Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI097
Project title:	**Comprehensive Study on the Design and Applications of RISC-V's Vector Scalar Instructions**
Discipline:	Computer Science
Supervisor(s)	Bruce Sham
Contact details	b.sham@auckland.ac.nz
Skills Needed	Skills Required: • Knowledge of digital design and embedded systems • Familiarity with FPGA programming (VHDL/Verilog or HLS) • Experience with AI/ML frameworks (e.g., TensorFlow, PyTorch) • Proficiency in C/C++ and Python • Understanding of heterogeneous computing and hardware acceleration • Coursework or experience in computer architecture and digital logic design • Basic understanding of machine learning and neural networks • Familiarity with Linux-based development environments • Exposure to hardware-software co-design concepts

Project description

This project focuses on exploring the capabilities of AMD's Versal™ Adaptive SoC platform in accelerating artificial intelligence workloads. AMD Versal™ combines scalar processing, adaptable hardware (FPGA fabric), and intelligent engines (AI Engines) into a single heterogeneous computing platform, making it ideal for high-performance AI inference and edge computing applications. This project aims to investigate the architecture of the Versal™ platform, understand its AI Engine programming model, and evaluate its performance in accelerating AI tasks such as neural network inference. The study will involve setting up the development environment using tools like Vitis AI, implementing AI models on the Versal™ platform, and benchmarking their performance against traditional CPU/GPU-based implementations. The project will also explore real-world use cases in edge AI, computer vision, and embedded systems, assessing the trade-offs in power, latency, and throughput.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI098
Project title:	**Comprehensive Study on the Design and Applications of RISC-V's Vector Scalar Instructions**
Discipline:	Computer Science
Supervisor(s)	Bruce Sham
Contact details	Bruce Sham
Skills Needed	Skills Required: Prerequisites: • Understanding of computer architecture and instruction set design • Proficiency in RISC-V assembly and C/C++ programming • Familiarity with Linux-based development environments • Coursework or experience in computer architecture and systems programming • Basic understanding of vector processing and parallel computing concepts • Comfort with low-level programming and debugging

Project description

This project aims to investigate the architectural design, operational principles, and practical applications of vector-scalar instructions within the RISC-V instruction set architecture. These instructions, part of the RISC-V Vector Extension (RVV), enable efficient parallel processing by combining scalar values with vector operands, delivering significant performance gains across domains such as machine learning, digital signal processing, and scientific computing. The project will involve a detailed study of the RVV specification, implementation of sample programs using vector-scalar operations, performance benchmarking against scalar-only approaches, and an evaluation of compiler and toolchain support. The ultimate goal is to assess the effectiveness and readiness of RISC-V vector-scalar instructions for real-world applications.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI100
Project title:	**A Student-Authored Peer Assessment System for Project-Based Courses**
Discipline:	Computer Science
Supervisor(s)	Anna Trofimova Asma Shakil
Contact details	anna.trofimova@auckland.ac.nz
Skills Needed	• Interest in assessments & education • An eye for UI/UX design • Experience in web development

Project description

Fairly assessing team-based projects is a persistent challenge in education. In some courses, teams work on different problems, produce different kinds of outputs, and divide responsibilities in different ways. As a result, a marking rubric created by the instructor before projects may not accurately reflect the goals, complexity, or contributions of every team. Determining how much each individual team member contributed is an additional challenge.

This project explores a student-centred approach to assessment, allowing each team to help define the criteria for evaluating their own project. Because each team defines their own criteria, the rubric fits their specific project rather than forcing all teams into the same mould.

The project will begin with a review of existing literature on fair assessment in project-based learning, particularly approaches that involve students in the assessment process. Based on this review, you will design a model for student-authored assessment.

You will then develop a simple web-based prototype to support the process. At the start of a project, teams will use the tool to create and agree on assessment criteria, which will be reviewed and approved by the instructor. At the end of the project, each team member will use the rubric to rate their teammates' contributions. The goal is a marking process that feels fair, clear, and owned by students.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI101
Project title:	**Improving student experience with an automated marking platform**
Discipline:	Computer Science
Supervisor(s)	Michaael J. Dinneen
Contact details	mjd@cs.auckland.ac.nz
Skills Needed	• At least two of Java, Python, PHP, JavaScript programming languages • Linux, AWS, Docker environments • https://automarker.cs.auckland.ac.nz/

Project description

We need some new features to one of the automated marking platforms that we use in computer science algorithms courses. This is for student experience and additional staff features where new ideas and creativity are desired.

We also want to fix few operational issues with solution validators and multi-threaded marking.

The scope of the project is big enough that the selected student and can choose to focus on front-end (web/GUI) or back-end (scheduling and marking performance) of the application.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI102
Project title:	**Agentic Programming for GPU Kernel Design and Optimization**
Discipline:	Computer Science
Supervisor(s)	Elliott Wen
Contact details	elliott.wen@auckland.ac.nz
Skills Needed	• C++, Pytorch, Triton, CUDA

Project description

Agentic programming offers a new approach to GPU kernel development by using autonomous or semi-autonomous software agents to assist with code generation, optimization, testing, and performance tuning. GPU kernels are often difficult to write efficiently because they require careful reasoning about memory hierarchy, thread scheduling, parallelism, synchronization, and hardware-specific constraints. Agentic systems can help developers navigate this complexity by iteratively proposing implementations, compiling and benchmarking kernels, diagnosing performance bottlenecks, and refining code based on feedback from profiling tools and test results.

More specially, an agent can plan optimization strategies, compare alternative kernel designs, reason about trade-offs between occupancy, memory bandwidth, register pressure, and instruction throughput, and adapt its approach based on empirical measurements. This makes agentic programming especially valuable for workloads where performance portability and rapid experimentation are important.

The student will develop an agentic programming workflow for GPU kernel development, focusing on how coding agents can generate, test, benchmark, and improve high-performance GPU kernels. They will work on prompt engineering to guide the agent with clear descriptions of the target computation, correctness requirements, hardware constraints, and optimization goals, and they will compare different prompting strategies to understand how they affect code quality and performance.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI103
Project title:	**Deploying a Simple CNN for Handwritten Digit Recognition on an FPGA Platform**
Discipline:	Computer Science
Supervisor(s)	Sean Ma
Contact details	sean.ma@auckland.ac.nz
Skills Needed	• Basic Python programming • Introductory knowledge of machine learning or neural networks • Familiarity with PyTorch • Basic Linux command line skills • FPGA knowledge • Hardware design (High Level Synthesis (HLS) programming)

Project description

This project introduces students to hardware-accelerated machine learning using a simple and well-understood task: handwritten digit recognition (MNIST). The student will design and train a small Convolutional Neural Network (CNN) using standard frameworks such as PyTorch or TensorFlow, and then deploy the trained model onto an AMD KV260 FPGA platform using high-level deployment tools.

The focus is on understanding the end-to-end workflow—from model training to deployment—without requiring prior FPGA or hardware design experience. The student will run inference on the FPGA platform, evaluate prediction accuracy, and measure performance metrics such as latency and throughput. A comparison with CPU-based inference will highlight the benefits and trade-offs of hardware acceleration.

The project is designed to be accessible while still providing hands-on experience with modern edge AI systems. Final outputs include a written report, source code, and a demonstration of the deployed model.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI104
Project title:	**AI-Powered Virtual Assistant for Aged Care**
Discipline:	Computer Science
Supervisor(s)	Jing Sun Zixiao Zhao
Contact details	jing.sun@auckland.ac.nz
Skills Needed	• The project requires mobile application development skills, with knowledge of LLM-based systems, user-centred design, and user study methods being desirable. • The system will be evaluated in terms of care coordination, user engagement, usability, early risk detection, and caregiver workload reduction. • Technical documentation, evaluation reports and functional extensions to the existing prototype will be produced to support future deployment and scalability.

Project description

This project will extend the existing CareMate AI prototype, an LLM-powered virtual avatar designed to provide personalised support for aged care. The system will integrate autonomous reasoning, structured memory, and tool use to deliver reliable, context-aware interactions. CareMate AI will support companionship, daily routines, medication reminders, appointment management, and emotional well-being through natural language communication and healthcare-specific knowledge. Using multimodal data analysis and adaptive learning, it will monitor activity patterns and health indicators, provide personalised recommendations, detect potential risks, and generate actionable summaries for caregivers.

A key component of the project will be a co-design process involving older adults, caregivers, and aged care stakeholders. Through user studies, interviews, and iterative feedback sessions, the project will refine the system's functionalities, interaction design, and usability to ensure that CareMate AI is practical, trustworthy, and aligned with real-world care needs. By combining intelligent interaction, data-driven personalisation, autonomous decision-making, and human-centred co-design, the project aims to enhance resident well-being, promote independent living, and reduce caregiver workload. It will deliver a scalable and user-informed solution for next-generation aged care services.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI105
Project title:	**Agentic system for Medical Imaging Pipeline Synthesis & Evaluation**
Discipline:	Computer Science
Supervisor(s)	Jing Sun Zixiao Zhao
Contact details	jing.sun@auckland.ac.nz
Skills Needed	• An interest in AI for code generation • Experience in LLM agent development techniques (Agent Skills, RAG, ...) • Some knowledge in medical imaging and machine learning • Good skills in Linux

Project description

Recent years have seen rapid growth in LLM-based agentic systems capable of automating machine learning (AutoML) pipeline synthesis. While these systems demonstrate promising results across general domains, a critical gap remains: there is no universal, domain-specific standard for evaluating AI-generated pipelines in medical imaging. Medical imaging tasks demand rigorous criteria beyond generic ML metrics, encompassing code quality, pipeline accuracy, domain-specific module design and clinical relevance.

This Summer Research project will develop a structured evaluation framework tailored to AI-generated medical imaging pipelines. The student will survey and benchmark existing agentic AutoML systems (e.g., AutoML-Agent, MLZero) against this framework across representative medical imaging datasets. Based on evaluation findings, the project will propose and prototype targeted improvements to bridge the gap between automated pipeline generation and domain-specific medical deployment. The outcome will include a reusable benchmark suite and potentially an academic publication.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI106
Project title:	**AI-Powered Digital Support for Family Carers of People with Dementia**
Discipline:	Computer Science
Supervisor(s)	Jing Sun Sarah Cullum Mengze Li
Contact details	jing.sun@auckland.ac.nz
Skills Needed	• An interest in AI for healthcare • Experience in LLM agent development techniques (Agent Skills, RAG,...) • Software Engineering or Computer Science majors

Project description

This project will extend an existing AI-powered digital resource management prototype designed to support family carers of people with dementia. The majority of people with dementia are living in their own homes and family carers provide most of the care with little training or support. Our tool will provide much-needed assistance to carers. Building on its current capacity to provide interactive access to care-related resources, the project will enhance the system's functionality, usability, knowledge base, and personalisation capabilities to better support healthcare professionals, caregivers, families, and people living with dementia. The extended platform will help users access and tailor dementia care resources, including managing changed behaviours, self-care materials, and community services. By integrating dementia-specific knowledge, conversational AI, adaptive personalisation, and secure data management, the system will deliver timely, relevant, and user-centred support. The project will also develop AI testing strategies to assess the system's reliability, accuracy, safety, robustness, and quality of responses across different user scenarios. In addition, an ethical evaluation will be conducted to examine privacy, transparency, fairness, accessibility, and responsible use, ensuring that the platform is trustworthy and appropriate for dementia care contexts.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI107
Project title:	**Full-Body Interaction within a Virtual Reality Art Installation**
Discipline:	Computer science
Supervisor(s)	A/P Danielle Lottridge A/P Becca Weber
Contact details	d.lottridge@auckland.ac.nz
Skills Needed	• Interest in interactive art installations and VR development. • Experience with PyTorch and/or Unity is a plus.

Project description

This project explores the future of interacting in VR --- full-body interaction with AI agents within an immersive environment where users experience responsive audio-visual feedback based on real-time body tracking. We will work with Dance Movement Therapists to get design requirements for the existing software, which could be integrating AI agents into a Unity code, creating custom sound effects, creating custom visual effects. The research goal is to build a VR installation that supports embodiment and subjective experiences. Over the summer, we will work with dance experts to iteratively develop the agents and interaction. This summer research project is related to a larger project that is likely to lead to topics of Masters and PhD studies and to collaborations with other researchers in universities abroad.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI108
Project title:	**Toward Reliable AI: Uncertainty and Calibration in Deep Learning Models**
Discipline:	Computer Science
Supervisor(s)	Katerina Taskova
Contact details	katerina.taskova@auckland.ac.nz
Skills Needed	• This project is suitable for students with a basic background in statistics and machine learning, and advanced programming experience in Python. Prior exposure to deep learning is helpful but not strictly required.

Project description

Large-scale data from diverse sensing technologies is increasingly used to support decision-making across domains such as healthcare, environmental monitoring, and transportation. Deep learning models have achieved remarkable success in analysing such data across both classification tasks (e.g., image recognition) and regression problems (e.g., time series forecasting). However, despite their predictive power, these models often lack reliable methods for assessing uncertainty, making their outputs difficult to trust in high-stakes applications.

In this project, you will explore methods for confidence calibration and uncertainty estimation in deep learning models for classification and/or regression settings. This includes predicting discrete outcomes (e.g., object categories) as well as continuous variables (e.g., wind speed, risk of dementia). You will gain hands-on experience in evaluating when model predictions can be trusted, and how uncertainty can be quantified and improved.

Faculty of Science
Summer Research Scholarships
2026/2027 Projects (Computer Science)

Project code:	SCI109
Project title:	**Interpretable Model Discovery with Symbolic Regression**
Discipline:	Computer Science
Supervisor(s)	Katerina Taskova
Contact details	katerina.taskova@auckland.ac.nz
Skills Needed	• Students interested in interpretable mathematical models and scientific discovery, with basic knowledge of mathematics, machine learning, and Python. Experience with deep learning and evolutionary algorithms like genetic programming will be helpful.

Project description

Symbolic regression aims to automatically discover interpretable mathematical expressions that describe relationships in data, offering a powerful alternative to black-box machine learning models. Unlike traditional regression methods, it simultaneously searches for both model structure and parameters, producing human-readable equations that can provide scientific insight.

In this project, you will explore modern symbolic regression approaches, like evolutionary algorithms, deep learning, and potentially emerging large language model (LLM)-based methods for guiding or accelerating symbolic regression. You will work with standard benchmark problems as well as real-world datasets (e.g., environmental or time-series data) to evaluate model performance. The project will investigate trade-offs between accuracy, complexity, and interpretability, and assess how well different approaches generalise to unseen data.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI110
Project title:	**A Scientific Approach to Interactive AI Agents**
Discipline:	Computer Science
Supervisor(s)	Gerald Weber
Contact details	g.weber@auckland.ac.nz
Skills Needed	• Programming skills Python

Project description

This project investigates a gap in current AI agent research: the lack of systematic, user-centred methods to control and evaluate agent actions in real-world settings. While existing work prioritises autonomy and task performance, it provides limited evidence on how human oversight can be integrated in a measurable and reliable way. This study focuses on designing and testing a Human-in-the-Loop control mechanism that requires user approval before an agent executes actions such as web access or file modification.

The research methodology combines system development with structured evaluation, ensuring controlled and reproducible conditions. The system is then assessed through scenario-based testing, including cases designed to trigger unsafe or incorrect actions.

To analyse usability and control, the study applies the Cognitive Dimensions of Notations framework. This allows the research to examine how easily users can understand and manage the agent's behaviour. Key aspects include visibility of pending actions, and the mental effort required to make decisions.

This work raises the scientific bar in agent research because it formulates a clear hypothesis on usability and tests it through repeatable experiments and structured evaluation criteria. The outcome is evidence-based guidance for safer AI system design.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI111
Project title:	**Sense and Respond: Designing a Cognition-Aware Interactive System for Human–AI Creative Collaboration**
Discipline:	Computer Science
Supervisor(s)	Yun Suen Pai
Contact details	yun.suen.pai@auckland.ac.nz
Skills Needed	• Basic programming (Python or Unity); an interest in HCI, cognitive psychology, or affective computing; background in physiological signals or machine learning is a plus; some prototyping experience is welcome.

Project description

When people work with AI on creative tasks, say, brainstorming poster ideas around a few keywords, their attention is rarely static: it shifts between focus, mind-wandering, rumination, and other states. Most AI tools ignore this, responding the same way regardless of the user's state and missing the right moment to help.

Grounded in Christoff et al.'s (2016) dynamic framework of spontaneous thought, this project builds a prototype that senses the user's cognitive state and lets a large language model (LLM) respond accordingly. The student will use a wearable sensor (such as EDA or an eye tracker) to capture these signals and train a classifier to recognize one key state (e.g., mind-wandering or others). The novel part is what comes next: instead of the usual "caught you drifting, get back to work" reaction, the system judges whether a given moment of wandering should be protected or nudged. A wandering mind is often where good ideas form, so when the drift looks productive, the system leaves it alone; when the user seems genuinely stuck, it sends their current keywords or work to the LLM, which offers a fresh question or prompt to get things moving again.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI112
Project title:	**Certificate Complexity of Boolean Functions**
Discipline:	Computer Science
Supervisor(s)	Marc Vinyals
Contact details	marc.vinyals@auckland.ac.nz
Skills Needed	• Mathematical maturity, including the ability to read and write formal proofs • Strong background in discrete mathematics • Prior knowledge of theory of computation strongly recommended but not required

Project description

One of the greatest problems of modern mathematics is whether P equals NP. We seem far away from answering this question, but we are able to prove that some problems are hard for limited computational models. For example, in models of computation where we measure the number of queries to an oracle, or the amount of communication shared between two parties, we are able to pinpoint the advantage that nondeterminism provides. The project consists of exploring similar hardness results.

The first part of the project consists of the candidate acquainting themselves with a weak computational model called certificate complexity. In other words, surveying cornerstone results about query and certificate complexity, and research techniques used in Boolean function analysis. This will involve reading books and research articles with guidance from the supervisor.

The second part consists of applying these techniques to attempt to establish the relation between deterministic query complexity, space-bounded query complexity, and nondeterministic query complexity, also known as certificate complexity. This will involve research discussions with the supervisor consisting of brainstorming ideas and discussing technical roadblocks, developing ideas and formalising them into proofs individually, and writing down finished proofs.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI113
Project title:	**Reverse Engineering Chemistry: Designing Pathways to Target Molecules**
Discipline:	Computer Science
Supervisor(s)	Joerg Wicker
Contact details	j.wicker@auckland.ac.nz
Skills Needed	• Machine Learning, Python

Project description

This project focuses on computational retrosynthesis for organic compounds, with particular attention to reaction classes inspired by metabolic pathways. Rather than forward prediction, the goal is to identify plausible precursor compounds and construct synthesis routes leading to a target molecule.

The work builds on our group's extensive experience in developing enviPath (https://envipath.org), a leading platform for predicting environmental biotransformation reactions. Leveraging the knowledge, reaction rules, and modelling approaches established through enviPath, we will extend these ideas toward reverse pathway construction, combining chemical insight with data-driven techniques.

We will develop and evaluate methods to infer synthesis pathways using reaction templates, transformation rules, and mechanistic patterns derived from metabolic chemistry. A key focus will be on environmentally relevant and biologically inspired transformations, aiming to generate chemically meaningful and sustainable synthesis routes.

The project sits at the intersection of cheminformatics, organic chemistry, and machine learning, providing experience with real-world reaction datasets and computational tools.

This project is ideal for students interested in computational chemistry, green synthesis, and reaction modelling.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI114
Project title:	**Towards Holistic Environmental Risk Prediction of Organic Compounds**
Discipline:	Computer Science
Supervisor(s)	Joerg Wicker
Contact details	j.wicker@auckland.ac.nz
Skills Needed	• Machine Learning, Python

Project description

This project focuses on advancing computational methods for predicting the environmental fate of organic chemicals by integrating multiple modelling approaches into a unified framework. While pathway prediction provides insight into possible transformation routes, a comprehensive understanding of chemical fate also requires information on physicochemical properties, toxicity, and reaction kinetics.

Building on our group's experience in developing enviPath (https://envipath.org) for biotransformation pathway prediction, we will extend these capabilities by incorporating additional predictive models. These include property prediction (e.g. solubility, partitioning), toxicity estimation, and kinetic modelling to better prioritise and evaluate predicted pathways.

We will investigate how to combine these diverse sources of information to improve accuracy and relevance, enabling more realistic assessments of persistence, exposure, and risk. This may involve integrating machine learning models, rule-based systems, and curated datasets into a cohesive prediction workflow.

The project lies at the intersection of cheminformatics, environmental chemistry, and data science, providing experience with real-world datasets and modelling tools.

This project is ideal for students interested in environmental modelling, computational chemistry, and sustainability.

Faculty of Science
Summer Research Scholarships
2026/2027 Projects (Computer Science)

Project code:	SCI115
Project title:	**Modelling and Simulation of Adaptive Sensor Swarms for Predator Surveillance**
Discipline:	Computer Science
Supervisor(s)	Katerina Taskova Rachelle Binny
Contact details	katerina.taskova@auckland.ac.nz
Skills Needed	• Students interested in artificial intelligence, environmental applications, and simulation-based research. Good knowledge of Python, basics in statistics and ML.

Project description

This summer project explores how intelligent sensor swarms can improve large-scale predator monitoring and control. You will work with and further develop a simulation framework to study how mobile, AI-enabled sensors can adaptively reposition themselves based on sensor detection data to locate areas of likely predator presence. We focus on surveillance for brushtail possums, one of New Zealand's most commonly targeted predator species, for which well-established data on detection probabilities and spatial ecology are available.

The project involves analysing and comparing adaptive swarm strategies with conventional approaches, and understanding how factors such as landscape structure and detection uncertainty influence performance. You will gain experience in computational modelling, optimisation, and data-driven decision-making.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI116
Project title:	**Rethinking Academic Assessment: Towards Scalable AI-Supported Oral Interviews in Higher Education**
Discipline:	Computer Science
Supervisor(s)	Shyamli Sindhwani Anna Trofimova
Contact details	shyamli.sindhwani@auckland.ac.nz
Skills Needed	• Some web development experience • Curiosity about user research and usability • Awareness of data privacy and security • Interest in qualitative and quantitative research • Enthusiasm for AI in education

Project description

Generative AI has fundamentally disrupted traditional approaches to academic assessment, making it increasingly difficult to verify that student submissions genuinely reflect individual understanding. This project responds directly to that challenge by investigating how AI-supported oral interviews can provide a scalable, authentic, and integrity-preserving alternative to conventional assessment methods.

The student will work on an existing AI-supported assessment prototype. Research will include user studies, usability testing, and critical investigation of key dimensions including system security, data privacy, scalability, and research ethics. Findings will inform both the technical development of the tool and a broader evaluation framework designed for university-wide adoption across disciplines.

This project sits at the intersection of human-computer interaction, educational technology, and applied AI research, offering hands-on experience across the full research cycle from study design and data collection through to analysis and evidence-based recommendations.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI117
Project title:	**Vision-Language AI for Sports Reasoning**
Discipline:	School of Computer Science
Supervisor(s)	Patrice Delmas Supported by Gibran Zazueta (PhD candidate)
Contact details	p.delmas@auckand.ac.nz, gzaz976@aucklanduni.ac.nz
Skills Needed	• Interest in Computer Vision and AI • Basic knowledge in algorithm design, data science and mathematics/probability • Programming skills/python programming

Project description

To develop algorithms capable of analysing sports player behaviour from video broadcasts, the AI in Sports project has produced multiple multi-sports datasets, along with computer vision and causality-based frameworks.

This Summer Research project will develop an AI system for sports reasoning, grounded in causal relationships observed from data. The researcher will explore how modern Vision-Language Models can be combined with known causal structures to answer increasingly demanding questions about player behaviour: from descriptional to counterfactual. The project provides an opportunity to work with real broadcast footage and established causal frameworks, building toward a powerful tool for sports analytics that could help trainers analyse and interpret player movements.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI118
Project title:	**3D Player Reconstruction for Rugby Broadcast Video**
Discipline:	School of Computer Science
Supervisor(s)	Patrice Delmas Supported by Gibran Zazueta (PhD candidate)
Contact details	p.delmas@auckand.ac.nz, gzaz976@aucklanduni.ac.nz
Skills Needed	• Interest in Computer Vision and AI • Basic knowledge in algorithm design, data science and mathematics/probability • Programming skills/python programming

Project description

This Summer Research project will develop an AI system for 3D skeletal tracking that generalises across sports, grounded in real broadcast footage. The researcher will explore how a pose estimation pipeline built for football (recovering globally-positioned 3D skeletons from a single moving broadcast camera) can be adapted to the very different setting of rugby, where dense player contact and unfamiliar body poses test how well such a system transfers. The project provides an opportunity to work with real World Cup footage and established pose estimation frameworks, while helping to build and annotate a new rugby dataset, building toward a powerful tool for cross-sport analytics that could bring skeletal tracking to all levels of the game.

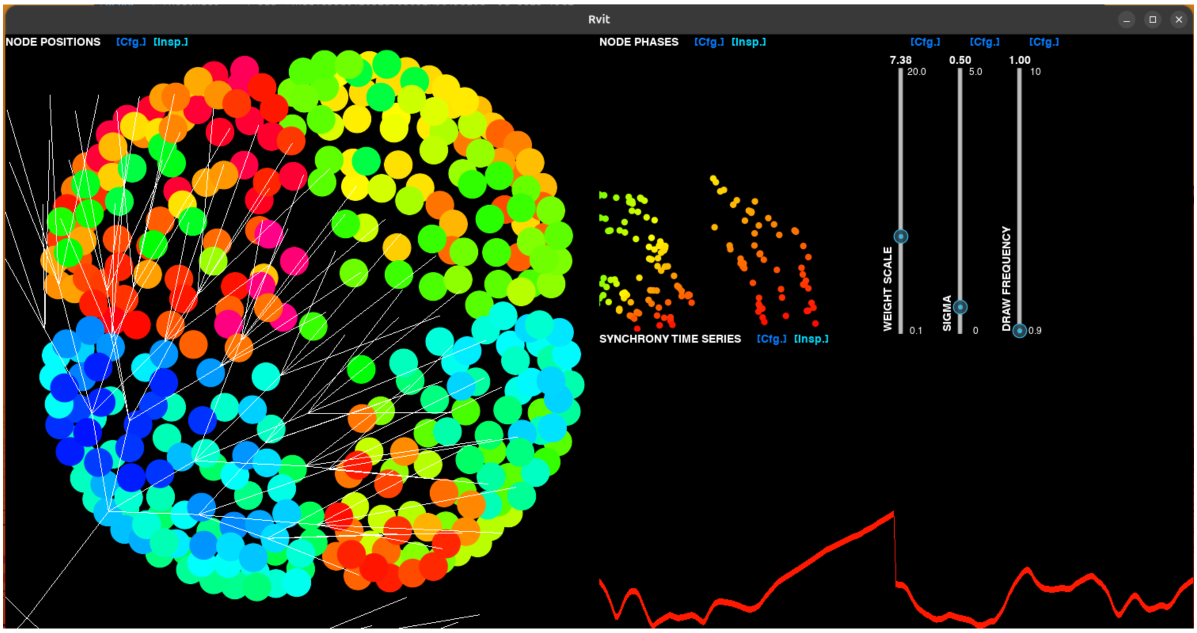
Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI119
Project title:	**Realtime Visualization and Interaction Toolkit for Investigating Computational Models**
Discipline:	Computer Science
Supervisor(s)	Matthew Egbert
Contact details	m.egbert@auckland.ac.nz
Skills Needed	• Python • UI interface development

Project description

Over the past several years, I have developed a toolkit that I use regularly to interact with and visualize my computational models as they are running. The toolkit is called RVIT or the “Realtime Visualisation and Interaction Toolkit” (https://github.com/matthew-egbert/rvit). It is built in Python and leverages the UI library “kivy” (https://kivy.org/). The software is mature enough for me to use it regularly as part of my research flow, but needs research and development to get it out of alpha into a format that can be adopted by a wider range of researchers. You would contribute to this development.



Project code:	SCI120

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project title:	Development of a Linux Network Driver and Hardware Frontend for Ambient-Light Visible Light Communication
Discipline:	School of Computer Science
Supervisor(s)	Talia Xu
Contact details	Talia.xu@auckland.ac.nz
Skills Needed	• Linux kernel driver development • C/C++ programming • Embedded systems and Raspberry Pi development • Linux networking and communication protocols • Hardware–software integration and testing

Project description

This project will develop a Linux network driver with a hardware frontend for visible light communication using ambient light, sunlight, as the transmission medium. The proposed system will replace ad hoc byte transmission with a structured network interface, allowing standard Linux tools and protocols to send messages, sensor data over a light-based channel. Initial development will use a Raspberry Pi, while a Raspberry Pi Pico will provide signal generation for testing the optical link. The driver will manage transmission and reception, support error correction and encoding, and create a foundation for communication between multiple devices.

A major objective is to design the software and hardware layers so they are adaptable across different platforms rather than tied to one device. The system will also respond automatically to changing ambient-light conditions, maintaining reliable communication as sunlight intensity varies. Performance will be assessed through network throughput, latency, reliability, and power consumption using tools such as iPerf and fping. By releasing the hardware and software as open source, the project aims to encourage community development and wider adoption. Ultimately, it seeks to create a practical, low-power, potentially battery-free communication platform suitable for IoT devices and environments where radio-frequency communication is inefficient, restricted, or unreliable.

For background information see

Qing Wang, Marco Zuniga, and Domenico Giustiniano. 2016. Passive Communication with Ambient Light. In Proceedings of the 12th International on Conference on emerging Networking EXperiments and Technologies (CoNEXT '16). Association for Computing Machinery, New York, NY, USA, 97–104. https://doi.org/10.1145/2999572.2999584

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI121
Project title:	AI-Powered Smart Cup Sleeve for Beverage Health Estimation
Discipline:	School of Computer Science
Supervisor(s)	Talia Xu
Contact details	Talia.xu@auckland.ac.nz
Skills Needed	• Python programming and data analysis • Basic machine learning and model evaluation • Sensor data collection and calibration • Microcontroller and basic electronics prototyping • Hardware assembly, interface design, and testing

Project description: This project will develop and evaluate a smart cup sleeve that estimates key health-related characteristics of beverages and displays the results directly on the cup. The aim is to help users make more informed drink choices without relying on a mobile application or nutrition label. The system will combine low-cost sensors, a small reference database, and artificial intelligence or data-driven models to estimate indicators such as sugar content, calories, caffeine level, acidity, and, where relevant, alcohol content.

The student will design the sensing setup, collect measurements from known drinks and mixtures, and compare these readings with reference values from labels, recipes, or laboratory data. Potential inputs may include pH, temperature, colour, optical response, conductivity, and other feasible sugar-related measurements. The project will also investigate calibration, uncertainty, and the limitations of estimating beverage properties using inexpensive hardware.

The outcome will be a working prototype with an easy-to-read display, supported by a complete data analysis and machine-learning pipeline. The system will be tested across selected beverages to assess estimation accuracy, usability, and reliability. The project emphasises practical experimentation, clear communication of uncertain results, and accessible hardware design rather than clinical, medical, or regulatory-grade measurement for everyday consumer use and future development.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI122
Project title:	Gesture-Controlled Multi-Particle Acoustic Levitation Display
Discipline:	School of Computer Science
Supervisor(s)	Talia Xu
Contact details	Talia.xu@auckland.ac.nz
Skills Needed	• Python or C/C++ programming • Embedded systems and microcontroller development • Computer vision and hand-tracking techniques • Electronics, ultrasonic hardware, and prototyping • Real-time control, simulation, and system testing

Project description

This project investigates how real-time gesture input can be used to control one or more acoustically levitated particles within a three-dimensional workspace. The research will examine how phased ultrasonic arrays can dynamically reposition acoustic traps with low latency while maintaining particle stability, positional accuracy, and reliable motion.

A central focus is finger-centred multi-particle interaction, where the user's finger acts as a temporary hub for gathering, arranging, selecting, moving, and releasing particles. The project will study how these interactions can be represented computationally and translated into coordinated trap trajectories. It will also investigate self-initialising and failure-aware levitation, including methods for detecting particle position, assessing stability, identifying drift or oscillation, and recovering from particle loss.

The research will combine acoustic simulation, real-time phase control, gesture tracking, particle tracking, and system integration. Experimental evaluation will measure latency, spatial accuracy, trap stability, recovery performance, and the effects of interference during multi-particle manipulation. The study will also compare simulated and physical behaviour to identify limitations in current control methods. Overall, the project aims to contribute new knowledge about robust, intuitive, and scalable interaction techniques for acoustic levitation systems, with particular attention to reliability and multi-particle human-computer interaction under varied, dynamic, and unpredictable real-world operating conditions.

For background information see

https://github.com/danfoisy/vdatp

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI123
Project title:	**Residual Connectivity in Large-Scale Internet Outages**
Discipline:	School of Computer Science
Supervisor(s)	Ulrich Speidel
Contact details	u.speidel@auckland.ac.nz
Skills Needed	• Internet IP addressing, scripting, monitoring

Project description: Large-scale Internet outages often happen as a result of events such as unrest or war. Projects such as Downdetector.com or IODA (https://ioda.inetintel.cc.gatech.edu/) track these more or less in real time. In recent years, outages have evolved from simple "pulling the plug" to tailored outages where some of a country's BGP prefixes retain connectivity whereas others don't. Focus to date has been on the loss of connectivity, but the networks that remain connected should also be of interest, as they are more likely to associated with the respective government initiating the shutdown. This project will look at the networks that remain connected and what we know about them: Are they truly associated with the country? If they are government networks: Who do they talk to, and in which context (cyberattacks?) to they show up? What can we say about them?.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI124
Project title:	Scientific Large Language Models for New Zealand Contexts
Discipline:	Computer Science
Supervisor(s)	Gillian Dobbie
Contact details	g.dobbie@auckland.ac.nz
Skills Needed	• Understanding of generative AI • Understanding of scientific processes

Project description: Scientific Large Language Models (LLMs) are emerging as powerful tools for supporting research across domains such as healthcare, agriculture, environmental science, and engineering. However, most of these models are developed overseas and may not perform optimally on New Zealand-specific scientific tasks, terminology, or datasets. While training frontier models from scratch is beyond New Zealand's current computational capabilities, adapting existing models offers a practical alternative.

This project will investigate how scientific LLMs can be adapted for use in New Zealand contexts. The student will conduct a literature review of adaptation techniques, including prompt engineering, retrieval-augmented generation (RAG), and lightweight fine-tuning approaches. A New Zealand-relevant application area, such as agriculture, biodiversity, environmental management, or health, will be selected, and a small benchmark dataset of representative tasks will be developed.

The project will evaluate several adaptation strategies using publicly available LLMs and compare their performance against a baseline model. Performance will be assessed using measures such as accuracy, relevance, and completeness of responses. The outcomes will include a benchmark dataset, an experimental evaluation of adaptation approaches, and recommendations regarding which methods appear most suitable for adapting scientific LLMs to New Zealand challenges. The project will provide valuable insights to guide future research and investment in scientific AI capability within New Zealand.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI125
Project title:	A multiprocessor cache simulator
Discipline:	Computer Science
Supervisor(s)	Mano Manoharan
Contact details	Mano.Manoharan@Auckland.ac.NZ
Skills Needed	• Web Development using pure HTML, JS, SVG, and CSS

Project description: This project develops an interactive multi-processor cache simulator designed to visualize and compare the behaviour of major cache coherence protocols, including MSI, MESI, MOSI, and MOESI. The simulator models a shared-memory multiprocessor system in which multiple processor cores access and modify common data while maintaining cache consistency. Through an intuitive web UI, users can observe cache states, memory transactions, bus operations, and coherence events in real time.

The simulator illustrates how cache lines transition between protocol-specific states in response to processor reads, writes, cache misses, and coherence messages. Animated visualizations highlight data movement between caches and main memory, making complex coherence mechanisms easier to understand. Users can configure the number of processors, cache parameters, memory access patterns, and coherence protocol selection to explore different execution scenarios.

A key feature of the project is the side-by-side comparison of MSI, MESI, MOSI, and MOESI, enabling users to analyse differences in communication overhead, memory traffic, cache-to-cache transfers, and protocol efficiency. Performance metrics such as cache hits, misses, invalidations, write-backs, and bus transactions are collected and displayed through charts and statistics. The simulator serves as both an educational tool and a platform for studying the trade-offs of cache coherence protocols in modern multiprocessor architectures.

Faculty of Science
Summer Research Scholarships

2026/2027 Projects (Computer Science)

Project code:	SCI126
Project title:	The Bob Doran Museum of Computing
Discipline:	Computer Science
Supervisor(s)	Mano Manoharan
Contact details	Mano.Manoharan@Auckland.ac.NZ
Skills Needed	• See project description

Project description: The Bob Doran Museum of Computing is seeking a student to develop a cataloguing and catalogue-rendering platform that supports the preservation, management, and public presentation of its collection of historical computing artefacts. The project combines software development with digital heritage preservation, providing an opportunity to contribute directly to New Zealand's computing history.

The system will enable museum curators to record, organise, and maintain detailed information about artefacts, including photographs, technical specifications, provenance, historical significance, and associated documentation. In addition to supporting efficient collection management, the platform will generate attractive online catalogue that make the collection accessible to the wider public.

The student will work closely with museum curators to understand the challenges of documenting historical technology and to design tools that balance archival requirements with usability. The project may involve data collection, web development, and responsive catalogue presentation.

This project is particularly suited to a student with a passion for the history of computing and digital heritage, especially within the New Zealand context. It offers a unique opportunity to engage with rare and historically significant computing artefacts while helping the Bob Doran Museum of Computing advance its vision of becoming New Zealand's leading institution for preserving and celebrating computing history.

Faculty of Science
Summer Research Scholarships
2026/2027 Projects (Computer Science)

Project code:	SCI127
Project title:	Using AI To develop a method for injury prevention in professional sports.
Discipline:	School of Computer Science
Supervisor(s)	Patrice Delmas Supported by Gibran Zazueta (PhD candidate)
Contact details	p.delmas@auckand.ac.nz, gzaz976@aucklanduni.ac.nz
Skills Needed	• Interest in Computer Vision and AI • Basic knowledge in algorithm design, data science and mathematics/probability • Programming skills/python programming

Project description: Modern live sports broadcasts incorporate many analytics and graphics to improve the audience's viewing experience and provide on-time information to coaches. Some applications still evade teams such as the prevention of injuries based on video footage of a given player. This may be based on unusual movements or behaviour of the player(s) as captured in publicly available video footage. This project will first review state-of-the-art methods and apply methods to our curated datasets. The student will add to our dataset of sports injuries based on publicly available NZ sports footage and use the wealth of publications and expertise within the IVSLab (post-doc, PhDs, Masters) to produce and test fatigue and injury prediction algorithms based on a combination of traditional machine learning and deep learning-based approaches.

Data: This project will use free publicly available datasets from various sports (including but not limited to the following three groups i) basketball/netball ii) rugby league/soccer iii) rugby union).