

# NICTA NEWS

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## Embracing Use-Inspired Basic Research

### Welcome to the July Edition of NICTA News.

As we find ourselves halfway through 2005 NICTA is progressing at a rapid rate. We have now engaged in 52 research projects, including recently announced joint projects with The Distillery and Seeing Machines in Canberra, and the West Australian Telecommunications Research Institute (WATRI) in Western Australia. This growth in projects has been enabled by a workforce that has now grown to over 300 staff and a student base of over 180 NICTA-endorsed PhD students.

In our short history we have made good progress in our research. Since I assumed the role of CEO just eight weeks ago, I have seen some fascinating and meaningful research projects that will make substantial contributions to knowledge and develop new technologies that have the potential to benefit all Australians.

NICTA recognises that to deliver these benefits we must effectively engage with industry. One of the main issues however, that has become apparent by talking to industry and indeed to some NICTA staff, is the confusion about the type of research we conduct. I would like to take the opportunity to clarify this issue.

In describing the type of research NICTA does, we use the term 'use-inspired basic research' and say that we work in Pasteur's Quadrant. This characterisation of NICTA's research is adopted from Donald E. Stokes, who developed a quadrant model of research in his book *Pasteur's Quadrant – Basic Science and Technological Innovation* [Brookings Institute Press, 1997].

Stokes chose Pasteur as an example of a successful scientist who combined the quest for fundamental understanding and the consideration of use in his research. He described research that embraced both of these aspects as use-inspired basic research.

The intended outcomes of use-inspired basic research are improved understanding and improved technology, and the stimulus for its conduct is grounded in consideration of use and may derive from limitations in existing understanding or existing technology. At NICTA we see this approach to research as the most effective way to leverage the knowledge creation of basic research to achieve impact through applying that research in a real-world domain.

Our approach to research is a significant element of our broader business model which is based on a unique portfolio of research, research training, commercialisation, and collaboration. NICTA is a company where researchers, general staff, and students move through the organisation generating research outcomes and creating benefits specific to each research activity.

NICTA expects to be a dynamic organisation, which encourages a flow through of staff and students, yet maintains an appropriate mix of research and other skills to achieve its goals.

To make a meaningful contribution to Australia's ICT skill base, NICTA requires a dynamic staffing model to feed Australia's ICT skill base and have an effective impact in the market.

Another significant element of our business model is our education program. I am delighted to announce that we have strengthened the NICTA education program by taking on the short course business of the CRC for Sensor Signal and Information processing (CSSIP).

The addition of the CSSIP short course program strengthens our education portfolio and helps us to deliver on our commitment to enhance Australia's ICT skills base. Further details can be found in this edition of NICTA News.

Finally, I would like to outline the recent changes to NICTA's Board of Directors. Mr Neville Roach AO, NICTA's Chairman since its establishment has retired as Chairman, and Mr Neville Stevens, who was Deputy Chairman, is our new Chairman. Also departing the Board were Dr Mel Slater, Prof. Tony Blake, Prof. Graham Goodwin, and Ms Alice McCleary. New members of the board are Ms Jennifer Clark, Prof. Michael Brooks, Ms Kelly Jones, and Dr Michael Sargent.

NICTA, under the previous Board, made great progress to become the vibrant organisation it is today. I am looking forward to working with the new Board to carry on this great work.

Thank you and I hope you enjoy this edition of NICTA News.

Best regards

David Skellern

The imagination driving Australia's ICT future.





# NICTA's KENSINGTON LABORATORY FINDS NEW HOME

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*NICTA is pleased to announce that its Kensington Laboratory has now moved into new state-of-the-art premises located adjacent to the University of NSW, Australia. Developed by the University of NSW, the building was completed in June 2005 and occupied by NICTA in July.*



NICTA occupies five out of the six levels in the east tower of the building.

The new building houses four of NICTA's research programs:

- Embedded, Real-Time, and Operating Systems;
- Formal Methods;
- Knowledge Representation and Reasoning; and
- Symbolic Machine Learning and Knowledge Acquisition.

"NICTA's Kensington laboratory is located at 223 Anzac Parade, directly adjacent to the University of New South Wales. This has given us the opportunity to locate all our staff at one site. This will provide a much better platform for collaboration and provides a modern, well equipped work environment with distinctive NICTA branding while maintaining links with the University", said Kensington Laboratory Director, Dr Terry Percival.

Also announced in April this year, was the signing of a crown lease agreement between NICTA and the Australian Capital Territory (ACT) Government for a new iconic building. The building will house NICTA's ACT operations, and other Australian firms in the Information and Communications Technology (ICT) sector.

The new building will be located on London Circuit in Canberra City, ACT. NICTA's new premises will provide Australia's national ICT research centre with a world-class facility to enable the creation of valuable information and communications technologies for the prosperity of Canberra and Australia's ICT industry.

The building is expected to be completed by early 2007.

Proposed design of the new NICTA Canberra building.





*“I was initially attracted to NICTA because of the passion for excellence imbued within those that I first met. That spirit is what it takes to create new technology, and from that new technology, new companies”.*



**US ENTREPRENEUR**

# Joins the NICTA Team



**One of the objectives of NICTA’s commercialisation pillar is to forge relationships between NICTA researchers and experienced business people who can become integrally involved in the transfer of NICTA technologies into the marketplace.**

The Entrepreneur in Residence program is one such example that provides NICTA researcher’s access to a highly experienced entrepreneur to assist in realising the commercial potential of their research.

These Entrepreneurs are charged with identifying an industry-specific market opportunity based on their specific domain expertise, and working with NICTA researchers and commercialisation team to build a world-class company.

In June this year NICTA took on a new Entrepreneur in Residence, Mr Steve Subar. A seasoned executive and accomplished entrepreneur with more than 20 years experience Mr Subar has been instrumental in accelerating growth for established enterprises, launching new startups, and transforming struggling ventures into viable operations.

“We are very pleased to have Mr Subar on board. He has a wealth of experience and knowledge that he can bring to NICTA”, said Randal Leeb-du Toit, Commercialisation and IP Manager, NICTA.

Mr Subar commented, “Australia has long enjoyed a rich heritage of creating world leading intellectual property. The creation of an organisation like NICTA has further allowed the concentration of exciting research within Australia.”

“As a NICTA Entrepreneur in Residence, I see myself as being instrumental in unlocking the wealth generated from NICTA research through the creation of a startup business.”

“I was initially attracted to NICTA because of the passion for excellence imbued within those that I first met. That spirit is what it takes to create new technology, and from that new technology, new companies. Creating successful start-up technology companies in the United States has been my passion for more than 20 years.”

“I am looking forward to working with all the staff at NICTA and applying my experience building successful venture-backed business in high-growth markets, as well as having some fun in the process”, concluded Mr Subar.



*NICTA held its first showcase in May this year. Held at the Australian Institute of Sport (AIS) in Canberra, on May 5, the event attracted around 200 attendees interested in seeing the progress of Australia's ICT research Centre of Excellence.*



## NICTA TECHFEST

# Showcases Results



Officially opened by the ACT Minister for Economic Development, Business and Tourism Mr Ted Quinlan, the TechFest demonstrated a wide array of research.

In a period of two years NICTA has grown from a research organisation of 10 people to one of over 300. NICTA's research programs now number 16 across four Australian states. "In our short time NICTA has embarked on some very exciting research, we are very proud of the exceptional research talent we have attracted", said NICTA Chief Scientist Prof. Brian Anderson.

Demonstrations at the TechFest were aimed at providing external visitors a better understanding and greater appreciation of the real-world applications of NICTA's use-inspired basic research. These included displays from NICTA's Quality of Service (QoS) Seeker project, which involved creating a QoS map using signal strength enabling users to determine the location of high-quality wireless connections in their surroundings.

The Symbolic Machine Learning and Knowledge Acquisition (SMLKA) program showcased its advanced work on current surveillance systems with real-time monitoring and object tracking and video database management for querying video content.

"The TechFest was an opportunity for Australian ICT firms and major users to see how NICTA has grown over its first two years; and to explore the possibilities for research collaboration with NICTA", said Mr James Galloway, Industry and Government Liaison Manager for NICTA.

The TechFest also saw the announcement of NICTA's agreement with The Distillery, an international leader in intelligence and investigations solutions. The partnership between NICTA and The Distillery is expected to develop technology with potential applications in the forensic investigation of email, for example identifying the sender of offensive or threatening emails; determining the author of a webpage; and similarity detection to uncover plagiarism or determine whether two statements originated from the same group.

The project will investigate machine learning algorithms for natural language document analysis to develop technology that can determine the author of a text passage.

NICTA is planning to hold a similar event next year in Sydney.



## INTELLIGENT SYSTEMS

# Getting it Right

**Dr Alex Smola is program leader of NICTA's Statistical Machine Learning (SML) research program. A leader in the field of machine learning and statistics, Dr Smola has written and edited several books on kernel methods and has served on the program committees of the premier machine learning conferences. In addition, he has initiated and co-organised the internationally successful series of Machine Learning Summer Schools.**

**Dr Smola's research interests include optimisation and numerical analysis; nonparametric statistics and inference; bioinformatics; document analysis and understanding; natural language processing; image analysis and classification; and data mining.**

**In this edition of NICTA News, Dr Smola looks at intelligent systems and their use in daily life.**

Over the past ten years, intelligent and adaptive systems have become main-stream features of innovative products. They allow for entirely new products or make existing products easier to use. It is foreseeable that most devices containing a microprocessor will include some sort of intelligence in the near future. Australian ICT companies need to embrace these new opportunities to flourish and survive in the marketplace.

At first sight, Adobe Acrobat, Microsoft Office, iRobot's Roomba, Sony's Playstation 2, Nikon's cameras, or Lionhead's Black and White have little in common with leading cancer diagnosis methods. However, all these products share one common enabling technology that makes them smarter and more successful than many of their competitors: artificial intelligence and machine learning.

- Adobe Acrobat includes optical character recognition algorithms that allow it to compress documents more efficiently and that allow users to search even scanned pages in full text. For this purpose it needs to be able to recognise patterns and understand the layout of a document.
- Microsoft Office's 'paperclip' tries to infer what the user is doing and make recommendations when it detects situations where help could be used. To do so, it requires methods to recognise behavioural patterns.
- iRobot's Roomba takes these requirements one step further. Not only does it need to understand and recognise its environment but it also needs to plan its actions, that is, vacuum-clean the house automatically.
- The eyeToy in Sony's Playstation 2 allows users to interact with the game console without the need of holding a controller in their hands. It contains algorithms to recognise and track humans and it uses their estimated position as input for the game.
- Similarly, Nikon's recent point-and-shoot cameras contain pattern recognition algorithms for face detection to correct red-eye problems inside the camera. Lionhead's game avatars perform pattern recognition to adapt themselves to the players.

Finally, for cancer detection, one needs pattern recognition algorithms to understand whether a cell sample is malignant.

Artificial intelligence can be the key differentiating feature in selling great products and can offer a significant value-add: when they work, they are usually very unobtrusive — the system just does exactly what the user wants. When done badly (e.g. in the case of the handwritten character recognition of the Apple Newton PDA ten years ago) they can kill a product.

NICTA is working on systems that work 'just right' the first time, all the time. That is, we design algorithms that are adaptive, reliable, and that allow customers to build intelligent products. Our portfolio ranges from data analysis and mining over pattern recognition, novelty detection, to fully fledged statistical analysis.

Machine Learning at NICTA is unique as we have both world-class theorists and engineers who are capable of designing practical solutions.

**Alex Smola**  
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*The iAwards, Australia's premier awards program for the ICT industry in Australia, were held on Wednesday 25 May, as part of CeBIT Australia 2005. Presented by the Australian Information Industry Association (AIIA), the awards program is a showcase of the entrepreneurial culture of Australia's ICT industry.*



Above: Former NICTA Chairman, Mr Neville Roach AO, with Tertiary Education Winners Simon Goldrei (far left) and Griffith University/AiWare Consultants.



## NICTA Cementing Education Focus

With a commitment to education, NICTA sponsored both the secondary and tertiary student project awards. Both awards were open to a student or group of students that presented the most innovative ICT project at secondary and tertiary levels.

This year's awards saw a record number of nominations received. Winners of the iAwards will represent Australia at the Asia Pacific ICT Awards (APICTA) in late November 2005.

"It is great to see NICTA further cement our focus on the importance of ICT education. The iAwards are a great initiative as they target young individuals interested in pursuing a future in the ICT industry. NICTA is working towards creating a strong education pillar where we can harness these young individuals and create a pipeline of ICT talent in Australia", said Dr David Skellern, NICTA CEO.



Above: Secondary Education Winners North Sydney Girls School with Former NICTA Chairman, Mr Neville Roach AO.

## NICTA TAKES ON CSSIP

### Short Course Business

NICTA has further reinforced its education program after taking on the short course business of the Cooperative Research Centre for Sensor Signal and Information Processing (CSSIP).

Established under the Commonwealth Government's CRC Program in 2002, CSSIP will finalise operations in June 2006 after completion of its second round of funding. Its comprehensive education program was

designed to redress the national shortage of postgraduate students in signal and information processing.

Each year CSSIP holds courses for engineers, scientists, and technicians in industries such as defence. Courses are held across Australia and sometimes internationally. The education model also provides scope for delivering in-house programs tailored to the specific needs of organisations.

Dr David Skellern, NICTA CEO commented, "The addition of CSSIP's short course program to NICTA's education portfolio strengthens our education program helping us to deliver on our mission of enhancing ICT education in Australia."

# DANTE

## Creating the Future of Digital Audio

Audio systems are all around us — in the places we work and shop, when we go out to see a movie, at a concert, in a game, and in our homes. Like most technologies, audio systems are getting more complicated. As audio systems offer more features (MP3, AAC, DTS, THX) more channels (surround sound) and more components (set top boxes, DVD players) they become more difficult to set up and use.

NICTA's Digital Audio Networking (DANTE) project has developed a networked solution for transporting digital audio, based on standard hardware and data networking protocols. Networking audio systems allow many channels to be sent through a single cable and allow components in the system to discover each other and be automatically configured. These are key steps toward making audio systems simpler and cheaper.

"No comprehensive solution today that uses standard networking hardware, can support live, high-quality audio and Musical Instrument Digital Interfaces (MIDI), and control information over both wired and wireless networks. Using standard networking protocols and commodity off-the-shelf hardware in this setting would reduce infrastructure costs and make it possible to support applications more flexibly and provide greater control", said DANTE Project Leader, Dr John Judge.

The challenges in designing a suitable network architecture can be grouped into three areas:

- 1) Timing — consider left and right speakers attached to an audio network. Audio must come out of each speaker at exactly the right time, otherwise the mixture of left and right you hear will sound distorted. In studio environments the accuracy of this timing is critical.
- 2) Plug and Play — eliminating unnecessary configuration and providing simple mechanisms for components to be discovered and used.
- 3) Unified Transport — a single cable to carry everything that is required: audio, timing, and other data.

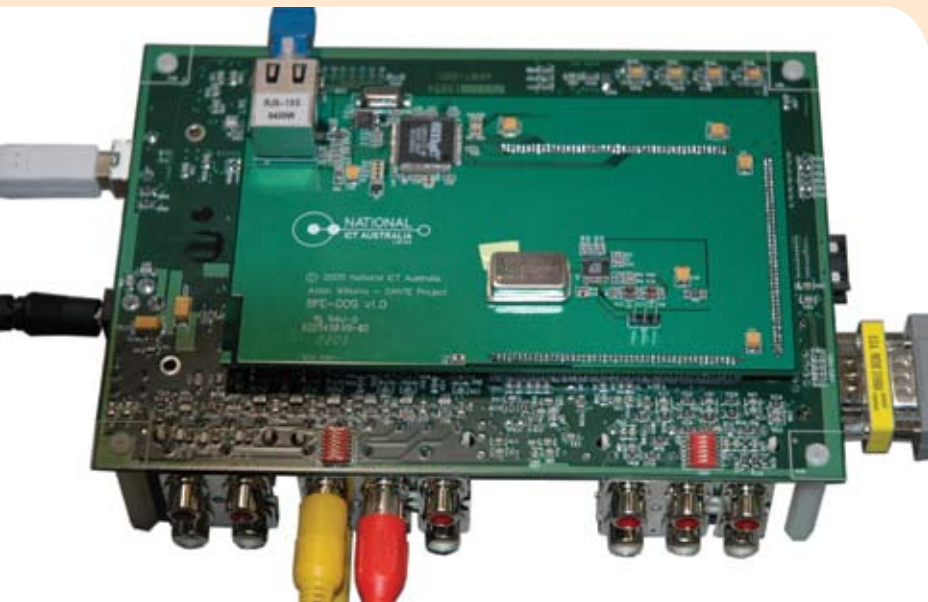
"The applications for this development are wide including professional recording studios; PA and live playback equipment as used in performance venues; home entertainment equipment; and musical instruments. The network will carry multiple high-quality audio channels, Musical Instrument Data Interface (MIDI), and control data with sample-accurate timing", said Dr Judge.

"NICTA's DANTE project brings a unique networking perspective to the problems associated with transporting digital audio. The researchers working on this particular project have extensive networking experience, including service discovery, multicast, quality-of-service, wireless networking, and zero-configuration networking", said Dr David Skellern, NICTA CEO.

The DANTE project is currently developing proof-of-concept prototypes.



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*"NICTA's DANTE project brings a unique networking perspective to the problems associated with transporting digital audio".*

# STOP PRESS



## NICTA Researchers Awarded Prestigious Prize

NICTA researchers Mr Steven Bleistein and Mr Karl Cox from the Empirical Software Engineering research program, along with Ms Aybūke Aurum and Mr Pradeep Ray from the University of New South Wales, have been awarded the Australian National Committee on Computation and Automatic Control (ANCCAC) Prize for 2005.

The winning paper was titled "Strategy-oriented Alignment in Requirement Engineering: Linking Business Strategy to Requirements of e-Business Systems using the SOARE approach".

The prize is awarded to the best paper published in the ACS's Journal of Research and Practice in Information Technology, or in any of the Society's National or Branch publications, including published conference proceedings during the year.

Congratulations on this great achievement.

## Best Paper Award Goes to NICTA Researcher

Dr Chang-Joon Chae, a researcher from NICTA's Victorian Laboratory has won the best paper award in the field of optical networks at the Opto-Electronics and Communications Conference 2005, held in Seoul, Korea in July.

The prize-winning paper was titled "Hybrid wavelength router architecture for optical virtual private networking with reduced hops".

Congratulations to Dr Chae.

## Gold Medal for NICTA-IIIS Project

Software by NICTA researchers and their collaborators took out first place in one of the major divisions of the SAT-2005 competition held in St Andrews, Scotland in June. SAT (short for Propositional Satisfiability) is the most basic part of logic, and solvers for it represent a core technology for artificial intelligence. The competition challenges programs to solve logical problems of the kind involved in reasoning about digital circuits.

The team included Dr Anbulagan and Prof. John Slaney from NICTA's Logic and Computation research program, and Mr Duc Nghia Pham and Prof. Abdul Sattar from Griffith University's Institute for Integrated and Intelligent Systems, now associated with NICTA Queensland.

## ICT Outlook Forum Secures International Speakers

The ICT Outlook Forum is an annual event that focuses on the future horizons of Australia's ICT industry, research, and development priorities.

The 2005 event will focus on the theme of **Creating Competitive Advantage through ICT**. ICT Outlook Forum provides an opportunity for members of industry, government, and the research community to help shape future collaboration in Australia and internationally.

To be held at The Powerhouse Museum in Sydney, Australia, the two-day event (31 August – 1 September 2005) will feature international speakers and Australian leaders from industry, government, and research.

Visit <http://www.ictoutlookforum.com.au> to register online.



### NICTA Members



### NICTA Partners