HDR Application Form

Introduction

SmartSat CRC (SmartSat) full and top-up scholarships, of up to 3 years maximum duration, are available to higher degree research (HDR) students who participate in SmartSat education and training program.

Scholarship recipients must enrol in a SmartSat partner (host) university and the supervision team will normally comprise the Principal Supervisor (host university); where practicable, an academic co-supervisor from another SmartSat partner university; and a co-supervisor from a relevant SmartSat end-user or Industry partner.

All students within the SmartSat education and training Program become valuable members of SmartSat, benefit from being a part of the graduate network, and an extensive professional development program that includes opportunities to participate in the SmartSat conference series and networking events.

Our students also benefit from being part of an organisation that links research and industry. SmartSat actively encourage students to undertake periods of placement with industry and end-user partners so they have both academic and industry-based research experience.

Application Conditions

1. Complete forms must be emailed by the applicant in pdf format (please compile into one file) to HDR@smartsatcrc.com
2. Applicants must be enrolled, or will be seeking to enrol, at a SmartSat partner university.
3. Applicants must have discussed their research with a University supervisor.

Scholarship Conditions

1. Generous full scholarships or top-up scholarship stipends for international students will be offered to suitably qualified applicants;
2. PhD Scholarships are available for up to 3 years.
3. Where SmartSat funds the scholarship the default position will be that SmartSat owns the IP. If there are opportunities to commercially exploit that IP then SmartSat will take a generous position in relation to helping the student share in the commercialisation activities and any benefits.

Scholarship Obligations

Scholarship holders will:

1. Maintain enrolment through satisfactory progress;
2. Comply with policies, procedures and codes of conduct of the host university;
3. Participate in the SmartSat induction process at commencement of the scholarship;
4. Participate in SmartSat professional development activities and reviews during the term of the scholarship;
5. Contribute to the achievement of the SmartSat objectives including that of the activating project;
6. Make outcomes from the research available to SmartSat staff and stakeholders;
7. Submit a progress report every 6-12 months;
8. Acknowledge SmartSat support in publications and presentations; and

9. Lodge a copy of their completed thesis and any publications with SmartSat for publication through the website and allied channels.

CHECKLIST

Please check the following items before submitting your form.

☐ I am enrolled at a SmartSat partner university (attach a copy of your Offer of Candidature)

OR

☑ I am seeking enrolment at a SmartSat partner university (attach evidence),

☑ My research is aligned with an SmartSat research project or priority theme

☑ Academic transcript(s) are attached (there is no requirement for these to be certified)

☑ Curriculum Vitae / resume is attached

☑ Research proposal of 2-3 pages is attached

☑ I have asked my proposed supervisor(s) to independently provide a statement of support

PERSONAL DETAILS

First Name William. **Surname** Meakin.

Address 18 / 347 Sir Donald Bradman Drive, Brooklyn Park, 5032.

Telephone -. **Mobile** 0401 680 173.

Email wjmeakin@gmail.com.

What degrees do you already hold? Bachelor of Software Engineering (Honours)

University Name University of South Australia.

Degree Bachelor of Software Engineering (Honours). **Year** 2017

Attach your academic transcript(s) to this application. See below

Your country of origin (required by Commonwealth CRC Program) Australia.

SCHOLARSHIP INFORMATION

What is your intended scholarship?

PhD Full ☐ **PhD Top- Up** ☑ (attach details of your current scholarship)

Domestic student ☑ **International student** ☐

What is your time commitment to your research?

Part time ☐ **Full time** ☑

If research has already started, start date Intended start: Jan 2022.

Expected finish date Dec 2024.

RELEVANT EXPERIENCE

Do you have any relevant academic or industry / end-user experience?

1. Organisation Minelab.

Position Honours Industry Placement. **Years** 2016.

Brief Description of Role

As part of my Honours ICT project I conducted research into optimising a correlation coefficient algorithm written in OpenCV by reimplementing it in CUDA. I found that the abstraction offered by OpenCV restricted certain optimisations made available by the lower level CUDA API, such as kernel merging.

This resulted in higher performance and lower power consumption for the end application, which was crucial for the target embedded platform.

2. Organisation University of South Australia.

Position Research Assistant. **Years** 2017.

Brief Description of Role

After graduating, I spent a year as a research assistant in UniSA's Advanced Computing Research Centre. Here I gained experience with wide residual networks for facial expression recognition, spherical camera calibration, and using the Tensorflow object detection API to conduct experiments for neural network calibration on popular datasets such as COCO.

Attach your curriculum vitae / resume.

~See below

List any other relevant material you have attached: -

Referees

1. Name Assoc. Prof Stewart Von Itzstein. **Relationship** UniSA supervisor.

Email Stewart.VonItzstein@unisa.edu.au. **Phone** 8302 3056.

2. Name Dr. John Hopf. **Relationship** UniSA supervisor.

Email John.Hopf@baesystems.com. **Phone** 0415 781 262.

RESEARCH DETAILS

Proposed Research Topic (if known)

Onboard Machine Learning for Intelligent Satellites

In a separate attachment, of approximately 2-3 pages, please attach a brief project plan, including the following sections:

1. **Background**
2. **Research problem(s) and Methodology**
3. **Expected outcomes**
4. **Project timeline and achievability**

In 300 words describe how your research will align to the SmartSat priority research areas, including any alignment to areas of application (i.e. Agriculture, Mining and Resources, Disaster and Emergency Management, Water and Environmental Management).

This project's resulting system will demonstrate and enable *Advanced Autonomy* through *Embodied Intelligence* by dynamically reconfiguring the processing techniques used based on observations. Autonomously understanding and processing usable or notable detections can save communication bandwidth, and enhance results through adaptive tasking of a sensor suite. Higher fidelity intelligence from *Remote Sensing* will allow *Onboard Analytics* to provide more accurate, prompt, and relevant data.

While this project will target ISR, the resulting system can be configured to any domain, and can be quickly customised for industry use. Areas that can benefit include *Disaster and Emergency Management*, where tracking and responding to an evolving situation quickly means crucial information is communicated efficiently. *Water and Environmental Management* too, where real-time hydrological analysis is needed to gauge flow changes, or real-time monitoring of forests and *Agricultural* crops can detect climate events or pest infestations.

In 300 words what is the intended nature and extent of your industry/end-user interaction within this scholarship?

This project will develop a system tailored for industry partner DSTG's ????? project/ platform. The goals will be to achieve outputs of ????? . The proposed system will aid this by providing real-time processing of data on-board ????? . Metrics of success will include deployment to ????? and enablement of ????, demonstrating enhancement over previous technologies.

DSTG end-user FirstName LastName will provide support in the capacity of providing access to platform/datasets ?????, and give clear expectations and timelines of goals. They will be provided with progress reports and system demonstrations to give feedback on direction/requirements ????? .

SUPERVISOR DETAILS AND REPORTS

Proposed Academic Supervisor(s)

1. University Name The University of Adelaide.
Supervisor Name & contact details

Name: Professor Tat-Jun Chin
Email: tat-jun.chin@adelaide.edu.au
Phone: (08) 8313 6188

Proposed End-user / Industry Co-Supervisor(s)

1. Organisation Defence Science and Technology Group
Co-Supervisor Name & contact details

Name:
Email:
Phone:

Academic supervisors are to provide a short confidential report on the PhD candidate including:

- The student's record to date and likelihood of successful and timely completion
- Your experience with the student

(The report should comprise no more than a few paragraphs. Should there be any conflicts of interest these should be noted.)

End-user co-supervisors are to provide a short confidential report on the PhD candidate including:

- The student's record to date and likelihood of successful and timely completion
- Your experience with the student

(The report should comprise no more than a few paragraphs. Should there be any conflicts of interest these should be noted.)

Note: if the student applicant does not yet have an end-user co-supervisor then SmartSat will assist in identifying potential candidates.

Gmail **William Meakin <wjmeakin@gmail.com>**

Confirmation of Receipt of your Higher Degree by Research Application

1 message

donotreply@adelaide.edu.au <donotreply@adelaide.edu.au> Sat, Oct 30, 2021 at 7:54 PM
To: wjmeakin@gmail.com

Dear Applicant,

Thank you for your application for a Higher Degree by Research program at the University of Adelaide.

The Registration Number of your application is **90109.** Please quote this number in all correspondence with the Adelaide Graduate Centre.

Your application will now be considered by the University.

You will be notified in writing of the outcome of your application in due course.

Regards

Higher Degree by Research Admissions Team
Adelaide Graduate Centre
Level 10 Schulz Building
The University of Adelaide, AUSTRALIA 5005
Ph: +61 8 8313 5882
e-mail: hdr_admissions@adelaide.edu.au
CRICOS Provider Number 00123M

University of South Australia

Name	William John Meakin
Student ID	110120221
Issue Date	3 May 2017

Official Academic Transcript

Program Summary

Conferred Programs

Program Code	LHSG
Program Name	**Bachelor of Software Engineering (Honours)**
Degree Honours	First Class Honours
Status	**Conferred on 28 March 2017**
Post-Nominals	BSoftwEng(Hons)
Program GPA	6.62

Inactive Programs

Program Name	**Bachelor of Software Engineering LBSG**

Year	Program	Prizes and Awards
2016	LHSG	BAE Systems - George H B Haskard Prize
	LHSG	Chancellor's Letters of Commendation
2015	LHSG	Chancellor's Letters of Commendation
2014	LBSG	University Merit Awards
2013	LBSG	University Merit Awards

Year	Program	Course Code	Course Description	Units	Grade
2016	LHSG	INFT 3032	Game Engines and Graphics	4.50	Credit
	LHSG	INFT 4017	Research Methods	4.50	Distinction
	LHSG	INFT 4023	ICT Specialist Major Project 2 (Honours)	9.00	High Distinction
	LHSG	COMP 4025	Advanced Knowledge Representation	4.50	High Distinction
	LHSG	COMP 4034	Advanced IT Prototyping Concepts	4.50	High Distinction
	LHSG	INFT 4022	ICT Specialist Major Project 1 (Honours)	9.00	High Distinction
2015	LHSG	COMP 3022	Computer Science Topics for Software Engineers	4.50	Distinction
	LHSG	COMP 3024	Systems Architecture	4.50	High Distinction
	LHSG	INFT 3029	Cloud Programming	4.50	High Distinction
	LHSG	INFT 3033	Mobile Application Enterprise Development	4.50	High Distinction
	LHSG	COMP 2019	Artificial Intelligence	4.50	Distinction
	LHSG	COMP 3021	Agile Development with .NET	4.50	Distinction
	LHSG	INFT 3030	Concurrent Programming	4.50	High Distinction
	LHSG	INFT 3034	Mobile Game Development	4.50	High Distinction
2014	LBSG	COMP 3023	Software Development with C++	4.50	High Distinction
	LBSG	INFS 2011	Database Technology	4.50	Distinction
	LBSG	INFT 1004	User Interfaces	4.50	Credit
	LBSG	INFT 2061	Web Engineering	4.50	High Distinction
	LBSG	COMP 2012	Data Structures	4.50	High Distinction
	LBSG	INFS 2035	Systems Analysis, Design and Project Management	9.00	Distinction
	LBSG	MATH 1043	Discrete Mathematics	4.50	Distinction
2013	LBSG	COMP 1040	Programming Fundamentals	4.50	Distinction

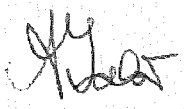
- Academic Record continued on next page -

University of
South Australia

Name	William John Meakin
Student ID	110120221
Issue Date	3 May 2017

Year	Program	Course Code	Course Description	Units	Grade
2013	LBSG	INFS 1019	Web and Database Development	9.00	High Distinction
	LBSG	INFT 1012	Network Fundamentals	4.50	Distinction
	LBSG	COMP 1039	Problem Solving and Programming	4.50	High Distinction
	LBSG	INFS 1014	Information Systems Professional Practice	9.00	Credit
	LBSG	INFT 1016	Information Technology Fundamentals	4.50	High Distinction

End of Academic Record



Allan Tabor
Academic Registrar

University of South Australia

Name	William John Meakin
Student ID	110120221
Issue Date	3 May 2017

UNIVERSITY OF SOUTH AUSTRALIA ASSESSMENT NOTATIONS

The University of South Australia was formed on 1st January 1991 by the amalgamation of the South Australian Institute of Technology and the Magill, Salisbury and Underdale campuses of the South Australian College of Advanced Education.
A full listing of antecedent institutions is available at unisa.edu.au

UNIVERSITY OF SOUTH AUSTRALIA

Coursework Notations

HD	High Distinction	85-100%
D	Distinction	75-84%
C	Credit	65-74%
P1	Pass Level 1	55-64%
P2	Pass Level 2	50-54%
F1	Fail Level 1	40-49%
F2	Fail Level 2	Below 40%
NGP	Non-graded Pass	50-100% (course assessed on a pass/fail basis only)
F	Fail	0-49% (course assessed on a pass/fail basis only)
SP	Supplementary Pass	50% (introduced in 1996 for a course passed on the basis of a supplementary assessment)
CP	Conceded Pass	Notional percentage not applicable
TP	Terminating Pass	Notional percentage not applicable
W	Withdrawn	Withdrew without penalty
WF	Withdrawn Fail	Withdrew after the date prescribed for withdrawing without penalty
****	No Grade Recorded	No grade recorded at the time of printing
I	Incomplete	Extension of time granted to complete the assessment
AS	Advanced Standing	Advanced Standing for prior studies
T	Credit Transferred	Credit transferred from another institution
AU	Audit Student	Enrolment on a single-course basis with no assessment completed

Honours Notations (for Honours degrees and degrees with honours)

Honours First Class	Outstanding example of scholarship
Honours Second Class A	High level of scholarship and performance in both the coursework and research components
Honours Second Class B	Substantial performance in application and scholarship across the program
Honours Third Class	Performance at a satisfactory level and completion of the requirements
F	Unsatisfactory performance in the program

Research Notations (for Doctor of Philosophy, Masters by research and Professional Doctorates by research)

O	Ongoing	Assessment continues in a subsequent study period
NGP	Non-graded Pass	Met specified assessment criteria to required standard
SE	Suspended - Examined	Thesis examined, revisions required, candidate elects not to complete. Reinstatement may be permitted
SNE	Suspended - Not Examined	Requirements not met, candidate suspended prior to examination. Reinstatement may be permitted
T	Terminated	Unsatisfactory progress against established milestones. Reinstatement not permitted
F	Fail	Thesis failed examination. Reinstatement not permitted

The explanation of grades was current at 1 August 2005. Subsequent amendments and a full explanation of any assessment notations will be published in the relevant academic policies at unisa.edu.au

This document is printed using a number of security features including watermarked paper, a University of South Australia hologram and microprint. The absence of these features may indicate that this document is not an original and should not be accepted as an official University document.

Any questions regarding this document should be made to Student and Academic Services at graduations@unisa.edu.au

University of
South Australia

Name	William John Meakin
Student ID	110120221
Issue Date	3 May 2017

THIS PAGE INTENTIONALLY LEFT BLANK

University of South Australia

Australian® Higher Education Graduation Statement

Australian Higher Education Graduation Statement
The Australian Higher Education Graduation Statement is provided by Australian higher education institutions to graduating students on completion of the requirements for a particular higher education award. It provides a description of the nature, level, context and status of studies that were pursued by the individual named. Its purpose is to assist in both national and and international recognition of Australian qualifications and to promote international mobility and professional recognition of graduates.

Certification

Date	3/05/2017
Signature	Allan Tabor
Capacity	Academic Registrar

1. The Graduate

Name: William John Meakin
Student Number: 110120221

2. The Award

Bachelor of Software Engineering (Honours)

Detail:
The program, taught in English, is normally completed in 4 years of full-time study, or part-time equivalent. Admission requirements and program rules are available at www.unisa.edu.au. The learning outcomes of the program meet the requirements for Level 8 of the Australian Qualifications Framework.

Features:
The degree program is designed to prepare graduates for careers in computing and information services industries in general and specialist software development organisations in particular. The program incorporates experiential, industry based learning and requires the completion of a final year industry based Honours project or thesis.

Pathway to further Study:
Completion of an undergraduate degree program qualifies students for a range of postgraduate degree opportunities. See unisa.edu.au for further details.

3. Awarding institution

The University of South Australia is a large, modern and multidisciplinary public university established in 1991 under legislation passed by the South Australian parliament. It was founded through the amalgamation of the South Australian Institute of Technology and the South Australian College of Advanced Education and has a history of teaching and research stretching back to the 1860s.The University continues to build on the long standing traditions of its antecedent institutions in educating professionals, creating and applying knowledge and engaging with the community. See unisa.edu.au for further details.

University of South Australia

4. Graduate's academic achievements

Program Code	Program Name	Status	Date
LHSG	Bachelor of Software Engineering (Honours) First Class Honours H1	Conferred	28/03/2017
Course Code Year 2016	**Course Description**	**Units**	**Grade**
COMP 4034	Advanced IT Prototyping Concepts	4.50	High Distinction
COMP 4025	Advanced Knowledge Representation	4.50	High Distinction
INFT 3032	Game Engines and Graphics	4.50	Credit
INFT 4022	ICT Specialist Major Project 1 (Honours)	9.00	High Distinction
INFT 4023	ICT Specialist Major Project 2 (Honours)	9.00	High Distinction
INFT 4017	Research Methods	4.50	Distinction
Year 2015		**Units**	**Grade**
COMP 3021	Agile Development with .NET	4.50	Distinction
COMP 2019	Artificial Intelligence	4.50	Distinction
INFT 3029	Cloud Programming	4.50	High Distinction
COMP 3022	Computer Science Topics for Software Engineers	4.50	Distinction
INFT 3030	Concurrent Programming	4.50	High Distinction
INFT 3033	Mobile Application Enterprise Development	4.50	High Distinction
INFT 3034	Mobile Game Development	4.50	High Distinction
COMP 3024	Systems Architecture	4.50	High Distinction
COMP 2012	Data Structures	4.50	Transfer Credit
INFS 2011	Database for the Enterprise	4.50	Transfer Credit
MATH 1043	Discrete Mathematics	4.50	Transfer Credit
INFS 1014	Information Systems Professional Practice	9.00	Transfer Credit
INFT 1016	Information Technology Fundamentals	4.50	Transfer Credit
INFT 1004	Interface Design, Interaction and Experience	4.50	Transfer Credit
INFT 1012	Network Fundamentals	4.50	Transfer Credit
COMP 1039	Problem Solving and Programming	4.50	Transfer Credit
COMP 1040	Programming Fundamentals	4.50	Transfer Credit
COMP 3023	Software Development with C++	4.50	Transfer Credit
INFS 2035	Systems Analysis, Design and Project Management	9.00	Transfer Credit
INFT 2061	Web Engineering	4.50	Transfer Credit
INFS 1019	Web and Database Development	9.00	Transfer Credit

End of Academic Record

University of
South Australia

Additional program details:

Special achievements, recognition and prizes

Year	Description of award
2016	BAE Systems - George H B Haskard Prize
2016	Chancellor's Letters of Commendation
2015	Chancellor's Letters of Commendation

Transfer Credit

Unit Value	Institution
72.00	University of South Australia

University of
South Australia

University of South Australia Assessment Notations

The University of South Australia was formed on 1st January 1991 by the amalgamation of the South Australian Institute of Technology and the Magill, Salisbury and Underdale campuses of the South Australian College of Advanced Education. A full listing of antecedent institutions is available at unisa.edu.au

Coursework Notations

HD	High Distinction	85-100%
D	Distinction	75-84%
C	Credit	65-74%
P1	Pass Level 1	55-64%
P2	Pass Level 2	50-54%
F1	Fail Level 1	40-49%
F2	Fail Level 2	Below 40%
NGP	Non-graded Pass	50-100% (course assessed on a pass/fail basis only)
F	Fail	0-49% (course assessed on a pass/fail basis only)
SP	Supplementary Pass	50% (introduced in 1996 for a course passed on the basis of a supplementary assessment)
CP	Conceded Pass	Notional percentage not applicable
TP	Terminating Pass	Notional percentage not applicable
W	Withdrawn	Withdrew without penalty
WF	Withdrawn Fail	Withdrew after the date prescribed for withdrawing without penalty
****	No Grade Recorded	No grade recorded at the time of printing
I	Incomplete	Extension of time granted to complete the assessment
AS	Advanced Standing	Advanced Standing for prior studies
T	Credit Transferred	Credit transferred from another institution
AU	Audit Student	Enrolment on a single-course basis with no assessment completed

Honours Notations (for Honours degrees and degrees with honours)

Honours First Class	Outstanding example of scholarship
Honours Second Class A	High level of scholarship and performance in both the coursework and research components
Honours Second Class B	Substantial performance in application and scholarship across the program
Honours Third Class	Performance at a satisfactory level and completion of the requirements
F	Unsatisfactory performance in the program

Research Notations (for Doctor of Philosophy, Masters by research and Professional Doctorates by research)

O	Ongoing	Assessment continues in a subsequent study period
NGP	Non-graded Pass	Met specified assessment criteria to required standard
SE	Suspended - Examined	Thesis examined, revisions required, candidate elects not to complete. Reinstatement may be permitted
SNE	Suspended - Not Examined	Requirements not met, candidate suspended prior to examination. Reinstatement may be permitted
T	Terminated	Unsatisfactory progress against established milestones. Reinstatement not permitted
F	Fail	Thesis failed examination. Reinstatement not permitted

The explanation of grades was current at 1 August 2005. Subsequent amendments and a full explanation of any assessment notations will be published in the relevant academic policies at unisa.edu.au

This document is printed using a number of security features including watermarked paper, a University of South Australia hologram and microprint. The absence of these features may indicate that this document is not an original and should not be accepted as an official University document.

Any questions regarding this document should be made to Student and Academic Services at graduations@unisa.edu.au

University of South Australia

5. Description of the Australian Higher Education System

Introduction
The Australian higher education system consists of self-governing public and private universities and higher education institutions that award higher education qualifications.

The Australian Qualifications Framework
The Australian Qualifications Framework (AQF) is a single national, comprehensive system of qualifications offered by higher education institutions (including universities),vocational education and training institutions and secondary schools.

The AQF has 10 levels, each with defined criteria based on a taxonomy of learning outcomes. Higher education qualifications are placed between level 5 (the Diploma) and level 10 (the Doctoral Degree). The Bachelor Degree is at level 7. Each AQF qualification has a set of descriptors which define the type and complexity of knowledge, skills and application of the knowledge and skills that a graduate who has been awarded that qualification has attained, and the typical volume of learning associated with that qualification type. The full set of levels criteria and qualification type descriptors can be found by visiting www.aqf.edu.au.

Australian Qualifications Framework

The main AQF qualifications awarded by higher education institutions are Bachelor Degrees, Masters Degrees and Doctoral Degrees. There are also three qualifications at the sub-degree level: the Diploma, the Advanced Diploma and the Associate Degree. At the graduate level but below the Masters Degree are the Graduate Certificate and Graduate Diploma.

Level	Summary	Qualification Type
Level 1	Graduates at this level will have knowledge and skills for initial work, community involvement and/or further learning	Certificate I
Level 2	Graduates at this level will have knowledge and skills for work in a defined context and/or further learning	Certificate II
Level 3	Graduates at this level will have theoretical and practical knowledge and skills for work and/or further learning	Certificate III
Level 4	Graduates at this level will have theoretical and practical knowledge and skills for specialised and/or skilled work and/or further learning	Certificate IV
Level 5	Graduates at this level will have specialised knowledge and skills for skilled and/or paraprofessional work and/or further learning	Diploma
Level 6	Graduates at this level will have broad knowledge and skills for paraprofessional and/or highly skilled work and/or further learning	Advanced Diploma Associate Degree
Level 7	Graduates at this level will have broad and coherent knowledge and skills for professional work and/or further learning	Bachelor Degree
Level 8	Graduates at this level will have advanced knowledge and skills for professional highly skilled work and/or further learning	Bachelor Honours Degree Graduate Certificate Graduate Diploma
Level 9	Graduates at this level will have specialised knowledge and skills for research, and/or professional practice and/or further learning	Masters Degree
Level 10	Graduates at this level will have systematic and critical understanding of a complex field of learning and specialised research skills for the advancement of learning and/or for professional practice	Doctoral Degree

Admission
Requirements for admission to particular awards are set by higher education institutions and provide a range of routes for entry and only admit those students considered to have potential to complete an award successfully. Admission of school leavers to undergraduate awards is typically on the basis of the level of achievement in Year 12 secondary education, although some institutions and awards also use interviews, portfolios or demonstrated interest or aptitude. Most institutions also provide alternative entry provisions via bridging or foundation programs for mature age students or other special provisions, such as recognition of prior learning from previous study. Admission to post-graduate awards is generally based on the level of achievement in previous higher education studies and in most cases, admission to PhD awards is based on high achievement in a research Masters Degree or in a Bachelor Degree with first class honours or second class honours division A.

Quality
Quality assurance and stringent approval requirements for higher education institutions ensure that Australia has an international reputation for high quality education.

The Tertiary Education Quality and Standards Agency (TEQSA) was established on 30 July 2011 as a new national regulator and quality assurance agency for higher education. TEQSA is an independent body with the powers to regulate university and non-university higher education providers and monitor quality against standards.

From 29 January 2012 TEQSA assumed responsibility for registering and re-registering providers and accrediting and re-accrediting awards for higher education providers that do not have authority to accredit their own awards. At the time of registration, re-registration, accreditation and/or re-accreditation, TEQSA evaluates the performance of a higher education provider against the Higher Education Standards Framework. The Standards Framework comprises: Provider Registration, Category and Course Accreditation Standards and Qualification Standards (based on the AQF). The Higher Education Standards Panel, which is independent from TEQSA, is responsible for developing and monitoring the Standards Framework.

TEQSA also undertakes quality assessments of individual providers or reviews issues within the sector across a cohort (thematic reviews). These reviews help to identify sectoral good practice, guide sectoral quality enhancement and inform policy and research.

TEQSA's primary aim is to ensure that students receive a high quality education at any of Australia's higher education institutions.

All higher education institutions receiving Australian Government financial support must meet quality and accountability requirements that are set out in the *Higher Education Support Act 2003*. The Australian Government also uses a range of tools to measure and monitor the quality of outcomes, while the interests of international students are protected by the *Education Services for Overseas Students Act 2000* and the Commonwealth Register of Institutions and Courses for Overseas Students (CRICOS), providing tuition assurance and ensuring that institutions listed on CRICOS meet defined minimum standards.

William John Meakin
SmartSat CRC Top-Up Scholarship application
Cover Letter

Project - Onboard Machine Learning for Intelligent Satellites

My Background

When I began my degree, I was mostly interested in abstracted application development. As I progressed though I gained an interest in lower level systems and concepts, i.e. computer science over software engineering, hence my interest in pursuing research grew. The opportunity to explore cutting edge technology, investigate novel problems, and contribute to scientific knowledge became highly motivating.

My first exposure was during my Honours project, where I conducted research into optimising a correlation coefficient algorithm for an embedded System on a Chip. This was conducted as part of an industry placement at Minelab, as part of their research and development team, and gave me an awareness of how research can be tailored to industry end-users for practical real-world application.

After graduating and then spending a year as a research assistant in the Advanced Computing Research Centre at The University of South Australia, I decided not to pursue a PhD immediately. I have since spent three years as a tutor at UniSA, and a year as a Staff Cadet at the Royal Military College Duntroon. This has given me perspective and skills that will assist in undertaking the challenge a PhD can be. The motivation, discipline and professionalism I have developed along the way have strengthened my commitment to returning to a career in research.

I am now intent on pursuing a career in Machine Learning, and the domain of embedded systems for satellites extends upon my past experience while suiting my passion for space and exploration. Its continued growth will also provide unique problems to solve to further enhance capabilities for the betterment of the world, and is an area I’m very excited to pursue.

I believe gaining expertise through this PhD will enable an engaging career that necessitates constant skills growth to contribute to emerging technologies. Being a part of the SmartSat CRC will enhance this experience and provide unique opportunities that broaden my knowledge.

RESUME - William John Meakin

CONTACT DETAILS

Name: **William John Meakin**
Email: **Will.Meakin@unisa.edu.au**
Mobile: **0401 680 173**
Address: **U18 / 347 Sir Donald Bradman Drive, Brooklyn Park, 5032.**

EDUCATION

2016. Bachelor of Software Engineering (Honours), First Class, 6.62 GPA
~ The University of South Australia

- Technology Proficiencies:
  - Linux / Windows / Mac
  - Java / C++ / Python 3
- Web (HTML, CSS, SQL, Javascript, dynamic frameworks)
- Git
- Mobile development (Android / iOS)
- .NET
- Amazon Web Services

2016. Industry Placement
~ Minelab Electronics

- Optimising computer vision algorithms via parallel processing
- Technologies used:
  - OpenCV
  - NVIDIA embedded GPUs - CUDA, Tegra K1 (Jetson series)
  - Working effectively and efficiently on various novel technical problems
  - Working in a professional environment, both independently and in a team

2011 - 2012. South Australian Certificate of Education
~ Thebarton Senior College

- ATAR result: 91.75 (natural), 99.65 (bonus points applied)

EMPLOYMENT

2021-current. Laboratory Supervisor / Tutor
~ The University of South Australia

- *Information Technology Fundamentals*
- *AnDe College Programming Fundamentals*
- *Cloud and Concurrent Programming*
- *Agile Development and Governance*
- *Project Studio*

2020. Staff Cadet ~ *Royal Military College Duntroon*

2018-2019. Laboratory Supervisor / Tutor
~ The University of South Australia

- *Concurrent Programming*
- *Cloud Programming*
- *Programming Fundamentals*
- Facilitating effective learning by:
  - Interpreting and responding to technical questions
  - Ensuring conceptual understanding
  - Doing so in a fast paced environment
- Grading student work, requiring detail oriented consideration
- Management / administration (organising students, clarifying course details, etc.)

2017-2018. Computer Science Research Assistant
~ The University of South Australia

- Implementing omnidirectional camera calibration algorithms
- Calibrating confidence of object detection CNNs
- Building, training, and using Neural Networks for facial expression recognition
- Technologies used:
  - Tensorflow Object Detection API
  - UnrealCV (Virtual Scenes)
  - NumPy, SciPy
  - MatLab
  - Keras
  - Deep / Wide Residual Networks
  - Software analysis and integration
  - Writing technical reports/documentation for team collaboration

PUBLICATIONS

V. Stamatescu et al., ‘Automatic Ground Truths: Projected Image Annotations for Omnidirectional Vision’, in 2017 International Conference on Digital Image Computing: Techniques and Applications (DICTA), Sydney, NSW, Nov. 2017, pp. 1–8. doi: 10.1109/DICTA.2017.8227409. Available: https://arxiv.org/pdf/1709.03697.pdf

AWARDS AND RECOGNITIONS

Member of ~ *Golden Key International Honour Society*

2016. George H B Haskard Prize - BAE Systems
- Awarded to the student with the most outstanding project at undergraduate or postgraduate program work level.

2015, 2016. Chancellor's Letters of Commendation - *University of South Australia*
- Division of Information Technology, Engineering and the Environment
- Top 5% of students in Division

2014. Outstanding Work Award ~ *University of South Australia*
- INFS 2035 Systems Analysis, Design and Project Management course

2013, 2014. Merit Awards ~ *University of South Australia*
- Division of Information Technology, Engineering and the Environment
- Top 15% of students in Division

2013. Study Support Grant - *University of South Australia*
- Selected on the basis of the Aspire bonus point scheme and academic merit.

2011/2012. 6 SACE Stage 1 Outstanding Achievement Awards ~ *Thebarton Senior College*

VOLUNTEERING

2013-2019. Assistant Karate Instructor ~ *Bushido Martial Arts*
- Structuring and running karate classes
- Teaching children and adults techniques and exercises.
- Assisting senior instructors
- Managing assistant instructors

2016. Orientation Day Volunteer ~ *University of South Australia - Mawson Lakes*

2015. Development of "Introduction to Programming" seminar
~ *Unley Libraries Digital Literacy Reboot Program*
- Developed beginner Python programming seminar structure and content
- Active group work consisting of:
- Cooperative content idea generation.
- Interpreting and responding to constructive criticism for content refinement
- Offering constructive criticism on other seminars in development.

REFERENCES

Assoc. Prof. Stewart Von Itzstein
Program Director UniSA STEM
Stewart.VonItzstein@unisa.edu.au
8302 3056

Victor Pisaniello
Bushido Martial Arts Instructor
Victor.Pisaniello@hotmail.com
0409 677 092

Dr. John Hopf
Project Manager BAE Systems Australia
John.Hopf@baesystems.com
0415 781 262

Dr. James Walsh
Enterprise Fellow UniSA STEM
James.Walsh@unisa.edu.au
0403 762 068

SmartSat CRC Project Plan
William John Meakin

1. Background

Machine learning has seen rapid development in the last decade, especially for the domain of edge devices where there are significant power, computational and bandwidth restrictions. Many techniques have been demonstrated that aim to lower the complexity of networks while minimising loss of detection accuracy. These typically target competitive performance benchmarks against standard datasets as a measure of their merit. Few have specific goals beyond this, or only target a particular use case.

A unique case of the edge computing domain is ISR satellites, which typically play a passive data collection and dissemination role with processing done further downstream at ground stations. This "offline" processing approach introduces significant delays in converting data to actionable insights, prevents low-latency coordination between end-users (e.g. field operatives) and space-based assets, and precludes more intelligent sensing capabilities; for example, adaptive tasking of the sensor suite based on real-time data enhancement and analytics to improve intelligence gathering.

This presents an opportunity to bring cutting edge optimisation techniques to a novel domain. Enabling higher fidelity information to be generated on-board satellites yields greater capability of making decisions autonomously. The end goal is to enable adaptive ISR on satellites.

There are many techniques to optimise neural networks. Below is a non-exhaustive discussion of those which will be initially investigated for integration into this project's system.

Quantisation is a technique by which neural networks can be made more efficient by approximating weights and activations using lower precision data types. This has the side effect of accuracy degradation. Binary Neural Networks (BNN) are the most extreme case where 1-bit values are used, allowing efficient XNOR operations [1] and 32x memory reduction [2]. Significant work has been done to overcome this for model deployment to edge-devices.

Pruning allows the Simplification of models by selectively removing unnecessary layers, and has been shown to work with acceptable accuracy degradation. [3]
This technique can also be exploited to dynamically reconfigure models based on rates of detections confidences, i.e. add or remove layers based on mostly low or high confidence detections.

Early Exiting is a method of separating neural networks into tiers of complexity with intermediate results between each. Crucially, calculations from lower tiers can be passed onwards to the next to avoid repeated work when some threshold is not met. This technique was applied in [4] to split a neural network between devices in an edge-server scenario.

Segmentation is an expensive feature of some neural networks that makes a detection on a per-pixel level, i.e. it allows tracing the exact area around a detection, instead of a simple bounding box. This is useful for cloud removal techniques, and for compressing data through the removal of unnecessary information for efficient transmitting. Efficient segmentation has been applied to clouds in [5] and acknowledges network quantisation is a further work. BNNs have successfully applied this technique in [6].

Most DNN research trains and tests against standard RGB images, as in [5]. Significant datasets of satellite imagery though is composed of *hyperspectral* cubes [7], containing data from multiple frequency-bands. [8] recognises the opportunity to exploit these extra bands for specific detection uses.

Multi-class Classification involves creating a neural network capable of detecting features in multiple categories. Many models from the literature are limited to simple binary responses, i.e. is or is not cloudy [7, 8]. This limitation restricts high-fidelity information from being used for autonomous decision-making, but

can be addressed with multi-class models or a dynamic system of models. Categories of detection include: clouds, terrain type, artificial structures, etc.

There are many variations of these and other techniques that will be revealed and evaluated from the literature. The challenge of creating multi-class segmentation models for on-board processing of satellite imagery is a novel task and will be a focus of this project.

2. Research Problems and Methodology

RQ1: What actions would ISR satellites most benefit from undertaking autonomously, and what inputs are needed for these decisions?

RQ2: What suite of models is needed to generate the required inputs?
No one model would be suitable for all necessary detections, and indeed using a complex model when a simpler one would suffice is an inefficient use of scarce resources. Hence a clear definition of exact configurations would require careful design and testing.

RQ3: What combination of techniques is most suitable for the required models?

RQ4: How can a system of models be dynamically reconfigured to enable autonomous decision making on ISR satellites?

This project will also consider the merits of specific platforms for the domain. While some (such as the Coral Edge TPU) may be appropriate for fixed-point optimisation techniques, the robustness to the rigours of space operation may restrict options to those with radiation resistance such as the Jetson Nano or Myriad 2 VPU. The Coral Edge TPU also has feature limitations that may restrict potential optimisations. [9]

3. Expected Outcomes

Initially this project will aim to understand the previous work done in this domain, both generally and from partner institutions University of Adelaide and University of New South Wales, as well as BAE Systems.

From there, research and choice of target platform and datasets to train/test against will be done with consideration of the required goals and most promising optimisation techniques.

Implementation and testing of these techniques will be developed on the target platform/datasets, as well as any benchmark approaches from the literature to ensure a fair comparison.

Finally, the resulting models will be arranged into a complete engine for dynamic reconfiguration via autonomous decision making from ISR data. This will enhance the quality and promptness of data while relaxing power, computation, and bandwidth requirements.

An example scenario of the resulting system would be as follows:
1: System observes cloud cover with high confidence, so uses a lightweight model for detection.
2: Confidence begins to drop, indicating cloud is clearing.
3: System switches to a model capable of segmenting cloud regions, and runs other models to determine revealed terrain type or detect anomalies (ground objects)
4: System switches to deeper multi-classification segmentation models to determine anomaly types and transmit segmentation as required.

There are numerous other decision based scenarios such as this.

4. Project Timeline and Achievability

Timeline:

- 1 Month: Gain an understanding of existing work done by partner universities and BAE Systems. Define requirements of system.

- 3 Months: Literature review with minor testing for understanding and demonstration of validity. Selection of improvement techniques.
- 6 Months: Implementation of improvement techniques on target platform, broken into granular milestones once requirements and techniques are found.
- 1 Month: Performance Testing
- 3 Months: Development of dynamically reconfigurable Space Analytics Engine using autonomous decisions with integration of previous outputs.
- 3 Months: Writing of thesis.
- 1 Year throughout: Necessary tangential study to gain required skills and knowledge, and continual investigation of emerging research.

Achievability
Previous literature has demonstrated the viability of individual components of this project's resulting system, in disparate platforms and domains. Adequate time has been allocated for completion of all outputs, only affordable resources are required, and necessary datasets are publicly available.

4. References

[1] B. Zhuang, C. Shen, M. Tan, L. Liu, and I. Reid, 'Structured Binary Neural Networks for Accurate Image Classification and Semantic Segmentation', arXiv:1811.10413 [cs], Nov. 2018, Accessed: Oct. 30, 2021. [Online]. Available: http://arxiv.org/abs/1811.10413

[2] Z. Liu, Z. Shen, M. Savvides, and K.-T. Cheng, 'ReActNet: Towards Precise Binary Neural Network with Generalized Activation Functions', in Computer Vision – ECCV 2020, vol. 12359, A. Vedaldi, H. Bischof, T. Brox, and J.-M. Frahm, Eds. Cham: Springer International Publishing, 2020, pp. 143–159. doi: 10.1007/978-3-030-58568-6_9.

[3] L. Guerra, B. Zhuang, I. Reid, and T. Drummond, 'Automatic Pruning for Quantized Neural Networks', arXiv:2002.00523 [cs], Feb. 2020, Accessed: Oct. 30, 2021. [Online]. Available: http://arxiv.org/abs/2002.00523

[4] Y. Chen, T. Yang, C. Li, and Y. Zhang, 'A Binarized Segmented ResNet Based on Edge Computing for Re-Identification', Sensors, vol. 20, no. 23, p. 6902, Dec. 2020, doi: 10.3390/s20236902.

[5] G. Bahl, L. Daniel, M. Moretti, and F. Lafarge, 'Low-Power Neural Networks for Semantic Segmentation of Satellite Images', in 2019 IEEE/CVF International Conference on Computer Vision Workshop (ICCVW), Seoul, Korea (South), Oct. 2019, pp. 2469–2476. doi: 10.1109/ICCVW.2019.00302.

[6] E. A. Dmitriev, A. A. Borodinov, A. I. Maksimov, and S. A. Rychazhkov, 'Automatic detection of constructions using binary image segmentation algorithms', Information Technology and Nanotechnology, no. 2391, pp. 264–268, 2019, doi: 10.18287/1613-0073-2019-2391-264-268.

[7] M. Drusch et al., 'Sentinel-2: ESA's Optical High-Resolution Mission for GMES Operational Services', Remote Sensing of Environment, vol. 120, pp. 25–36, May 2012, doi: 10.1016/j.rse.2011.11.026.

[8] G. Giuffrida et al., 'CloudScout: A Deep Neural Network for On-Board Cloud Detection on Hyperspectral Images', Remote Sensing, vol. 12, no. 14, p. 2205, Jul. 2020, doi: 10.3390/rs12142205.

[9] L. Diana, J. Xu, and L. Fanucci, 'Oil Spill Identification from SAR Images for Low Power Embedded Systems Using CNN', Remote Sensing, vol. 13, no. 18, p. 3606, Sep. 2021, doi: 10.3390/rs13183606.