regulation of antioxidant synthesis during dormancy transitions in grapevine ---------- *15*

Work factors and retirement adjustment ---------- *16*

The future of leadership in the age of AI ---------- *17*

The CARE Study of Mental Wellbeing during COVID-19 ---------- *18*

Workforce Diversity Benchmarking ---------- *19*

Genetic resistance of livestock to gastro-intestinal worms – understanding the immune system so we can reduce our reliance on drugs ---------- *20*

Quantifying economic impacts of emerging technologies in the transport sector ---------- *21*

Assessing future uncertainties within existing transport infrastructure investment assessment frameworks ---------- *22*

Port planning ---------- *23*

Faculty of Engineering and Mathematical Sciences

Empathy in Engineering ----------***24***

Quantum Machine Learning----------***25***

Deep learning for classifying the synthesized images of galaxies from computer simulations----------***26***

Pre-merger detection of gravitational waves----------***27***

Search for Electromagnetic Counterparts of Gravitational Wave Events----------***28***

A panchromatic view of galaxy evolution----------***29***

Logic via Quantum Computing----------***30***

Road Puddle and Splash Identification in Video----------***31***

Bat Call Identification via Machine Learning----------***32***

Bee Identification and Tracking in Video----------***33***

Permutation groups and graph symmetry----------***34***

Automatic Machine Learning ----------***35***

Wave energy devices with adaptive geometry----------***36***

Which wave energy device is the best?----------***37***

FACULTY: FACULTY OF ARTS, BUSINESS, LAW AND EDUCATION **SCHOOL: LAW SCHOOL**	
Main Supervisor : Prof Erika Techera	**Co-supervisor(s) :**
Project title:	**Oceans governance**
Project description: The project will explore international environmental law that addresses the problem of marine invasive species. The focus will be on exploring the different pathways for introduction of species and in particular ballast water and bio-fouling of ships. Whilst there is a new treaty on ballast water, there is no binding international law directly addressing bio-fouling. The research will involve collating literature on the extent of the marine invasive species challenge and its causes, examining existing international law that addresses these causes, analysing in detail the specific laws for ballast water and bio-fouling, and identifying some potential ways forward to improve oceans governance.	
Required skills, knowledge or experience: Knowledge of international environmental law. The student need not be a law student, but if not, s/he must have studied international environmental law. It is possible that a law student who has studied public international law, but not international environmental law, may be suitable depending upon other subjects undertaken.	
Keywords: International environmental law, oceans, biodiversity conservation, governance, invasive species	
Supervisor Contact email: erika.techera@uwa.edu.au	
Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 2

FACULTY: FACULTY OF ARTS, BUSINESS, LAW AND EDUCATION
SCHOOL: SCHOOL OF SOCIAL SCIENCES

Main Supervisor : Dr Clare Mouat	**Co-supervisor(s) :**

Project title:	**Socialising conflict transformation towards resilient peace-building in planning and governance: transferrable lessons and lingering challenges**

Lab/Group: Geography and Planning

Project description:
Urban planning decisions defining our urban futures are often marked by conflict. Conflict in planning is inevitable but too-often it is poorly or violently managed. Arguably there is under-examined democratic potential especially in socialising conflict transformation across multiple urban scales. Already climate change and large infrastructure projects, for example, exacerbates the need for conflict transformation to manage injustice, resource conflict and trade-offs at all scales and across borders. We need to better learn how to disagree so communities and individuals can make better decisions towards achieving the places we need: restorative justice, sustainable development (SDG16 – Peace, Justice and Strong Institutions and SDG11 – Sustainable Cities and Communities).

This project aims to interrogate the democratic potential for reorientating how local governments and planners deal with conflict in urban planning by drawing on insights from the resilient peace project and conflict transformation literature and divided societies/cities or other critical cases. The research will include a literature review, collection of critical case studies and policies as comparative exemplars, and possible adaptations into (West) Australian local government settings.

Required skills, knowledge or experience:
Postgraduate student or senior undergraduate preferred.
Suggested Undergraduate major in human geography, planning, politics or political science, law, environmental science, anthropology, sociology; qualitative/quantitative research skills training.
Student contribution: the exact details of the student's role will be worked out in consultation with the student. The student will likely be involved in qualitative data design, case study and data collection, analysis, research management, data entry and analysis, plus written and graphic communication of findings.

Keywords: Conflict transformation, urban planning, governance, social innovation, community

Supervisor Contact email: clare.mouat@uwa.edu.au

Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks (can be extended to 12 weeks)
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 7(5 for this project)

Faculty: Faculty of Arts, Business, Law and Education
School: School of Social Sciences

Main Supervisor : Dr Clare Mouat	**Co-supervisor(s) :**

Project title:	**Wise city planning for healthy Local Urban Nightscapes across Australasia: the pathways, policies and priorities for sustainable Artificial Lighting Regimes (LUNAR)**

Lab/Group: Geography and Planning

Project description:

Many sustainability projects routinely focus on day-time conditions and activities in a climate of global change. Yet the way we plan, develop, and live in our cities and homes during the night needs our urgent attention. This project aims to better understand how artificial lighting regimes (ALR) affect (more-than-) human and ecological health and the politics of light in cities by firstly understanding how communities and stakeholders understand ALR in terms of commons and ecological light pollution in local urban places. The project may use surveys and policy development to explore the range of healthy and unhealthy ALR to find ways for communities to appreciate and create healthier and more sustainable ALR in their local and significant places across Australasia. Consequently, communities can collaborate with local councils and developers to better inform how we plan, promote, and develop safe and healthy cities (SDG11).

About the WUN Project: "The Healthy Polis" is funded to develop understanding and continuing research into
1. challenges posed by climate change and NCDs in cities,
2. international approaches to healthy urban planning and sustainability, and
3. integrated assessment of urban planning interventions.

This project serves all three WUN Healthy Polis research priorities to understand how communities live, work, and play in their local landscapes at night (nightscapes).

Wise cities, rather than smart cities, are needed to balance urban development, ecological wisdom, and planning practices. Urban nightscapes have ALR that dramatically affect economic, social, and ecological sustainability. ALR are regulated systems of night lighting – permanent and temporary – including streetlights; lighting from industrial, residential, civic, commercial, festival, and construction sources. While lighting at night offers many benefits (productivity, safety, and entertainment, for example), it can also cause problems for human and non-human health through light and ecological pollution. Light pollution includes sky glow from ALR sources that obscure the night sky (today more than one third of humanity cannot see the Milky Way). More broadly, ecological light pollution disrupts ecological health of humans and non-humans (plants, animals, and insects) in a wide variety of ways. For healthy urban development, planners need a better understanding about how communities relate to the night sky and nightscapes of their urban places, and communities need to better understand the technologies and systems that offer or restrict lighting innovations. In so doing, communities and planners can better appreciate the trade-offs and effects of ALR and the wise city imperatives for healthy and sustainable nightscapes.

Required skills, knowledge or experience:

Suggested undergraduate major in human geography and planning, environmental science, anthropology, sociology, public health; qualitative or quantitative research skills training.
Student contribution: the exact details of the student's role will be worked out in consultation with the student. The student will likely be involved in qualitative and/or quantitative data collection and analysis, including individual and focus group interviews, data entry, analysis, plus written and graphic communication of findings.

Keywords: Artificial lighting, urban planning, health, community governance, wise cities

Supervisor Contact email: clare.mouat@uwa.edu.au

Project done on Crawley campus: Yes with some off-campus fieldwork	**Length of project:** Standard 8 weeks (can be extended to 12 weeks)
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 7(1 for this project)

Faculty: Faculty of Arts, Business, Law and Education
School: School of Social Sciences

Main Supervisor : Dr Clare Mouat	**Co-supervisor(s) :** Dr Katie McClymont

Project title:	**Challenging geographies of super-rich urban development by infrastructuring an ethics of care over time and place**

Project description:

Relevant Research Sub-themes (WUN In-Herit)

• Resilience, place and place-making: What is the role of heritage in identity and ontological security?

• Contested urban spaces: Can an understanding of cultural heritage support healthy, inclusive, and just development in urban public space?

Dr Clare Mouat (UWA) and Dr Katie McClymont (University of the West of England, Bristol, UK) are the chief investigators in an ongoing project mapping the contours and curation of an ethics of care: reorientating critical infrastructure planning in super-prime development of Nine Elms, London, UK. Nine Elms is a £15 billion multi-level governance partnership project; the package (including a London Underground Northern Line extension) is currently one of Europe's largest regeneration schemes. We are keen for projects which explores the tensions and opportunities evidenced in this project either in the same location or in others globally which can deepen, extend or challenge our conceptualisations.

Our project explore the vital need to better recognise how cultural heritage is- or could be differently- co-opted as a critical infrastructure and postsecular ethics of care. This is especially where such super-rich urban development threatens to displace or impoverish existing communities. Addressing the subthemes above, we aim to witness the contours and curation of an ethics of care by secular and postsecular actors as noted in the ongoing regeneration of the Vauxhall Nine Elms Battersea Opportunity Area in London, UK ("Nine Elms"). Several key Opportunity Areas are nominated along the Thames within the Diocese of Southwark. The Diocese represents a significant participatory curator of care by invoking history and heritage, through non-financial notions of ownership and belonging. Moreover, their strategic planning and ambitions for #AGoodCity create a paradoxical tension with secular local governments democratically-sanctioned strategic spatial frameworks seek to promote community health and wellbeing. A range of qualitative data collection techniques will capture and chart the distinctive heritage and future development of Faith-based organisations and actors using a postsecular lens and grounded theory. We aim to provoke deeper inquiry and assess actual and potential planning implications in and beyond this extraordinary postsecular situation.

Required skills, knowledge or experience:

Undergraduate major in human geography and planning, politics, anthropology, sociology, history, qualitative or quantitative research skills training.

Student contribution: the exact details of the student's role will be worked out in consultation with the student. The student will likely be involved in qualitative and/or quantitative data collection and analysis, including individual and focus group interviews, data entry and analysis and report writing. We are open to student-initiated projects in a range of different geographical locations which pick up on the key concerns raised by our project but explore how these play out elsewhere.

Keywords: Urban regeneration/renewal, ethics, care and wellbeing, heritage, postsecular

Supervisor Contact email: clare.mouat@uwa.edu.au

Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks (can be extended to 12 weeks)
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 7(1 for this project)

Faculty: Faculty of Arts, Business, Law and Education **School: School of Social Sciences**	
Main Supervisor: Associate Professor Glenn Savage (UWA)	**Co-supervisor(s):** Jessica Gerrard (University of Melbourne)
Project title:	**Parents, communities and public schools**
Lab/Group: N/A **Lab/Group Link:**	
Project description: **Project 1** This three-year Australian Research Council project aims to examine the impact of Australian state and federal school autonomy policies on how public secondary schools engage with parents in disadvantaged communities. Through policy analysis and case studies in schools, the project seeks to advance policy and conceptual knowledge about how school autonomy reforms are potentially reshaping meanings and practices associated with public schooling. Expected outcomes include enhanced knowledge about the shifting nature of schooling reform in Australia's federal system and insights into evolving relationships between governments and citizens in public service delivery. Intended benefits include insights to inform future policy design and implementation at school and system levels.	
Required skills, knowledge or experience: A background of study in either sociology, politics, public policy or education is highly recommended. Students who have experience conducting qualitative research would be especially well-placed.	
Keywords: public policy, sociology, schooling reform, education policy, autonomy, parents, public schooling, federalism, social and economic disadvantage	
Supervisor Contact email: glenn.savage@uwa.edu.au	
Project done on Crawley campus: YES	**Length of project:** Standard 8 weeks or can be extended to 12 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 2

Faculty: Faculty of Arts, Business, Law and Education
School: School of Social Sciences

Main Supervisor : Prof Loretta Baldassar	**Co-supervisor(s) :**

Project title: **Ageing and New Media**

Project description:

Project 1

Project is a collaborative research project that examines how support networks for older people are affected by their mobility and the dispersal of their family, friends and care services. Co-ordinated by Loretta Baldassar (Anthropology and Sociology, The University of Western Australia) and Raelene Wilding (Sociology, Social Inquiry, La Trobe University), this four year project is funded by the Australian Research Council (2015-2020).

The aim of this project is to highlight the current and potential role that new media can play in fostering local, distant and virtual support networks of older Australians. This will help to update both aged care policy and service delivery. The research includes a survey of the sector as well as participant observation, ethnographic life history interviews, and network analysis to compare experiences of diverse older migrants and non-migrants in both urban and regional locations, at home and in institutional care. The project will examine the impact of mobility and migration on the dispersal of older people's support networks; evaluate the current and potential role of new media in fostering new and existing networks; and extend theoretical, policy and practice understandings of healthy 'ageing in place' by introducing what we call a 'mobilities and new media' perspective.

Access to social networks and a capacity to belong and engage with other people is now understood as a significant indicator of healthy ageing. Importantly, the increasing uptake of new communication technologies means that social activities, social interactions and a sense of belonging are no longer limited to local, proximate networks and communities. What remains unknown, and will be addressed by this project, is the role of distant and virtual support networks in the lives of older Australians, and the potential and actual role of new media in older people's experiences and uses of effective support networks.

Required skills, knowledge or experience:

Undergraduate major in anthropology, sociology, gerontology, public health; qualitative or quantitative research skills training.

Student contribution: the exact details of the student's role will be worked out in consultation with the student. The student will likely be involved in qualitative and quantitative network data analysis and visualisation in VennMaker.

Keywords: Ageing, migration, new media, social support networks, social network analysis, VennMaker.

Supervisor Contact email: loretta.baldassar@uwa.edu.au

Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 3

Faculty: Faculty of Arts, Business, Law and Education **School: School of Social Sciences**	
Main Supervisor : Prof Loretta Baldassar	**Co-supervisor(s) :** Lukasz Krzyzowski
Project title:	**Internationalisation at Home - Student Research Project**
Lab/Group Link: http://blogs.uwa.edu.au/lorettabaldassar/home/iah/	

Project description:

Project 2

Internationalisation at Home - Student Research Project

Built-in as part of the formal curriculum in the 4th year Anthropology and Sociology Honours unit, ANTH4101 Advance Qualitative Methods: Interviews and Focus Groups, this project both develops initiatives that offer guided opportunities for local and international students to engage with each other, and allows students to collect data on international/local student interaction that contributes to their own personal research assignments and a broader research project.

These objectives respond directly to the UWA Strategic Plan in improving the student experience, developing research and research training and the teaching/research nexus. As part of their contribution to this research project, students produce a research report and poster based on their analysis of the data they collected. For a detailed look at these reports and posters please click here. International student partners will audit this unit and collaborate on joint student-led projects.

Required skills, knowledge or experience:

Undergraduate major in anthropology, sociology, youth studies, social work, human geography, public health; qualitative or quantitative research skills training.

Student contribution: the exact details of the student's role will be worked out in consultation with the student. The student will likely be involved in qualitative and/or quantitative data collection and analysis, including individual and focus group interviews, data entry and analysis and report writing.

Keywords: Student study abroad; internationalisation at home	
Supervisor Contact email: loretta.baldassar@uwa.edu.au	
Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 3

Faculty: Faculty of Arts, Business, Law and Education
School: School of Social Sciences

Main Supervisor : Prof Loretta Baldassar	**Co-supervisor(s) :**

Project title: **YMAP Youth Mobilities**

Lab/Group Link: https://www.ymapproject.org/

Project description:

Project 3

YMAP: Youth Mobilities, Aspirations and Pathways Projects - Current ARC Discovery Project

Loretta Baldassar, Anita Harris (Research Professor in the Alfred Deakin Institute for Citizenship and Globalisation at Deakin University, Melbourne) and Shanthi Robertson (Senior Research Fellow in migration studies and globalization at the Institute of Culture and Society at Western Sydney University) are the chief investigators on the YMAP Project, funded by the Australian Research Council (2017-2022).

The project examines transnational mobility amongst young people moving both in and out of Australia in order to understand its real-life effects on their economic opportunities, social and family ties, citizenship and transitions to adulthood. Young people increasingly migrate abroad for work and education and Australia is a significant hub for sending and receiving. Much of this mobility is encouraged by current migration and education policies and is expected to provide youth with enhanced competitive skills. This project examines transnational mobility amongst young people moving both in and out of Australia in order to understand its actual effects on their economic opportunities, social and familial ties, capacity for citizenship and transitions to adulthood. It charts how youth from various cultural backgrounds productively manage mobility and develop economic, social and civic benefits – for themselves and the broader community. The project involves a five-year longitudinal study of 2000 young people aged 18-30 of Indian, Chinese, Italian and British ancestry, including both Australian citizens/permanent residents who have left Australia for 6+ months, and overseas citizens/permanent residents who have entered Australia for 6+ months.

Required skills, knowledge or experience:

Undergraduate major in anthropology, sociology, youth studies, social work, human geography; qualitative or quantitative research skills training.
Student contribution: the exact details of the student's role will be worked out in consultation with the student. The student will likely be involved in qualitative and/or quantitative data collection and analysis, including individual and focus group interviews, data entry and analysis and report writing.

Keywords: Youth studies; youth mobility; young people and transitions

Supervisor Contact email: loretta.baldassar@uwa.edu.au

Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 3

<table>
<tr><td colspan="2">Faculty: Faculty of Science
School:School of Biological Sciences</td></tr>
<tr><td>Main Supervisor : Prof Jacqui Batley</td><td>Co-supervisor(s) :</td></tr>
<tr><td>Project title:</td><td>Genomics of Plant Pathogen Interactions</td></tr>
<tr><td colspan="2">Lab/Group: Batley Lab
Lab/Group Link: www.batleylab.net</td></tr>
<tr><td colspan="2">Project description:
Research on the interactions between plants and pathogens has become one of the most rapidly moving fields in the plant sciences, findings of which have contributed to the development of new strategies and technologies for crop protection. A good example of plant and pathogen evolution is the gene-for-gene interaction between the fungal pathogen Leptosphaeria maculans, causal agent of Blackleg disease, and Brassica crops (canola, mustard, cabbage, cauliflower, broccoli, Brussels sprouts). The aim of this project is to use whole genome sequencing technologies to characterise the diversity and evolution of these genes in different wild and cultivated Brassica species. This will involve phenotypic analysis of the disease in a variety of cultivars and species and genetics to link to the phenotype</td></tr>
<tr><td colspan="2">Required skills, knowledge or experience:
Keen interest in plant biology, with knowledge of DNA and genetics</td></tr>
<tr><td colspan="2">Keywords: Genome sequencing, plant pathogen interactions, crop protection, evolution, food security</td></tr>
<tr><td colspan="2">Supervisor Contact email: Jacqueline.batley@uwa.edu.au</td></tr>
<tr><td>Project done on Crawley campus: Yes</td><td>Length of project: Standard 8 weeks (can be extended to 12 weeks)</td></tr>
<tr><td>Total number of project(s) offered by supervisor: 1</td><td>Total number of place(s) available with supervisor: 3</td></tr>
</table>

<table>
<tr><td colspan="2">Faculty: Faculty of Science
School: School of Molecular Sciences</td></tr>
<tr><td>Main Supervisor : A/Prof Michael Considine</td><td>Co-supervisor(s) : Dr Joanne Wisdom</td></tr>
<tr><td>Project title:</td><td>The photoperiod regulon of dormancy transitions in grapevine</td></tr>
<tr><td colspan="2">Lab/Group: Grapevine Biology Lab
Lab/Group Link: https://research-repository.uwa.edu.au/en/persons/michael-considine
www.vinebiology.com</td></tr>
<tr><td colspan="2">Project description:
<u>Project 1</u>
Grapevine is the most commercially important fruit crop and a scientific model woody plant. It is highly dependent on seasonal change to regulate growth cycles, however there is very little knowledge of how the onset of dormancy is regulated.

This study will carry out qPCR of homologues of key flowering regulators. In other woody species, these show specific patterns of control, which do not appear to apply in grapevine.

This study would be highly publishable.</td></tr>
<tr><td colspan="2">Required skills, knowledge or experience:
Molecular biology, specifically qRT-PCR</td></tr>
<tr><td colspan="2">Keywords: Gene expression, Molecular biology, Plant development, Grapevine</td></tr>
<tr><td colspan="2">Supervisor Contact email: michael.considine@uwa.edu.au</td></tr>
<tr><td>Project done on Crawley campus: Yes</td><td>Length of project: Standard 8 weeks (can be extended to 12 weeks)</td></tr>
<tr><td>Total number of project(s) offered by supervisor: 2</td><td>Total number of place(s) available with supervisor: 3 (1 for this project)</td></tr>
</table>

<table>
<tr><td colspan="2">Faculty: Faculty of Science
School: School of Molecular Sciences</td></tr>
<tr><td>Main Supervisor : A/Prof Michael Considine</td><td>Co-supervisor(s) : Dr Joanne Wisdom</td></tr>
<tr><td>Project title:</td><td>Regulation of antioxidant synthesis during dormancy transitions in grapevine</td></tr>
<tr><td colspan="2">Lab/Group: Grapevine Biology Lab
Lab/Group Link: https://research-repository.uwa.edu.au/en/persons/michael-considine
www.vinebiology.com</td></tr>
<tr><td colspan="2">Project description:
<u>Project 2</u>
Grapevine is the most commercially important fruit crop and a scientific model woody plant. It is highly dependent on seasonal change to regulate growth cycles, however there is very little knowledge of how the onset of dormancy is regulated. Of particular interest is that of antioxidants ascorbate and glutathione, which perform critical functions in signalling.

This study will carry out qPCR of homologues of the synthetic pathway of ascorbate and glutathione. Time permitting, the student would also measure ascorbate and glutathione concentrations.

This study is highly novel and would be publishable.</td></tr>
<tr><td colspan="2">Required skills, knowledge or experience:
Molecular biology and/or biochemistry. Specifically qPCR or metabolite assays.</td></tr>
<tr><td colspan="2">Keywords: Gene expression, Antioxidant and redox signalling, Plant development, Molecular biology and biochemistry</td></tr>
<tr><td colspan="2">Supervisor Contact email: michael.considine@uwa.edu.au</td></tr>
<tr><td>Project done on Crawley campus: Yes</td><td>Length of project: Standard 8 weeks (can be extended to 12 weeks)</td></tr>
<tr><td>Total number of project(s) offered by supervisor: 2</td><td>Total number of place(s) available with supervisor: 3 (2 for this project)</td></tr>
</table>

Faculty: Faculty of Science **School:School of Psychological Science**	
Main Supervisor : Dr Darja Kragt	**Co-supervisor(s) :**
Project title:	**Work factors and retirement adjustment**

Project description:

Project 1

This project aims to investigate work factors that contribute to retirement adjustment. The increased duration of retirement presents challenges (such as health care costs), but also opportunities to involve retirees in activities that are meaningful for them and the society. Investigating factors that contribute to a better life in retirement, therefore, is of importance. Retirement adjustment is defined as the process of getting used to life changes resulting from retirement. Because for majority of individuals retirement involves transition from working to not working, workplace factors play an important role in determining how individuals will experience their retirement. The aim of the project is to conduct a meta-analytical review of the literature.

The student involved in the project will likely assist with the coding process and some writing.

Required skills, knowledge or experience:

Undergraduate major in psychology, sociology, business, public health; qualitative or quantitative research skills training.

Keywords: Retirement adjustment, aging, workplace	
Supervisor Contact email: Darja.kragt@uwa.edu.au	
Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2

Faculty: Faculty of Science **School:School of Psychological Science**	
Main Supervisor : Dr Darja Kragt	**Co-supervisor(s) :**
Project title:	**The future of leadership in the age of AI**

Project description:

Project 2

This project aims to investigate how the advancement of artificial intelligence (AI) systems will change the nature of the workplace and, specifically, what impact this will have on leadership. The analysis of the future workplace relationships between human leaders, subordinates and machines is conducted through the lens of well-known organisational behaviour theory of social power. It will be argued that social power has been rarely acknowledged as part of leadership theorising in the past, but in the future technological workplaces it might hold the key to understanding new leadership challenges. Leading an intelligent machine (and humans) by relying on hierarchy and power abuse is highly ineffective. Instead, it is suggested that future leadership will exert influence through becoming experts in (human) relationships and/or will lead by focusing on a greater social good. It is also likely that a shift to more shared/distributed forms of leadership will be required to respond to the threat of a leadership takeover by the AI.

The student involved in the project will assist with conducting the literature review and some writing.

Required skills, knowledge or experience:

Undergraduate major in psychology, business, engineering, computer science; quantitative research skills training.

Keywords: Leadership, artificial intelligence, workplace relations	
Supervisor Contact email: Darja.kragt@uwa.edu.au	
Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2

Faculty: Faculty of Science
School: School of Psychological Science

Main Supervisor : Dr Julie Ji	**Co-supervisor(s) :**

Project title: **The CARE Study of Mental Wellbeing during COVID-19**

Lab/Group: Centre for the Advancement of Research on Emotion
Lab/Group Link: http://www.ermcare.com/

Project description:

The CARE Project on Mental Wellbeing during COVID-19 is a naturalistic longitudinal observational online survey study that examines the impact of social isolation and mental health during COVID-19. Led by Dr Julie Ji, Dr Julian Basanovic and Professor Colin MacLeod (UWA), the CARE Study is a major collaborative initiative between the University of Western Australia, prominent philanthropic foundations in Western Australia, and leaders in student mental health at collaborating institutions (including the Chinese University of Hong Kong, University of Cape Town, and Technical University of Monterrey). For more information, please visit www.thecarestudy.com. This is a large project with many aspects of the study that students can be involved in, particularly in assisting with the data processing and analyses aspects of the study.

Required skills, knowledge or experience:

Students should have either a background in psychology or data science. Specifically, the following are highly desired:

- Knowledge and experience of psychology and mental health research; &/or
- Knowledge and experience of data handling and statistical data analysis, ideally at an advanced level (e.g. including time series and mixed-effects modelling); &/or
- Knowledge and experience of machine-learning and natural language processing data analysis

Keywords: mental health, advanced data analysis, cross-cultural research, COVID-19

Supervisor Contact email: julie.ji@uwa.edu.au

Project done on Crawley campus: Not required	**Length of project:** Standard 8 weeks or longer
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 3

Faculty: Faculty of Science
School: School of Psychological Science

Main Supervisor : Liz Pritchard (Organisational Psychologist)	**Co-supervisor(s) :** Dr Serena Wee

Project title: **Workforce Diversity Benchmarking**

Lab/Group: Psychology at Work Lab
Lab/Group Link: https://www.uwa.edu.au/research/industrial-organisational-psychology-and-human-factors

Project description:
Diversity and inclusion is a strategic focus for many organisations but most organisations face significant challenges when it comes to measuring, understanding and implementing practices to meet this objective.

Industry is driven by both legislative obligations as well as a performance orientation when making decisions to embed diversity in their workplaces. To illustrate, the Workplace Gender Equality Act 2012 requires non-public sector employers with 100 or more employees to submit a report to the Workplace Gender Equality Agency on an annual basis as a means of tracking performance against key diversity metrics. Further, regular advice is issued from corporate governance leaders such as ASX recognising the productivity that comes from embracing diversity.

There are innumerable benefits to having a diverse workforce where differences are appreciated and valued (Wrench, 2005). Diversity is thought to deliver competitive advantages via inclusive organisational cultures, yet the evidence base for these effects can be patchy (Hicks-Clarke & Iles, 2000), with some recognising there can be unintended negative consequences. To mitigate these risks organisations can benefit from critically reflecting and assessing the outcomes and processes they wish to achieve via diversity management, ensuring these goals are aligned with other key organisation drivers. In order to do this effectively, it is necessary to understand the current state, desired future state, and the organisational process that needs to be supported to make that transition.

Valid and reliable measurement of diversity and inclusion practices underpins the effective diagnostic process, which is an essential part of understanding the organisational picture.

The focus for the Summer Down Under internship will be to assist the team in the development of the diagnostic benchmarking tool. This process will involve meeting with a few key stakeholders to understand their needs, as well as undertaking literature reviews, market appreciation analysis, and considering marketability in the development of the benchmarking tool.

Wrench, J. (2005). Diversity management can be bad for you. Race & Class, 46(3), 73-84.
Hicks-Clarke, D., & Iles, P. (2000). Climate for diversity and its effects on career and organisational attitudes and perceptions. Personnel review, 29(3), 324-345.

Required skills, knowledge or experience:
Background and interest in psychology, specifically work and organisational psychology. Skills in measurement, literature reviews and diversity desirable.

Keywords: Organisational psychology, diversity, inclusion, bench marking

Supervisor Contact email: liz.pritchard@uwa.edu.au

Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 2

Faculty: Faculty of Science
School: UWA School of Agriculture and Environment

Main Supervisor: Prof Graeme Martin	**Co-supervisor(s):** Prof Phil Vercoe

Project title:	**Genetic resistance of livestock to gastro-intestinal worms – understanding the immune system so we can reduce our reliance on drugs**

Project description:

In ruminant livestock, gastro-intestinal worms (helminths) reduce productivity. In most cases, the worms also cause diarrhoea (or 'scouring') and, in Merino sheep, the diarrhoea leads to faecal contamination around the anus (or 'breech') that attracts blowflies, leading to flystrike. Moreover, in Australia and around the world, the worms are becoming resistant to anthelminthic drugs. This 'worm-fly complex' costs the Australian Merino industry up to $700m pa.

After 25 years of genetic selection, the WA Department of Primary Industries and Regional Development (DPIRD) has produced helminth-susceptible and helminth-resistant sheep (the 'Rylington' flock). Resistance to helminth infection is assessed by worm egg counts (WEC) and the incidence of diarrhoea is assessed by the 'dag' score, a subjective assessment of the amount of faecal material adhering to the wool around the anus.

Breeding worm-resistant sheep is very effective, but a significant proportion of the worm-resistant animals still develop diarrhoea because they become hypersensitive to low-mild levels of worm infection. To explain the hypersensitivity, we need to identify the components of the immune system that are affected by worm infection and by genetic selection for worm resistance. The work involves characterising the humeral arm of immune response (concentrations of anti-worm antibodies in blood) and the cellular arm of immune response (cytokine concentrations in blood).

We expect these measurements to lead to a combined genetic trait that will allow simultaneous selection for resistance to both worms and diarrhoea. For livestock industries, this outcome would see improvements in profitability, animal welfare and marketplace image.

Required skills, knowledge or experience: studies in in animal science or veterinary science. Desirable but not essential: animal industry, animal physiology, genetics, immunology, parasitology.

Keywords: Animal industry; Animal physiology; Genetics; Immunology

Supervisor Contact email: Graeme.Martin@uwa.edu.au

Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total place(s) available with supervisor:** 4

<table>
<tr><td colspan="3">Faculty: Faculty of Science
School: UWA School of Agriculture and Environment</td></tr>
<tr><td colspan="2">Main Supervisor : Dr Sae Chi</td><td>Co-supervisor(s) : Prof Sharon Biermann,
Dr Doina Olaru and Dr Chao Sun</td></tr>
<tr><td>Project title:</td><td colspan="2">Quantifying economic impacts of emerging technologies in the transport sector</td></tr>
<tr><td colspan="3">Lab/Group: Planning and Transport Research Centre (PATREC)
Lab/Group Link: https://patrec.org/</td></tr>
<tr><td colspan="3">Project description:

This project reviews potential economic impacts of emerging technologies in the transport sector such as Mobility-as-a-Service (MaaS) and how they can be quantified.</td></tr>
<tr><td colspan="3">Required skills, knowledge or experience:
Economics or Civil Engineering</td></tr>
<tr><td colspan="3">Keywords: Transport economics, transport engineering, emerging technologies</td></tr>
<tr><td colspan="3">Supervisor Contact email: sae.chi@uwa.edu.au</td></tr>
<tr><td colspan="2">Project done on Crawley campus: Yes</td><td>Length of project: Standard 8 weeks (can be extended to 12 weeks)</td></tr>
<tr><td colspan="2">Total number of project(s) offered by supervisor: 3</td><td>Total number of place(s) available with supervisor: 5</td></tr>
</table>

<table>
<tr><td colspan="3">Faculty: Faculty of Science
School: UWA School of Agriculture and Environment</td></tr>
<tr><td colspan="2">Main Supervisor : Dr Sae Chi</td><td>Co-supervisor(s) : Prof Sharon Biermann,
Dr Doina Olaru and Dr Chao Sun</td></tr>
<tr><td>Project title:</td><td colspan="2">Assessing future uncertainties within existing transport infrastructure investment assessment frameworks</td></tr>
<tr><td colspan="3">Lab/Group: Planning and Transport Research Centre (PATREC)
Lab/Group Link: https://patrec.org/</td></tr>
<tr><td colspan="3">Project description:

This project reviews potential impacts and implications of future uncertainties in the transport sector. It then explores how they can be quantified and assessed within existing transport infrastructure investment assessment frameworks.</td></tr>
<tr><td colspan="3">Required skills, knowledge or experience:
Economics or Civil Engineering</td></tr>
<tr><td colspan="3">Keywords: Transport infrastructure, transport engineering, future uncertainties, infrastructure investment</td></tr>
<tr><td colspan="3">Supervisor Contact email: sae.chi@uwa.edu.au</td></tr>
<tr><td colspan="2">Project done on Crawley campus: Yes</td><td>Length of project: Standard 8 weeks (can be extended to 12 weeks)</td></tr>
<tr><td colspan="2">Total number of project(s) offered by supervisor: 3</td><td>Total number of place(s) available with supervisor: 5</td></tr>
</table>

<table>
<tr><td colspan="2">Faculty: Faculty of Science
School: UWA School of Agriculture and Environment</td></tr>
<tr><td>Main Supervisor : Dr Sae Chi</td><td>Co-supervisor(s) : Prof Sharon Biermann,
Dr Doina Olaru and Dr Chao Sun</td></tr>
<tr><td colspan="2">Project title: Port planning</td></tr>
<tr><td colspan="2">Lab/Group: Planning and Transport Research Centre (PATREC)
Lab/Group Link: https://patrec.org/</td></tr>
<tr><td colspan="2">Project description:

This project reviews how port options are assessed in other jurisdictions (other states and overseas) and how they can be applied to the Perth context.</td></tr>
<tr><td colspan="2">Required skills, knowledge or experience:
Economics or Civil Engineering</td></tr>
<tr><td colspan="2">Keywords: Transport, port planning, infrastructure investment, planning</td></tr>
<tr><td colspan="2">Supervisor Contact email: sae.chi@uwa.edu.au</td></tr>
<tr><td>Project done on Crawley campus: Yes</td><td>Length of project: Standard 8 weeks (can be extended to 12 weeks)</td></tr>
<tr><td>Total number of project(s) offered by supervisor: 3</td><td>Total number of place(s) available with supervisor: 5</td></tr>
</table>

Faculty: Faculty of Engineering and Mathematical Sciences **School:Engineering**	
Main Supervisor : Dr Sally Male	**Co-supervisor(s) :**
Project title:	**Empathy in Engineering**
Lab/Group: Engineering & Science Education, Society and Work **Lab/Group Link:** https://www.uwa.edu.au/research/engineering-and-science-education-society-and-work	
Project description: Strobel, Hess, and others, have found that engineers in the USA and Europe consider empathy and care to be important for engineering practice. This project would be part of a larger project involving a collaboration between UWA and University of Missouri. Empathy has not traditionally been taught in engineering degree programs. We are studying Australian engineers' perceptions of the importance and relevance of empathy in engineering to inform engineering education. You would use threshold concept theory, which is a curriculum development theory. You would be guided in understanding threshold concept theory and developing interview skills. You would interview a small number of practising engineering graduates about their experiences of threshold concepts related to empathy in engineering and analyse your transcripts to identify potential threshold concepts related to empathy in engineering. Note: The Australasian Association for Engineering Education Postgraduate Winter School will be held at UWA 13-17 July 2020. There could be an opportunity to join this.	
Required skills, knowledge or experience: This project would suit an engineering student with an interest in engineering practice and engineering education. Strong communication skills (reading, writing, and interacting with others) would be essential.	
Keywords: Engineering, education, threshold concepts, empathy, interviews	
Supervisor Contact email: sally.male@uwa.edu.au	
Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 1

Faculty: Faculty of Engineering and Mathematical Sciences **School:Physics, Mathematics and Computing**	
Main Supervisor : Prof Jingbo Wang	**Co-supervisor(s) :** Sam Marsh, Gareth Jay, Mitchell Chiew, Kooper De Lacy
Project title:	**Quantum Machine Learning**
Lab/Group Link: http://www.physics.uwa.edu.au/research/quantum-dynamics-computation	
Project description: Quantum computing has come a long way since the discovery of Shor's factoring (1995) and Grover's search (1996) algorithms. We now know a quantum computer can solve enormously large set of linear equations, can simulate a wide range of Hamiltonians representing chemical and biological systems, can perform various linear transformations including Fourier transforms, and can efficiently evaluate inner products and distances in super high dimensional vector space, the last of which is particularly useful in machine learning. In this project, we will explore applications in machine learning, taking advantage of intrinsic quantum correlations and quantum parallelism. In particular, we will examine which parts of classical machine learning algorithms can speed up in the quantum setting with deterministic queries.	
Required skills, knowledge or experience: Quantum physics, linear algebra, and basic programming skills	
Keywords: Quantum computing, quantum information, quantum walk, machine learning, optimisation, graph theory	
Supervisor Contact email: jingbo.wang@uwa.edu.au	
Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 1

Faculty: Faculty of Engineering and Mathematical Sciences **School: Physics, Mathematics and Computing**	
Main Supervisor : Prof Kenji Bekki	**Co-supervisor(s) :**
Project title:	**Deep learning for classifying the synthesized images of galaxies from computer simulations**

Project description:

Learning is classifying. Therefore, classifying galaxies can lead us to learn important aspects of galaxy formation and evolution. In this project, students will try to develop a new convolution neural network (CNN) to classify the synthesized images of galaxies produced by high-resolution computer simulations of galaxies. First, students in this project will use a million of synthesized galaxy images to train the CNN for an automated classification of galaxies. Then they will classify the observed images of galaxies from telescopes using the trained CNN in an automatic way. This novel galaxy classification scheme will be able to be used for real scientific research to discover something new (e.g., new discovery of hidden spiral arm structures, massive black holes, and dark matter etc).

Required skills, knowledge or experience:

Programming skills of Python and Keras/Tensorflow (AI libraries) and some basic knowledge / about deep learning are required.

Keywords: Artificial intelligence (AI), astronomy, computer simulations	
Supervisor Contact email: kenji.bekki@uwa.edu.au	
Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 3

<table>
<tr><td colspan="2">Faculty: Faculty of Engineering and Mathematical Sciences
School:Physics, Mathematics and Computing</td></tr>
<tr><td>Main Supervisor : Prof Linqing Wen</td><td>Co-supervisor(s) :</td></tr>
<tr><td>Project title:</td><td>Pre-merger detection of gravitational waves</td></tr>
<tr><td colspan="2">Lab/Group:
Lab/Group Link:</td></tr>
<tr><td colspan="2">Project description:
The project aims at detecting and localising gravitational waves from the inspiral of two compact objects before their final merger for early warnings of gravitational wave events. The students will help with the implementation and testing of the search methods.</td></tr>
<tr><td colspan="2">Required skills, knowledge or experience:
Proficient in C or Python programming language</td></tr>
<tr><td colspan="2">Keywords: gravitational wave, astronomy, detection, data analysis, signal processing, early warning, multi-messenger, simulation</td></tr>
<tr><td colspan="2">Supervisor Contact email: linqing.wen@uwa.edu.au</td></tr>
<tr><td>Project done on Crawley campus: Yes</td><td>Length of project: Standard 8 weeks</td></tr>
<tr><td>Total number of project(s) offered by supervisor: 1</td><td>Total number of place(s) available with supervisor: 1</td></tr>
</table>

Faculty: Faculty of Engineering and Mathematical Sciences **School:Physics, Mathematics and Computing**	
Main Supervisor : Prof Linqing Wen	**Co-supervisor(s) :**
Project title:	**Search for Electromagnetic Counterparts of Gravitational Wave Events**
Lab/Group: **Lab/Group Link:**	
Project description: The project aims searching for electromagnetic counterparts of gravitational wave events. The students will conduct searches in available astronomical databases for fast radio bursts (and possibly gamma-ray burst) counterparts of gravitational waves.	
Required skills, knowledge or experience: Astronomy, comfortable with writing C/python/Unix-shell scripts	
Keywords: gravitational wave, astronomy, detection, data analysis, signal processing, early warning, multi-messenger, simulation	
Supervisor Contact email: linqing.wen@uwa.edu.au	
Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 1

Faculty: Faculty of Engineering and Mathematical Sciences
School: Physics, Mathematics and Computing

Main Supervisor : Dr Luca Cortese	**Co-supervisor(s) :** Dr Amelia Fraser-McKelvie / Dr Alfred Tiley

Project title: **A panchromatic view of galaxy evolution**

Lab/Group: International Centre for Radio Astronomy Research
Lab/Group Link: https://www.icrar.org/
https://corteseluca.wordpress.com/

Project description:
One of the most outstanding challenges in extragalactic astronomy is to identify the astrophysical processes responsible for transforming simple dark matter haloes into the heterogeneous population of galaxies inhabiting today's Universe. How did different morphological types form and evolve? Does the environment where a galaxy lives influence its evolution? Inevitably, the answers to these questions entail a detailed investigation of all the components of the interstellar medium (gas, dust, metals) and their relation to stellar properties, kinematics and environment. This clearly requires multi-frequency information (e.g., including ultraviolet, optical, infrared and radio observations) for statistically significant samples of galaxies across the cosmic web, which are becoming available only now.

Our research group investigates the physical properties of galaxies and their dependence on redshift and environment using large, multi-wavelength datasets. The multi-wavelength approach is at the foundation of our research, as it is the only way to trace all the baryonic constituents of galaxies and to reveal how the Universe formed and evolves.

We offer projects spanning a wide range of topics, and taking advantage of observations obtained with state-of-the-art ground- and space-based facilities. The expectation is that, during this internship, the student will gain the ability of handling and analyzing multi-frequency observations of galaxies, with specific focus on state-of-the-art integral field spectroscopic observations, providing a 3D view of the distribution and kinematics of stars, gas and metals in galaxies (e.g., SAMI, MANGA, KROSS). S/he may also be involved in the publications of the project results on refereed journals in the field. In particular, the student will have the opportunity to work on on-going projects aimed at understanding the physical processes regulating the star formation activity of galaxies and the interplay between galaxy kinematics and visual morphology.

Required skills, knowledge or experience:
Basic knowledge of observational extragalactic astronomy (e.g., completion of introductory unit to galaxies).
Basic experience in handling astronomical observations (e.g., use of ds9/SAOImage and knowledge of FITS format).
Basic programming knowledge with Python or R (i.e., ability to produce plots).
Basic knowledge of statistical methods and their application to large datasets.

Keywords: Galaxies, Star formation, Telescopes, Big data

Supervisor Contact email: luca.cortese@uwa.edu.au

Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks (can be extended to 12 weeks)
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 2

Faculty: Faculty of Engineering and Mathematical Sciences **School: Physics, Mathematics and Computing**	
Main Supervisor : Prof Mark Reynolds	**Co-supervisor(s) :** Prof Jingbo Wang
Project title:	**Logic via Quantum Computing**
Lab/Group: Quantum information simulation and algorithms Research Cluster **Lab/Group Link:** https://www.uwa.edu.au/research/quantum-information-simulation-and-algorithms	
Project description: Can quantum computers calculate anything faster than classical computers? A famous result from 1994 shows that theoretically they can factor integers exponentially faster than any known classical algorithm. But that does not prove that classical computers are slower: there might be classical methods as yet unknown which solve this problem. A new 2018 result from an IBM research lab finds a class of problems and shows that a certain type of quantum algorithm, fixed circuit depth ones, can solve such problems. However, no fixed circuit depth classical algorithm can solve the problems. See the blog and video at https://www.ibm.com/blogs/research/2018/10/quantum-advantage-2/ One important fixed circuit depth problem is 3-SAT which is a famous NP-complete decision problem. This is the problem of determining whether a Boolean, or classical propositional logic formula (in a certain restricted format) is satisfiable, or could be made true by choice of truth values of its propositional atoms. This project aims to see if any speed-up can be hoped for in using Quantum Computing on related propositional logic search algorithms.	
Required skills, knowledge or experience: Good linear algebra skills	
Keywords: Quantum Computing, Logic, Algorithms, Complexity	
Supervisor Contact email: mark.reynolds@uwa.edu.au	
Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 4	**Total number of place(s) available with supervisor:** 5

Faculty: Faculty of Engineering and Mathematical Sciences **School: Physics, Mathematics and Computing**	
Main Supervisor : Prof Mark Reynolds	**Co-supervisor(s) :** Dr Du Huynh
Project title:	**Road Puddle and Splash Identification in Video**
Lab/Group: Systems for Knowledge Discovery from Data, Research Cluster **Lab/Group Link:** https://www.uwa.edu.au/research/systems-for-knowledge-discovery-from-data	
Project description: Implement image processing algorithms for the automatic detection of hazardous and nuisance amounts of water splashing on to a major Perth road from a fixed traffic camera video. There is an area of one of the busy main Perth freeways that is along a river and is susceptible to getting river water splashed on to it from waves and wind. This causes issues for motorists and could be hazardous. There is a fixed video traffic camera trained on this location providing a constant stream of image frames. This project will use current UWA CSSE video processing techniques and machine learning identification algorithms to attempt to automate the detection of when splash situations are occurring in real-time. There is separate data from on road water detectors which can be used to judge the effectiveness of the detection. The team works closely with Main Roads WA on traffic image processing and this project fits in as part of that work.	
Required skills, knowledge or experience: Good Python programming knowledge	
Keywords: Machine Learning, Image Processing, Data Science	
Supervisor Contact email: mark.reynolds@uwa.edu.au	
Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 4	**Total number of place(s) available with supervisor:** 5

Faculty: Faculty of Engineering and Mathematical Sciences
School: Physics, Mathematics and Computing

Main Supervisor : Prof Mark Reynolds	**Co-supervisor(s) :** Dr Du Huynh

Project title: **Bat Call Identification via Machine Learning**

Lab/Group: Systems for Knowledge Discovery from Data, Research Cluster
Lab/Group Link: https://www.uwa.edu.au/research/systems-for-knowledge-discovery-from-data

Project description:
Bats are useful indicator species in ecological surveys. Typically a device will record ultrasonic echolocation calls in the field and the subsequent data will be analysed to identify the bat species present. This is a laborious process that is amenable to machine learning. One such proprietary system has been used successfully to classify several years of calls in the South Coast region of WA.

However, some bat species, especially of the genus nyctophilus, are not amenable to the zero crossing techniques commonly used. McKenzie and Bullen (2003, 2009, 2012) have shown that the sharpness quotient, Q, of the fundamental harmonic and the characteristic frequency of the bat call cluster rather distinctly between different species of bats including nyctophilus.

The aim of this project is to examine whether similar techniques might be used for machine learning of call identification for the bats of the South Coast region.

You would be provided with full spectrum recordings covering several years in WAC/WAV files plus zero crossing analysis data and probable bat identification.

There would be a requirement to complete a Bush Heritage Australia research project form which details IP and the like.

Required skills, knowledge or experience:
Good Python programming knowledge

Keywords: Machine Learning, Signal Processing, Data Science

Supervisor Contact email: mark.reynolds@uwa.edu.au

Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisors: 4	**Total number of place(s) available with supervisor:** 5

Faculty: Faculty of Engineering and Mathematical Sciences **School: Physics, Mathematics and Computing**	
Main Supervisor : Prof Mark Reynolds	**Co-supervisor(s) :** Dr Du Huynh
Project title:	**Bee Identification and Tracking in Video**
Lab/Group: Systems for Knowledge Discovery from Data, Research Cluster **Lab/Group Link:** https://www.uwa.edu.au/research/systems-for-knowledge-discovery-from-data	
Project description: Understanding bee behaviour is important for ecological and economic reasons. In the Australian Government funded Cooperative Research Centre (CRC) for Honey Bee Products, researchers record videos of bee activities near flowers in the Australian bush. Currently useful information such as bee species identification, bee numbers and bee movement between flowers is extracted from the recording by human observers. This project will use current UWA CSSE video processing tracking techniques and machine learning identification algorithms to attempt to automate most of the information extraction. Related work will explore the geographical spatial distribution of bee activities in the areas under study. The student will work closely with CRC scientists.	
Required skills, knowledge or experience: Good Python programming knowledge	
Keywords: Machine Learning, Image Processing, Data Science	
Supervisor Contact email: mark.reynolds@uwa.edu.au	
Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 4	**Total number of place(s) available with supervisor:** 5

Faculty: Faculty of Engineering and Mathematical Sciences **School:Physics, Mathematics and Computing**	
Main Supervisor : Dr Michael Giudici	**Co-supervisor(s) :**
Project title:	**Permutation groups and graph symmetry**
Lab/Group: Centre for the Mathematics of Symmetry and Computation **Lab/Group Link:** https://www.cmsc.io/	
Project description: Permutation groups measure the symmetry of an object. One way in which they arise are as the symmetries of a graph. Knowledge of group theory then enables the construction and classification of families of symmetric graphs. Equally, graphs can be used to study group, for example Cayley graphs. This project will explore some of these connections.	
Required skills, knowledge or experience: A first course in group theory	
Keywords: Group theory, graph theory	
Supervisor Contact email: michael.giudici@uwa.edu.au	
Project done on Crawley campus: Yes	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 1

<table>
<tr><td colspan="2">Faculty: Faculty of Engineering and Mathematical Sciences
School: Physics, Mathematics and Computing</td></tr>
<tr><td>Main Supervisor : Dr. Zeyi Wen</td><td>Co-supervisor(s) : Prof Ajmal Mian</td></tr>
<tr><td>Project title:</td><td>Automatic Machine Learning</td></tr>
<tr><td colspan="2">Lab/Group Link: https://zeyiwen.github.io/</td></tr>
<tr><td colspan="2">Project description:
Machine learning has achieved great success in recent years. However, machine learning techniques are still not accessible to many practitioners who are knowledgeable in their domains, but unfamiliar with machine learning techniques (e.g., hyper-parameter tuning). Automatic machine learning can help increase the accessibility of the techniques to the wider communities.

This project will visit key areas of automatic machine learning. The research tasks in this project include:
(i) experimental studies to demonstrate pros and cons of existing automatic machine learning techniques;
(ii) applications with automatic hyper-parameter tuning techniques;
(iii) case studies on automated feature engineering techniques.</td></tr>
<tr><td colspan="2">Required skills, knowledge or experience:
Good programming skills in Python, Java or C/C++;
Basic knowledge in machine learning</td></tr>
<tr><td colspan="2">Keywords: Machine Learning, Artificial Intelligence, Computer Science</td></tr>
<tr><td colspan="2">Supervisor Contact email: zeyi.wen@uwa.edu.au</td></tr>
<tr><td>Project done on Crawley campus: Yes</td><td>Length of project: Standard 8 weeks (can be extended to 12 weeks)</td></tr>
<tr><td>Total number of project(s) offered by supervisor: 1</td><td>Total number of place(s) available with supervisor: 3</td></tr>
</table>

Faculty: Faculty of Engineering and Mathematical Sciences
School: Oceans Graduate School

Main Supervisor : Dr Adi Kurniawan	**Co-supervisor(s) :** Dr Hugh Wolgamot and Dr Jana Orszaghova

Project title: **Wave energy devices with adaptive geometry**

Lab/Group: Wave Energy Research Centre

Project description:

Project 1

Modern wind turbines are equipped with mechanisms to alter the orientation of the rotor and the blades relative to the wind direction and wind speed. This serves to regulate power output as well as mitigate loads in severe conditions. Such adaptability is key to an economic design in a variable environment. It allows a structure to survive the worst loading scenarios without being overdesigned and maximises energy absorption under constantly changing environmental conditions.

In contrast to wind turbines, many wave energy devices proposed to date do not have such adaptability incorporated into their design. The aim of this project is therefore to explore the potential of innovative adaptive geometry in a wave energy device. The hypothesis is that a wave energy device with adaptive geometry is potentially able not only to reduce loads but also to improve its power absorption performance across a wide range of wave conditions.

In this project, we will consider a wave energy device in the form of a bottom-mounted arm supporting a wide flap. Power is absorbed through rotation of the arm about a hinge on the sea bed. This so far sounds like yet another bottom-mounted flap device. However, the device is designed such that the flap can rotate and translate relative to the arm, thus adding an adaptive geometry feature to an otherwise ordinary flap. A numerical model will be developed to study the effects of flap orientation and position on the device power capture and loads. The geometry of the device will be optimised with the goal of achieving a cost-effective wave energy device.

Required skills, knowledge or experience:
Experience with programming languages such as MATLAB or Python is essential. Experience with hydrodynamic packages such as WAMIT, HydroStar, or NEMOH are desired.

Keywords: Waves, Energy, Modelling, Ocean, Engineering

Supervisor Contact email: adi.kurniawan@uwa.edu.au

Project done on Crawley campus: No (The project will be carried out mainly at the Wave Energy Research Centre in Albany - 6weeks*)	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2 (1 for this project)

<table>
<tr><td colspan="2">Faculty: Faculty of Engineering and Mathematical Sciences
School: Oceans Graduate School</td></tr>
<tr><td>Main Supervisor : Dr Adi Kurniawan</td><td>Co-supervisor(s) : Dr Hugh Wolgamot and
Dr Jana Orszaghova</td></tr>
<tr><td>Project title:</td><td>Which wave energy device is the best?</td></tr>
<tr><td colspan="2">Lab/Group: Wave Energy Research Centre</td></tr>
<tr><td colspan="2">Project description:
<u>Project 2</u>
Although many fundamental results concerning wave power absorption have already been discovered about four decades ago, harnessing wave energy in an economical manner remains an open question. There are yet no signs of wave energy technology converging into a single solution.

While there are numerous separate studies looking at specific wave energy devices, comparative studies of different devices are rare, and thus little is known about how devices measure against each other.

In this project, we will collect existing data on the power capture of various wave energy devices available in the literature. We will use these data to evaluate various performance metrics of each device, including not only the capture width ratio but also other potentially better non-dimensional metrics to more accurately measure the economic potential of a wave energy device. We will then compare the various devices on the basis of these metrics. One further aspect of the study is to compare the performance of these devices at different sites around the world, covering both the northern and southern hemispheres, thus providing a general correlation between wave climates and device economics. Albany will be used as one of the sites for this study.

The goal is to provide a comparison of the relative cost-effectiveness of different wave energy devices, and by doing so identify the most promising ones.</td></tr>
<tr><td colspan="2">Required skills, knowledge or experience:
Experience with programming languages such as MATLAB or Python is essential.</td></tr>
<tr><td colspan="2">Keywords: Waves, Energy, Engineering, Economics, Ocean</td></tr>
<tr><td colspan="2">Supervisor Contact email: adi.kurniawan@uwa.edu.au</td></tr>
<tr><td>Project done on Crawley campus: No (The project will be carried out mainly at the Wave Energy Research Centre in Albany - 6weeks*)</td><td>Length of project: Standard 8 weeks</td></tr>
<tr><td>Total number of project(s) offered by supervisor: 2</td><td>Total number of place(s) available with supervisor: 2 (1 for this project)</td></tr>
</table>

THE UNIVERSITY OF WESTERN AUSTRALIA

Perth is one of Australia's most affordable capital cities

(Worldwide Cost of Living Survey 2018, Economist Intelligence Unit)

Internationally recognised

Ranked in the world's Top 100

and **1st** in Western Australia *(ARWU 2019)*

5 stars+ for research, teaching, internationalisation, specialist criteria, employability, facilities, innovation and inclusiveness

(QS Stars University Ratings 2018)

Schooling for children of Master's & PhD students*

*Some schools have limited places and other modest fees apply. For more information visit study.uwa.edu.au/international-students/moving-to-perth/dependant-schooling

Ranked in the world's TOP 50

- Agriculture and Forestry
- Anatomy and Physiology
- Civil and Structural Engineering
- Earth and Marine Sciences
- Performing Arts
- Psychology
- Mineral and Mining Engineering

(QS 2018)

Global Engagement Office (GEO)

The University of Western Australia
M464A, 35 Stirling Highway
Perth WA 6009
Tel: +61 8 6488 7587
jerline.chen@uwa.edu.au

CRICOS Provider Code: 00126G

GROUP OF EIGHT AUSTRALIA