

CSIRO ICT Centre Vacation Scholarship Program 2009



Undergraduate vacation scholarships are available every summer at CSIRO's ICT Centre. This year we are offering vacation scholarships in 17 research areas.

1. Australian e-Health Research Centre Brisbane

The Australian e-Health Research Centre is improving the quality of healthcare and access to health services throughout Australia. It conducts research and develops applications for the management, integration and processing of health information for decision-making that will improve the quality and safety of healthcare for individuals and communities across the nation. Research is in many areas of Information and Communication Technology including: use of mobile phone and sensor technology in providing health services, tools for capturing and querying clinical data, semantic querying of clinical data using ontologies, software solutions for clinical trials, analysis of sensor streaming data from patient monitoring and use of new computer languages in designing health IT software.

2. Medical Imaging Brisbane

The aim of this area is primarily to develop new tools in medical imaging based on anatomical and functional images, such as X-Ray Computer Tomography (CT), Magnetic Resonance Imaging (anatomical, functional, spectroscopy), isotopic imaging (PET and SPECT), ultrasound imaging, molecular imaging, and histology imaging. Among the main research challenges are image registration (temporal, inter- and intra-modality, inter-subject), extraction of quantitative information (shape, volume, texture), morphometry (statistic of shape and intensities), soft-tissue modelling (3D meshing, visual and haptic interaction). The main application domains are image-guided therapy, image-guided surgery, surgery simulation, computer aided diagnosis, therapy monitoring, and medical robotics.

3. Robotics Brisbane

Our research is focused on the development of algorithms and systems for outdoor (field) robotic applications. The outcomes of our research are intended for use on robots operating on land, underwater, in the air and off-Earth. We have particular interests in vision-based navigation, sensor processing, sensor fusion, control and autonomous operation.

4. Mining Automation Brisbane

Interdisciplinary research for the mining industry particularly in the area of mining machinery, automation of mines and mechatronics. Our research is focused on increasing the level of automation for equipment, improving the communication systems, improving robotic perception and enabling users to remotely supervise mining operations. The research is focusing on solving these challenging tasks in particularly difficult environments.

5. Signal Processing Brisbane / Sydney

This involves the analysis of signals and systems for a range of applications such as communications and data compression. In Sydney the emphasis is on the transmission and recovery of information in general for communications - such as filtering, identification, classification, and detection. Analog and digital signal processing techniques are key to the development of new radio systems.

Work in Brisbane concentrates on (lossy) data compression and signal processing to meet bandwidth or storage limitation. A key area of research is the design and adaptation of algorithms to platforms with very limited computing power. Signals of interest include waypoints, audio and video.

6. Sensor Science and Technology Brisbane / Canberra / Sydney / Hobart

This research covers the full breath of possible activities involving the application of sensors to acquire data for solving major national challenges from water quality to security. It includes specific sensors for measurement of physical quantities such as temperature or salinity, technology at the sensor such a microcontroller or power source, networking of sensors, data conditioning and integrity.

7. Simulation and Visualisation Science **Brisbane / Canberra**

Computers and systems are now sufficiently powerful for simulation of very complex situations. Often these computations have to be done in real time. Our emphasis is on performing simulations in real time. This involves the study of advanced computer architectures, algorithms and software. At the same time it is necessary to understand the results obtained from simulations, place the simulations in the context of the immediate surroundings and provide collaboration tools for researchers. High quality simulations are powerful tools in a variety of fields including national security, emergency services and workplace collaboration.

8. Interacting with Information **Canberra / Sydney**

This area has several foci: 1) we look at how people interact with (textual) information, for example, to best support them in finding the information they need or browse through a large amount of information; 2) with the emergence of Web 2.0 technologies, we investigate how to build social networks and communities of interest and how to engage people with information and with each other, encouraging reflection and feedback; 3) building on social networking technologies, we treat the vast amount of information provided by people as new sources of information to mine, visualise and utilise.

This work is in a variety of application domains, including email management, government services, news and electronic publishing. This area is at the intersection of Natural Language Processing, Information Retrieval and Human Computer Interaction. We apply and develop technology in Text Analysis and Summarisation, User Modelling and Tailoring, Information Retrieval and Computed Supported Collaborative Work (CSCW). We are also interested in producing artistic visualisations of the processes involved in analysing large amounts of text.

9. Privacy, Security and Trust **Canberra / Sydney**

This area examines techniques for ensuring that information shared across a communication network is secure and satisfies the privacy objectives of the participants. Privacy and security research looks at techniques that enable individuals and organisations to determine for themselves when, how, and to what extent information about them is communicated to others, and to do so securely. We investigate the use of techniques for describing privacy constraints through policies that are understandable to the individual, and the techniques for enforcing those policies.

10. Web Services **Canberra / Sydney**

The science of effectively composing information services out of distributed resources and services. This research area covers services composition, service description, ranging from ad hoc methods to semantically prescribed, query planning, query execution, and result delivery.

11. Streaming Data **Canberra / Sydney**

This area focuses on the continuous detection, calculation and analysis of data as it arrives - irregularly and unpredictably. Applications include environmental monitoring, energy grids, sensor networks, event and alarm detection, network engineering and monitoring, high speed health care monitoring, and security-incident detection where knowledge must be extracted from continuous, often rapid data records that can be read only once or a small number of times using limited computing and storage capabilities. This research addresses a very different challenge from the stored data approach which involves assimilating operational data into data warehouses for subsequent processing.

The Australian e-Health Research Centre is developing new algorithms for compressing and querying streaming data from patient devices, including while a patient is undergoing surgery.

12. Antennas & Propagation **Sydney**

This area is concerned with theoretical and experimental advances in antennas and the propagation of electromagnetic waves, targeted towards application areas in radio communications and sensing. In the field of antennas, the areas of research include methods for the analysis, design, manufacture, and testing of antennas, covering traditional antenna systems such as reflectors, antenna arrays and steerable antennas as well as newer reconfigurable and integrated antenna systems.

In the field of electromagnetic wave propagation, topics of research include scattering, diffraction, interaction with continuous media, and inverse methods, covering areas such as indoor and outdoor terrestrial radio propagation, satellite and space communication, and remote sensing of properties of complex media such as biological tissue. Increasing emphasis is given to the role of antennas and propagation in the overall design and optimisation of systems.

13. Distributed Artificial Intelligence Sydney

This is the science of systems where the information gathering, processing and actions are decentralised and adaptive. The research focuses on learning, self organisation and emergent behaviour in such systems with applications in the areas of energy distribution, security and environmental monitoring.

14. Human Factors in Telecollaboration Sydney / Canberra

We are developing a scientific understanding of how users interact, collaborate and operate in advanced collaborative environments using novel forms of user interfaces. These interfaces include interactive tabletop settings, large, high resolution displays, augmented reality, as well as virtual and immersive environments. Techniques used include video streaming, augmented reality, 3D models, haptics and connecting virtual worlds to real world devices and robots. The investigation of human factors in these emerging technologies is one of the most crucial areas of research that would affect the speed of adoption of these technologies by industry (mining, health, education etc).

More specifically, our research explores:

- (1) the use of 3D UI and mixed reality UI for remote operations of mining equipment
- (2) natural interaction enhanced interfaces, such as using head tracking, eye tracking or gestures for user control in teleoperation or virtual environments
- (3) the role of advanced workspace and application sharing technologies for distributed collaboration
- (4) the use of gesture systems for supporting remote collaboration using large screen displays.

15. Wireless Communications, Positioning and Tracking Sydney

The area of wireless broadband communications and wireless position location are rapidly advancing, and rely on developing advanced signal processing techniques. New advances are needed in terms of coverage, bandwidth, mobility, data rates, and signal quality. The systems of interest include 3G mobile (or "Next G"), indoor wireless LAN (WiFi), mobile WiMAX, and others. Research projects include the use of new frequency bands, multiple channels, adaptive methods and topologies. The areas of research range from specific considerations of propagation, the front-end technologies as well as the manipulation and processing of signals as applied to communication systems such as algorithms,

protocols, coding and system architectures for the efficient transmission and recovery of information or tracking accuracy. In particular we are researching new systems able to adapt to different environments, increased requirements for throughput, improved positioning accuracy with greater demands on available spectrum.

16. Network Science Sydney

Understanding the operation of networks is fundamental to the delivery of information and services. Network Science involves the study of the flow, control and management of information in networks, be they fixed, wireless or increasingly some combination of heterogeneous networks. The major emphasis is on virtualisation of networks, traffic modelling, congestion, information flow, admission control, quality of service, network management and services, network simulation and planning, and network interconnection.

17. Tasmanian ICT Centre Hobart

This Laboratory delivers high-level and innovative research outcomes with a particular focus on Tasmania. Our researchers work in the areas of sensor networks, data management and robotics and targets impact in water monitoring and management, observations of our marine environment, distributed energy, cancer genomics, information to help people live healthier lives, improving the efficiency of the aquaculture industry and autonomous boat. Our projects aim to demonstrate the innovative impact of leading-edge information and communications technologies to deliver significant impact in a range of areas of value to Tasmania.

To apply for a summer vacation scholarship, head to: <https://recruitment.csiro.au>.

CSIRO ICT Centre

Contact	Dr Trevor Bird
Details	Chief Scientist, ICT Centre
Phone	+61 2 9372 4289
Fax	+ 61 2 9372 4446
Email	trevor.bird@csiro.au