

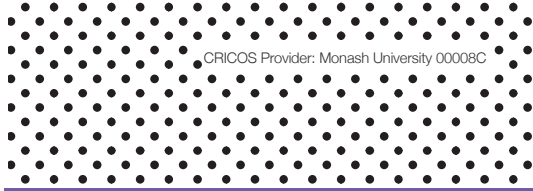
# Careers with **code**

Game-changing jobs of tomorrow

- > Find uni degrees
- > Create your job path
- > Love what you do

**COOL  
SKILLS  
CREATIVE  
CAREERS**

Google



# WELCOME TO THE WORLD OF **BIG DATA** AT MONASH

Monash University has unsurpassed breadth and depth of expertise across the broad range of areas in information technology that underpin the fast-developing field of data science.

Harvard Business Review recently deemed Data Scientist: The Sexiest Job of the 21st Century. Our degrees provide pathways to careers in this exciting and lucrative profession.

**Monash University Faculty of Information Technology offers a suite of course options:**

The **NEW**  
**MASTER OF  
DATA SCIENCE**

Short Course  
**DATA SCIENCE  
FOR MANAGERS**

Online Course  
**GRADUATE DIPLOMA  
IN DATA SCIENCE**



We work with industry, government and community partners to develop effective data-driven solutions with impact and research expertise. Areas covered include: data governance, data management and data archiving, as well as data analytics and visualisation in the digital humanities, community, cultural heritage and not-for-profit sectors.

# THINK BIG!

Technology is changing so rapidly that it is creating whole new career areas. With computer science skills and your amazingness, you can stay ahead of the game.

**W**hen I went to school, there were no computers. Fast forward 40 years and they're so much a part of our lives it's hard to imagine a world without them.

Today's world changes quickly, and your future career might be very different to those available now. Computing, robotics and automation are rapidly shifting the way we work and play. We expect that 44% of today's jobs will not exist in 20 years' time.

Anyone can learn about computers – how to program them and use computing power to access extraordinary volumes of information. If you get the chance to learn how to write a computer program, jump at it! Many of the world's richest and most successful people have backgrounds in science and digital technologies, and developing similar skills will make you very employable for the jobs of the future.

The possibilities with computer science (CS) are endless – and the work itself is great fun! I studied science and maths at high school and learnt computing at university,



which has led to a very fulfilling career.

*Careers with Code* is the perfect way for you to learn more about digital technologies and how you can use, control and benefit from them. I know I'll need to employ a lot more computer experts in the future. I hope you'll come and join me someday!

**DR CATHY FOLEY, DEPUTY DIRECTOR  
AND SCIENCE DIRECTOR,  
MANUFACTURING FLAGSHIP, CSIRO**



**ALAN NOBLE,  
ENGINEERING DIRECTOR,  
GOOGLE AUSTRALIA**

**T**echnology doesn't stand still, and nor do careers. Technological transformation in all areas of our lives has never been more rapid, nor given rise to more opportunities, than it has for today's students. It will revolutionise the work we do and create incredible opportunities for those who are ready.

It's hard to imagine, but just 10 years ago, careers such as smartphone app developer didn't exist. We were excited about driver-assisted reverse parking – but didn't dream of driverless cars. We timed our runs on our watches – and never imagined we'd wear fitness devices that measure more than just distance and time.

In just 10 years, we've seen an explosion in wearable devices that monitor your health, help you connect with others via video with a single click, and enable you

to access your entire workplace in the palm of your hand, from anywhere in the world.

Today, technology is leading to breakthrough innovations in every field and in every part of the world, from the depths of the oceans to the highest mountain peaks. People with a strong foundation in computer science (CS), an ability to think big and a passion to make a difference, will build our future world.

Careers in cross-disciplinary industries will result in innovations like self-driving cars, 3D printing of prosthetic limbs and drone delivery of critical medical supplies. For people with a passion for transport or healthcare, the addition of CS to these disciplines is creating truly impactful and exciting opportunities.

At the intersection of CS and your passion, innovative careers and industries will emerge, and you'll have the chance to take on the world's biggest challenges.

# Choose your 'X' factor

Combine computer science skills with your passion and invent your dream job. Ben Skuse reports

Used by millions of people around the world, Google+, Twitter, Snapchat, Pinterest, Facebook and Vine are all made possible by inventive coding. In less than a decade, social media has transformed the way we interact. So what will computer science make possible in another 10 years? And how could you be part of it?

"The world is just starting to wake up to a technology revolution," says Peter Argent, director of Coder Factory – a Sydney-based tech education business. "Young people need to think about pursuing careers that will still be around in 10 years."

Pinterest lead engineer Tracy Chou agrees: "More and more people understand the vital role computer science plays, and are compelled to take part."

A computer science (CS) course can lead to careers and experiences beyond your wildest dreams. Once you know the principles that underpin all software, you can improve lives in thousands of different ways.

Peter Morton, who's originally from Melbourne and now works at Google HQ in California, is a software engineer working on self-driving cars. "It's very exciting working on such an ambitious project that will have a big impact on the world," he says.

Whatever your passion, a degree in CS opens doors. All you have to add is your 'X' factor – your passion. If you're a fast

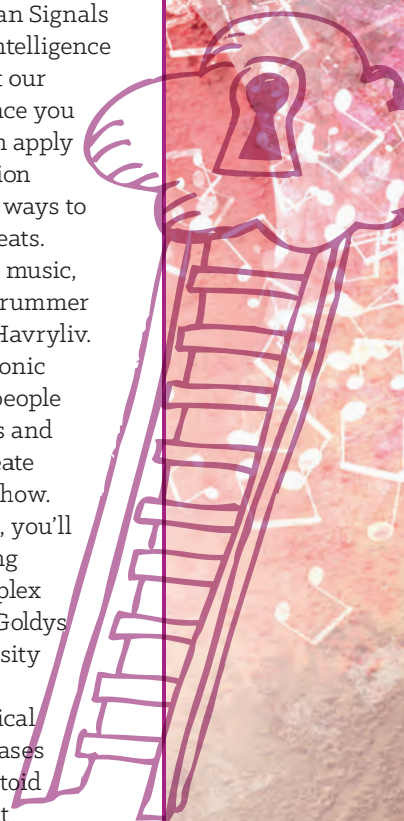
thinker, you might pit your brain against cyber criminals, with the Australian Signals Directorate (ASD), a government intelligence agency whose mission is to protect our secrets, while revealing others'. Once you graduate with a CS degree, you can apply to the ASD to become an information security professional, finding new ways to respond to sophisticated cyber threats.

Or, you might have a passion for music, like percussionist Alon Ilsar and drummer and computer programmer Mark Havryliv. They've designed a 'gestural electronic drum kit' called AirSticks, where people can trigger and manipulate sounds and visuals in a 3D virtual space to create an amazing live electronic music show.

If your passion is helping people, you'll be inspired by the researchers using everyday technology to solve complex health problems. The work of Ewa Goldys and her team at Macquarie University is a great example. They've built a smartphone app to perform a medical test that can diagnose serious diseases such as cystic fibrosis and rheumatoid arthritis. It does this using the light and camera on a regular smartphone.

"Coding enables you to move from being a consumer of technology to a creator," says Ewa.

Computer scientists are in great demand by employers. Information and communications technology is one of Australia's fastest



growing industries, with 461,000 people employed in this sector in 2013.

According to industry research, this rapid growth is set to continue, with permanent IT roles growing 14% since 2014. Salaries start at around \$60,000 and can leap to \$350,000 for management positions.

CS training teaches you how to think logically, solve problems and work in a team. It offers powerful ways for you to express yourself and pursue your passion – skills that can take you anywhere.

“I’m extremely lucky to have had the chance to travel, living in different cities and meeting different people,” says Peter from Google HQ.

The range of CS careers spans far beyond traditional programming roles. You could use digital tech to help improve the performance of athletes, plan greener homes and cities, build robot helpers, or create tools that make it possible for doctors to remotely



assist patients in developing countries. The possibilities are endless!

“Information and communications technology skills are flexible – you can use them across industries all over the world,” says Robyn Elliott, chief information officer at Fairfax Media. She’s also a coordinator of a volunteer community called Random Hacks of Kindness who are “hacking for humanity”.

“There’s a huge job satisfaction,” Robyn says. “It comes from creating a solution that impacts lots of people.”

**IT'S EXCITING WORKING ON A PROJECT THAT WILL HAVE A BIG IMPACT ON THE WORLD**



THE UNIVERSITY of ADELAIDE



# A world of opportunity with computers and software engineering

**There’s never been a better time to study computer science at the University of Adelaide. From the car you drive to the phone you use and the games you play, computer science is a key part of everyday life.**

With rapid advances in technology, studies in computer science and software engineering can lead to an exciting career at the forefront of modern innovation.

Our degrees have been developed in consultation with industry leaders to meet the growing demand for highly regarded graduates.

For a rewarding and interesting career in future-leading technology, study at the University of Adelaide – ranked in the top 1% of universities worldwide.

- > Bachelor of Computer Science
- > Bachelor of Computer Science (Advanced)
- > Bachelor of Engineering (Honours) (Software)
- > Bachelor of Mathematical and Computer Sciences

For further information visit [www.adelaide.edu.au/degree-finder](http://www.adelaide.edu.au/degree-finder)

# IGNITE YOUR CAREER



SHUTTERSTOCK

## COMPUTATIONAL THINKING IS A WAY OF BREAKING DOWN BIG ISSUES INTO BITE-SIZE PIECES TO CREATE AMAZING SOLUTIONS

**W**hat's your dream job? Are you planning a career as a writer, or would you prefer to start a business? How about helping others through healthcare and education? You might want to communicate your ideas through art, or save the planet through science. Maybe you want to rock the world with an amazing invention.

As you start thinking about your future career, it can feel like there's a lot of pressure to make decisions about the rest of your life, right now. But it's really just the beginning of a long, exciting journey.

"Sixty per cent of the jobs that will be available 10 years from now haven't been invented yet," says Thomas Frey, senior futurist at the DaVinci Institute, a US-based ideas hub and community of entrepreneurs.

Around the world, experts in data, digital technologies and coding are in growing demand. The 2015 report 'A Smart Move' by finance experts PwC Australia, says Australian companies need more employees

with skills in science, technology, engineering and maths (STEM) in order to compete in the new global economy. To ensure their success in our digital future, businesses of all sizes and in many industries will be on the lookout for people who are trained in computer science (CS).

One important aspect of this training is computational thinking, says Brenda Aynsley, president of the Australian Computer Society.

Computational thinking is essential for making computer programs and apps. It can also be used for problem-solving across all disciplines, including maths, science and the humanities.

"It's a skill that our research shows is an investment in the future," she says.

Brenda says there are "enormous opportunities" for students studying digital technologies, with job growth at around 2.5% per year in this area – higher than the general job growth rate of 1.6%. And a diverse range of industries will be calling for expertise in digital tech.

Musician and tech entrepreneur Will.i.am, from The Black Eyed Peas,

### HIGH-TECH IMPACT

Digital technologies will make big changes to what careers are available. According to a 2015 report called 'A Smart Move', around 44% of the jobs we do will change due to tech advances over the next 20 years, and many new jobs will be created.

Professions that will continue to be in demand include doctors, nurses, teachers and engineers.

Manufacturing will become more mobile as 3D printing replaces traditional factories. This will heavily reduce the need to transport goods by air and sea.

Transport itself will also change, with automatic driving, cargo loading and smart distribution saving time and money.

## WHY STUDY WITH US?

### Highest graduate employment rate

We provide the most technical computing degrees in Australia so our graduates are set when it comes to winning the top jobs\*\*.

### Lowest drop-out rate

We have the least drop outs\*\* in the country. That's because we care about our students and dedicate a lot of resources to improving the student experience at UNSW COMPUTING.

### More technology entrepreneurs

than any other university in Australia.  
(Crunchbase Report 2013)



### Venture Space available to future entrepreneurs

UNSW COMPUTING offers a unique dedicated Venture Space for Computing students to make visions into commercial realities.

## We stand up against the best

Winners are gridders, and we can safely say that our winning streak has continued over the years. From World's Fastest Solar Car to International RoboCup wins, UNSW COMPUTING is up there with the very best.

### 1st World

- RoboCup Standard Platform League: 2014, 2015
- Fastest electric car over 500km (on a single charge!): 2014
- Guinness World Record, Fastest Solar Car: 2011
- RoboCup 4-Legged League: 2000, 2001, 2003
- RoboCup Rescue (Autonomy): 2009, 2010, 2011
- RoboCup Rescue (Mobility): 2010
- World Solar Challenge, Silicon Challenge Class: 2005, 2009

### 2nd World

- RoboCup 4-Legged League: 1999, 2002, 2006
- RoboCup Rescue (Autonomy): 2006
- RoboCup Rescue (Mobility): 2009
- RoboCup Standard Platform League: 2010.

### 3rd World

- Def Con CTF Qualifications: 2014
- Imagine Cup: 2013
- RoboCup 4-Legged League: 2005, 2012
- RoboCup Rescue: 2005.

### 1st Australia

- Academic Ranking of World Universities in Engineering/Technology and Computer Science: 2014
- ACM International Collegiate Programming Contest (South Pacific Champions): 2000, 2001, 2002, 2003, 2004, 2011, 2012, 2013, 2014
- Cyber Security Challenge: 2012, 2013, 2014
- Def Con CTF: 2013, 2014
- First Venture Space for Computing Students: Founded 2011
- Imagine Cup: 2013
- Most number of Tech Startups for any Australian University (2013 CrunchBase)
- SECUINSIDE: 2013, 2014.

### 2nd Australia

- ACM International Collegiate Programming Contest: 2001, 2002, 2006, 2012, 2013, 2014
- Appathon: 2013
- CiSRA Extreme Imaging: 2013
- Codehire Cup (Students): 2013
- Cyber Security Challenge: 2013, 2014.

### 3rd Australia

- ACM International Collegiate Programming Contest: 1999, 2005, 2012
- Cyber Security Challenge: 2013, 2014.

\*\*Source: myuniversity.gov.au accessed 6th April 2014. Melbourne is omitted from the Attrition Rate as their common first-year skews this data. The Group of Eight (Go8) is a coalition of leading universities, intensive in research and comprehensive in general and professional education. Six members are ranked in the world's top 100 universities by the THE World University Rankings 2012-13. The Australian Technology Network (ATN) is a network of universities, with a vocational focus. Three members are ranked in the world's top 400 universities by the THE World University Rankings 2012-13.

hired a coding tutor in 2013 to teach him programming – and loved it.

“It’s 10 times better than music – a trillion times,” he told tech website *VentureBeat*. “I’m making music based on frequencies. With code, I can create operating systems of my own, or apps that allow me to make music.”

Tina Ornduff, program manager for Engineering Education at Google, identifies four key areas of computational thinking.

The first is decomposition – breaking a large project down into smaller pieces. Next, there’s pattern recognition, which involves finding the patterns among problems. Abstraction is the process of removing excess detail to focus on the differences between problems. Finally, algorithmic design is the stage where you create a step-by-step strategy that leads to a solution.

“One of the best examples of computational thinking is Google Earth. It takes the large problem of trying to visualise the entire planet and makes it so that anybody can explore the world around them,” says Tina.

Daniel Barcay spent more than six years as a senior software engineer at Google, where he helped develop Google Earth. He is now vice president of technology investment firm Thiel Capital.

“Thinking computationally is a lot more like art than maths class. You use computational thinking to paint on a blank canvas... and you end up creating something beautiful,” says Daniel.

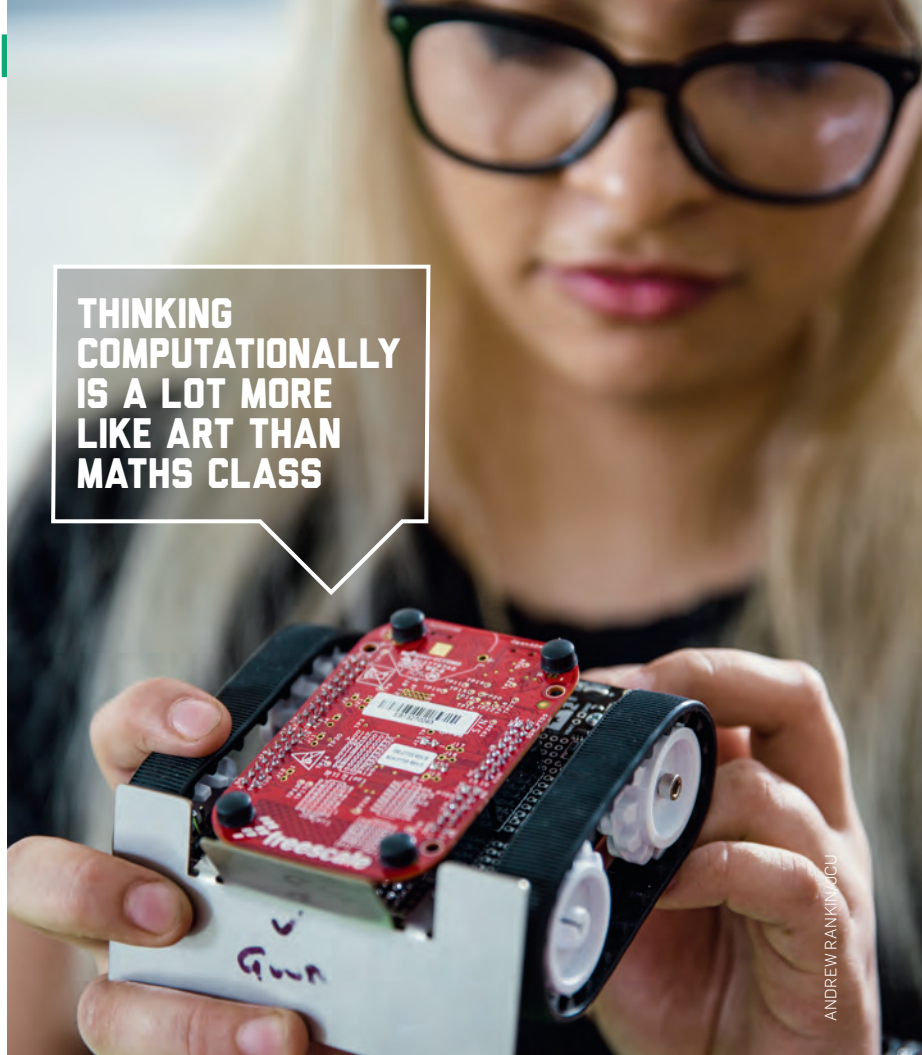
Jeremy Pack works as a software engineer on Google Street View, and says he used computational thinking to help him solve a big problem.

“Pegman is the little yellow guy on Google Maps that you can drag to get into Street View,” Jeremy says. The issue was that Pegman kept landing on random, unimportant places in big cities.

“He’d never land in front of a famous landmark,” Jeremy says. “If you dropped him on Paris, he’d never land on the Eiffel Tower.”

Jeremy trained Pegman to recognise places that people had taken lots of photos of, and prioritise those sites when he landed in Street View.

THINKING  
COMPUTATIONALLY  
IS A LOT MORE  
LIKE ART THAN  
MATHS CLASS



ANDREW RANKING/CCU

Computational thinking has led to some major solutions in ways that are as surprising as they are inspiring.

“A huge amount of computational thinking was involved in the recent NASA fly-by of Pluto,” says Brenda.

NASA sent the New Horizons spacecraft 7.5 billion km away from Earth. It was an epic project, but computational thinking helped make it possible. With it, NASA worked out that the spacecraft could use Jupiter’s gravity as a ‘slingshot’ to get itself close enough to photograph Pluto and its five moons.

Meanwhile, the Canberra Deep Space Communication Complex (CDSCC) used cutting-edge technology to track the tiny spacecraft over its nine-year journey to Pluto and collect data along the way.

The CDSCC received the first images from Pluto, and scientists will take a further 18 months to analyse all the data as it gradually arrives from the far reaches of the Solar System.

“Pluto is the latest astronomical body to be explored by NASA,” says Ed Kruzins, director of the CDSCC. “It will probably be the most exciting.”

And computer scientists will be there every step of the way. – *Fran Molloy*

## CODING NEEDS YOU!

From tech companies to industry groups, there’s a big call for more workers with computing skills.

Learning computational thinking is an investment in your future, says Brenda Aynsley, the Australian Computer Society’s president.

“As the jobs we know today disappear, they’ll be replaced by other jobs we’ve never conceived of. But they’ll require the same computational thinking, and the same sets of skills, that you can learn today,” she says.

It’s not just Australia that’s crying out for more coding. British entrepreneur Sir Richard Branson, billionaire co-founder of multinational Virgin Group, says: “Whether we’re fighting climate change or going to space, everything is moved forward by computers, and we don’t have enough people who can code.”

To find out more:  
[goo.gl/1wudwu](http://goo.gl/1wudwu)



**THIS IS A WONDERFUL TIME TO WORK IN TECH AND MAKE AN IMPACT ON THE LIVES OF THOSE WHO NEED HELP THE MOST**

DMITRI NIKULIN

# THINK FAST

**GOOGLE PRODUCT MANAGER GANESH SHANKAR IS PART OF A GROWING NUMBER OF CODERS FINDING NEW AND BETTER WAYS TO RESPOND TO EMERGENCIES**

The 2014 Ebola crisis in West Africa shook the world. A fatal disease for half of those who contract it, the ongoing pandemic has caused more deaths (so far, the count is over 11,000) than all previous outbreaks of Ebola combined. So when Sydney-raised Google product manager Ganesh heard Google was putting together a team to work out how technology could be used to fight the disease, he volunteered on the spot.

Ganesh helped medics from *Médecins Sans Frontières* (MSF – Doctors Without Borders) to find safe and efficient ways to send patient health data from the isolation centre to the diagnosis tent. It's a major infection risk to take paper outside the isolation zone, so health workers had been shouting updates over a fence to colleagues on the other side.

With a team from Google and MSF in London, Ganesh built an open-source medical information system for relief missions.

"We developed custom servers, tablets, and client and server-side software in under five months from concept to launch," he says.

The central part of the system is a standard Sony Android tablet with a specially designed casing that allows it to be repeatedly dunked in a chlorine solution, which kills the Ebola virus.

The tablet also needed to be mobile and able to be used in isolation with little power. So the team came up with a network server the size of a postage stamp that can be rapidly recharged with a generator.

Another challenge was recharging the tablet itself – standard chargers often have sharp edges that can puncture protective suits. In this emergency response system, tablets can instead simply be placed on a table to be recharged.

Google is highly active in developing and providing this kind of emergency response technology. "I wanted to work for a company with a conscience; one that supports and encourages me to work on projects like this," says Ganesh.

Many of these efforts are coordinated by the Google Crisis Response team, formally set up after the 2010 Haiti earthquake. Crisis Response provides updated satellite imagery of disaster areas, relief money and enhanced web services for people on the ground.

Another initiative is Google Person Finder, which anyone can embed in their website to help people find each other in the aftermath of a disaster.

There are plenty of roles for those with a talent for coding and a drive to help people. Computer scientists are working on early warning systems, disaster preparedness, emergency response

coordination, post-crisis rebuilding and more.

"This is a wonderful time to work in tech and make an impact on the lives of those who need help the most," says Ganesh. "Volunteering to help an organisation like MSF is a great way to get started." – Ben Skuse



# Playing it smart

From mechanical limbs to robot helpers, new technologies are transforming healthcare. Fran Molloy reports

Combining computer science with medicine and healthcare could solve some of society's biggest problems, and at the centre of it all is coding. "It's used in everything from app development to reading large volumes of data," says Flinders University biomedical engineering student, Laura Diment.

For her degree, Laura wrote a program called Splashboard that uses Microsoft Kinect to help kids with cerebral palsy, who have limited motor control, create their own artworks.

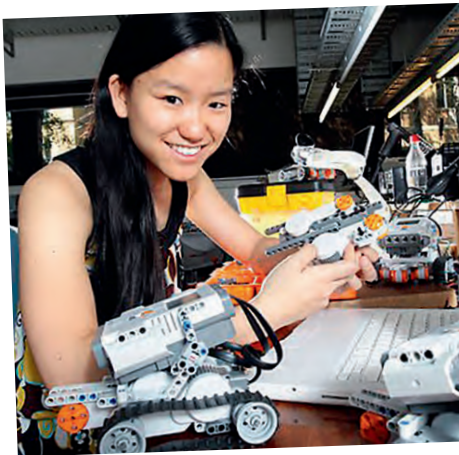
Her interest in health tech began while working as a volunteer teacher in Uganda, where she found there was an urgent need for medical devices. She's since won a scholarship to do her PhD at Oxford University in the UK, where she'll research biomechanical modelling to design walking aids for people in developing countries.

The healthcare and social assistance industry employs more Australians than any other field. One in five new jobs over the next five years will emerge in this area.

Many of the new jobs will be in startups like 2Mar Robotics, founded by biomedical engineer Marita Cheng, Young Australian of the Year 2012. Their inventions include the Jeva robotic arm, which people with limited mobility can control by tablet or phone. 2Mar's low-cost 'telepresence' robot, Teleroo, is a video telephone on wheels that can be controlled remotely by disability carers.

Starting a company was "always a dream" for Marita. "When I read about three young guys in the USA starting their own robotics company, I realised, if they can do it, I can!"

Marita is one of a fast-growing number of people creating health tech startups.



PETER CASAMENTO

In the USA by 2017, it's estimated \$6.5 billion a year will be invested in digital health startups. A Startup Weekend for Health has been set up in Australia to offer teams a forum to showcase their ideas.

Robotics is just one small part of health technology – a vast and expanding field that includes remote patient care, wearable devices that record brainwaves and blood pressure, and ways to crowdsource data to rapidly understand trends in disease and injury.

Gareth Goodier, chief executive at Melbourne Health, says hospitals are becoming increasingly dependent on technology. "The electronic hospital has digital patient records accessed by Wi-Fi on iPads. There's voice recognition, radio frequency ID chips in equipment, staff ID tags and patient wristbands to track people and measure efficiency," he says.

The health system of tomorrow will be an exciting place to work. "The future is in the coding and technology side of healthcare," says Laura.

## GET INTO CS + SMART HEALTH!

Check out some work and study options...

### CAREERS

Biomedical engineer, epidemiologist, health policy maker, roboticist, social worker, data analyst, 3D bio-printing specialist, app developer, health informatics expert, biostatistician + more!

### BACHELOR OF...

Bioinformatics Engineering (Hons), **UNSW Australia**  
[goo.gl/eAEm04](http://goo.gl/eAEm04)

Information Systems/Health Sciences, **Deakin University**  
[goo.gl/hWBgJE](http://goo.gl/hWBgJE)

Health Sciences/Mathematical and Computer Sciences, **University of Adelaide**  
[goo.gl/qUixsb](http://goo.gl/qUixsb)

Biomedical Engineering, **University of Sydney**  
[goo.gl/uJwsKQ](http://goo.gl/uJwsKQ)

Biomedicine (Bioengineering), **University of Melbourne**  
[goo.gl/HfxR5Y](http://goo.gl/HfxR5Y)

Science (Health Information Management), **Curtin University**  
[goo.gl/buqHjx](http://goo.gl/buqHjx)

E-Health (Health Informatics) (Professional Hons), **University of Tasmania**  
[goo.gl/mCpGz7](http://goo.gl/mCpGz7)

Biomedical Engineering, **Flinders University**  
[goo.gl/JWt1KP](http://goo.gl/JWt1KP)

WHEN I READ ABOUT THREE YOUNG GUYS IN THE USA STARTING A ROBOTICS COMPANY I REALISED IF THEY CAN DO IT... I CAN!

## ON A MISSION

**MAIA SAUREN COMBINES HACKER INGENUITY WITH BIOLOGY EXPERTISE TO FIND SOLUTIONS FOR MAJOR HEALTH CHALLENGES**

**M**elbourne-based Maia started a yearly event called HealthHack, where software developers meet with medical researchers over a weekend to build solutions to big challenges in health – like finding treatments for cancers. “The researchers are really into it, and all the software people are delighted to get the chance to work on something awesome like cancer research,” says Maia.

HealthHack also attracts designers, data analysts and game makers. And it sees some fantastic results – like Team Girror in 2014, who came second with a series of apps that help gambling addicts and psychologists understand what triggers the urge to bet. Team Gene Machine, meanwhile, found a way to visually map the stages of sequencing changes in DNA, a cell’s genetic ‘blueprint’, which will help speed up genetic testing and the medical treatments that follow.

By day, Maia is a full-time business analyst for ThoughtWorks, a global software company on a mission to help humanity and drive social change. Maia trained as a biomedical engineer before working in science communication and then as a data analyst.

She started out at ThoughtWorks as a software tester, where her job was to find “cool and interesting ways to break things”. Her work as a business analyst involves helping companies figure out how to solve their problems through software.

“I wanted to have a job where I was having fascinating conversations with interesting people!” – *Fran Molloy*

### TO GET THERE:

Bachelor of Engineering (Electrical & Computer Systems),  
**Monash University** [goo.gl/96L9GF](http://goo.gl/96L9GF)



IT'S AMAZING HOW TECHNOLOGY IS SHAPING THE NEXT GENERATION OF HEALTHCARE



# Bonus life

Using video game technology in healthcare settings is winning points for patients and doctors

**J**inman Kim knows the value of using gaming technology to help improve patients' lives. "Almost every gaming device or technology that's driven by the gaming industry can have a huge impact in a clinical setting," he says.

A computer scientist and biomedical imaging specialist, Jinman is the director of both the Nepean Telehealth Technology Centre at Nepean Hospital and the Visual TeleHealth Lab at the University of Sydney.

"Touchscreens are a fantastic way of navigating complex datasets. We use virtual reality headgear as part of medical training, and augmented reality to view medical image data. In medical imaging, we use the graphics cards that power ultra-fast, realistic graphics for computer games," says Jinman.

One of the most exciting areas of medical tech is remote healthcare – also known as telehealth. At its simplest, this means video conferencing between doctors and patients, giving patients access to specialists without the need to travel. But telehealth can also involve using apps to help patients record essential

medical data, and consultations using remote stethoscopes or even ultrasound.

"Telehealth is much more than just audio-visual these days. It includes mobile technology, mobile apps, sensors, smart homes and wellbeing equipment. We're also looking at cloud technology and data analytics," says Jinman. "It's amazing how technology is shaping the next generation of healthcare. It's just incredible."

Biomedical imaging is another fast-changing field. Ashnil Kumar recently completed a PhD with the Biomedical and Multimedia Information Technology Research Group at the University of Sydney. He specialises in PET-CT scan reading techniques that can help doctors make more accurate cancer diagnoses and develop individual treatment plans for patients.

"If you know what previous patients have gone through and a new patient is exhibiting similar symptoms, perhaps they have similar disease characteristics and a similar treatment would work," says Ashnil.

– Michelle Wheeler

## GAME BOY

**R**obin Huang created an app to help combat children's obesity as part of his Master of Philosophy in Engineering and IT at the University of Sydney. One in four children in Australia is overweight or obese, which can lead to ongoing health problems.

Robin's app is designed to be a part of a care program for Nepean Hospital's Children's Obesity Clinic, and encourages children to connect with their peers and promotes healthy eating.

The app can be used as a contract between parents, children and doctors, and includes positive reinforcement in the form of star ratings and rewards such as movie tickets.

"It's great to see something I created have a real effect on society and to look at how it will impact the lives of children," Robin says.

**TO GET THERE:** [sydney.edu.au](http://sydney.edu.au)

# VIRTUAL WORLD

**SOFTWARE ENTREPRENEUR JAMES BONNER TRANSFORMED HIS LOVE FOR VIDEO GAMES INTO A BUSINESS THAT CHANGES OUR UNDERSTANDING OF HEALTH ISSUES**

James is winning awards and making a positive impact through the work he does at his tech company, Opaque Multimedia. And it all stems from gaming.

"Our company takes video game technology and applies it in other domains, like health and education," says James.

Nearly three years ago, he and his three business partners – Liam McGuire, Chris Mackenzie and Norman Wang – set up Opaque Multimedia. They were studying at Swinburne University, sharing classes in game design and multimedia.

James had been doing paid computing projects on the side since high school – like building websites and helping academics develop programs to test their research. Now he's building amazing virtual reality tools, including a simulated walk-through of the International Space Station and programs to help people with dementia.

Opaque Multimedia has created the Virtual Dementia Experience – a scary, distorted-reality simulation that gives dementia carers a taste of what it's like to live with the disease. For dementia patients, meanwhile, they've built a fun and soothing immersive virtual environment called The Forest Project.

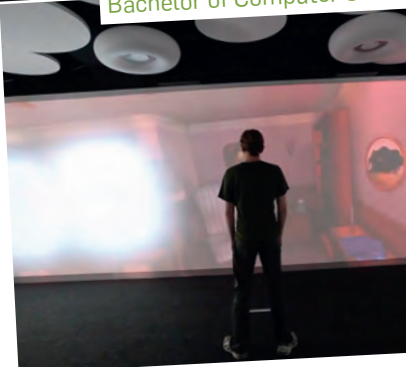
These projects started when James and his partners were helping a researcher who wanted to explore brain activity during MRI scans, which are used to image the body's soft tissues. "We helped build a virtual maze that was constantly changing, so people could have their navigational skills tested during an MRI."

"The gaming industry is incredibly cut-throat and making huge leaps in hardware and software," says James. "We're taking some of these advances and using them in other fields apart from entertainment to improve people's lives." – Fran Molloy



TINA SMIGIELSKI

**TO GET THERE:** Bachelor of Arts (Games and Interactivity)/ Bachelor of Computer Science, Swinburne University [goo.gl/JzNu1L](http://goo.gl/JzNu1L)





WHEN YOU DESIGN YOUR OWN STUFF YOU WANT IT TO BE THE BEST

# Pep talk

UQ helped these students turn their unique healthcare idea into a booming business

How do you find your dream job? “Make your own,” says University of Queensland (UQ) electrical and biomedical engineering graduate Jeremy Herbert, co-founder and chief technical officer of HSK Instruments.

His company’s main product is an invention called Pepster, which could make a huge difference to the lives of people with serious lung diseases such as cystic fibrosis and chronic obstructive pulmonary disease.

While studying at UQ, Jeremy and his team decided they wanted to build a medical device as their final project. The University’s close links with a local children’s hospital initiated an idea that could help in the treatment of respiratory diseases.

Their project went so well that they kept working on it after graduation, setting up the company as a way to sell their invention. They’re now in the early stages of production, and are continuing to test the device in hospitals.

Pepster has two components: a device designed to help cystic fibrosis sufferers do the breathing exercises they need to clear fluid from their lungs, and a mobile app that interacts with the device.

The app is what makes Pepster special because it helps people do their daily exercises while also recording important medical data as they do them, explains HSK Instruments co-founder Elliot Smith.

“Patients with cystic fibrosis start breathing exercises from about age four, and do them their whole lives. Trying to encourage a four-year-old to do them for an hour every day is super difficult,” he says.

The team developed a series of games that can be played on a tablet or smartphone during the breathing exercises – using the breathing device itself to control the game.

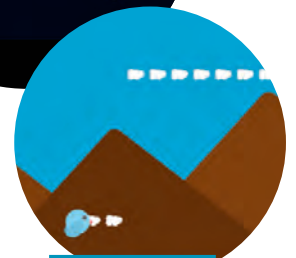
“It makes it a bit more fun. The exercises become less of a boring chore and more like something kids want to do voluntarily,” says Elliot.

As the patients do the breathing exercises, the device transmits the data to the cloud or directly to their clinician.

“It sends data to clinicians so they can track progress and communicate with the patient if something’s changed or they notice a decrease in performance,” says Elliot.

Pepster recently earned glowing praise from parents whose children took part in a clinical trial of the device. The team now plans to expand the system for use in other respiratory areas.

“When you design your own stuff, you want it to be the best, so you push it as hard as you can – to the very edge of what is possible.”  
– Bianca Nogrady



TO GET THERE:  
[uq.edu.au](http://uq.edu.au)

# SMARTER DIAGNOSIS

**MACQUARIE UNIVERSITY RESEARCHERS ARE UNLOCKING THE HEALTH POTENTIAL OF EVERYDAY DEVICES**

Did you know that Googling a question, playing games and posting on social media only uses a fraction of the 'smarts' in your smartphone? Macquarie University researchers have come up with a new and important use for our clever gadgets – to help us keep an eye on our health. They've developed a simple but innovative system that tests blood samples for substances that can indicate disease.

Ewa Goldys, deputy director of the Centre for Nanoscale BioPhotonics at Macquarie University, says that a smartphone has 70% of the capability of a standard laptop. "The smartphone is an amazing piece of technology that's capable of much more than we're currently using it for," she says.

We already know about apps that can count the steps you take, track your sleep and monitor your heart rate while exercising. But this new system goes further, turning smartphones into diagnostic sensing devices.

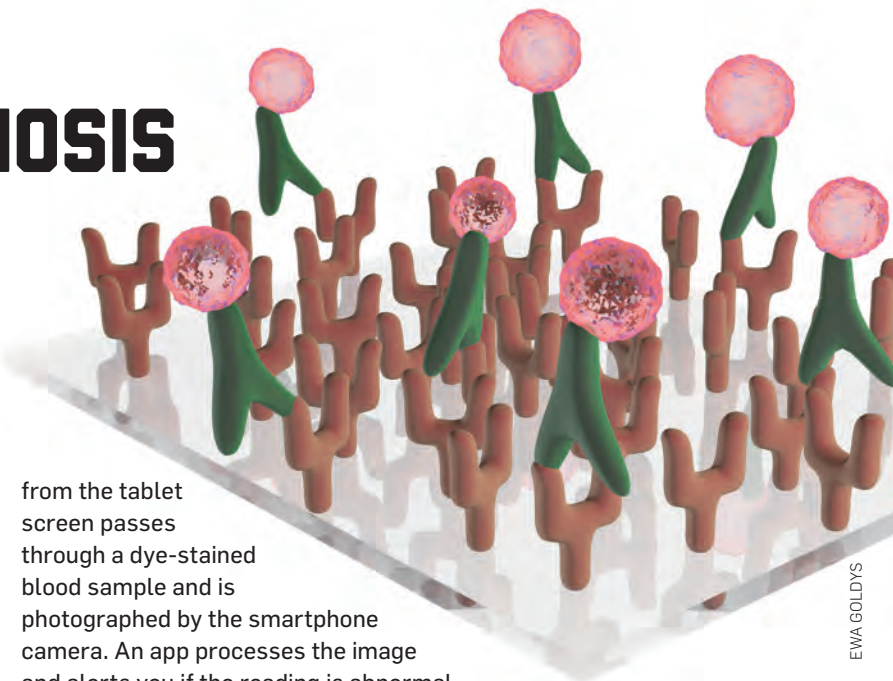
The researchers rigged up the system using little more than a smartphone and tablet. Light

from the tablet screen passes through a dye-stained blood sample and is photographed by the smartphone camera. An app processes the image and alerts you if the reading is abnormal.

The system successfully measured blood levels of trypsin and collagenase – molecules that are indicators for diseases such as cystic fibrosis, arthritis and pancreatitis. But it could be adapted for other human and animal diseases.

Especially in remote locations or developing countries, this kind of diagnostic testing could be a lifeline for people managing their own, or even their animals', health. Taking photos has never been so healthy – or smart!

– Carrie Bengston



EWA GOLDYS



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To find out more visit [firstaustralia.org](http://firstaustralia.org)



In conjunction with



# Coding for change

People are using computer science to build a greener, more sustainable future. *Laura Boness reports*

**S**ustainable computing is a rapidly growing research area using computer science and data analysis to find solutions for some of the world's most urgent environmental and social problems.

It can help us build greener cities, track the impact of climate change, improve renewable energy and target emergency medical help in a disaster. It's also being used to map wildlife populations and predict how they respond to threats such as habitat loss and disease.

Marine biologist Alicia Sutton learnt CS skills to help her research krill in the Indian Ocean off the coast of Western Australia. These tiny crustaceans are found across the world's oceans and are an important food source for whales, seals, penguins, squid and fish. They're also a major indicator of ocean ecosystem health.

Alicia used computer modelling to look at factors affecting krill diversity, but describes herself as "a late starter" in CS.

"I taught myself coding and began using it to look at temperature, oxygen and other variables that could be relevant," she says. Her research will contribute to marine conservation, climate change studies and sustainable fisheries management.

Alicia's advice is to look for workshops or online coding tutorials. "You can pick up the basics reasonably quickly, which broadens your choices for further study."

Andrew Craig is a graduate of UNSW Australia, and has used CS to test the

most effective way to vaccinate koalas against chlamydia. The disease is linked to infertility and high death rates among koala populations, and presents a significant wildlife conservation challenge. Andrew is working on a computer simulation where "hundreds of koalas interact, have sex, transmit chlamydia, have joeys and die," he says.

"This simulation runs really fast. It can simulate 50 years in just two seconds," says Andrew. "This makes it possible to mimic the effects of tens of thousands of different vaccination strategies to find the best ones."

CS can also be used to create buildings that use less water and energy, and generate less pollution, or to improve renewable energy technologies. Irvan Bastian Arief is doing a doctorate degree at RMIT University in Melbourne through their Sustainable Urban Precincts Program, looking at reducing energy consumption in buildings.

"In Australia, energy consumption charts have identified that heating, ventilation and air conditioning (HVAC) consume the highest amounts of all energy usage," he says.

Irvan says that if the number of people within a room is known, HVAC systems can be adjusted to be more efficient and save power when the room is empty.

"In the future, smart homes will have built-in ambient sensors for CO<sub>2</sub>, noise, light, temperature, humidity, pressure and doors opening or closing."

## GET INTO CS + SUSTAINABILITY!

Check out some work and study options...

### CAREERS

Renewable energy engineer, conservation manager, green building designer, urban planner, smart water systems designer, marine biologist, sustainable fisheries manager, environmental policy advisor + more!

### BACHELOR OF...

Engineering (Hons) (Mechatronic), **University of Adelaide** [goo.gl/ggvQtT](http://goo.gl/ggvQtT)

Marine Ecology (Spatial Ecology), **University of Western Australia** [goo.gl/x8KLHp](http://goo.gl/x8KLHp)

Applied Mathematics, **UNSW Australia** [goo.gl/RYw5a3](http://goo.gl/RYw5a3)

Science (Marine Science), **Murdoch University** [goo.gl/4VJgwD](http://goo.gl/4VJgwD)

Mathematics (Applied and Computational Mathematics), **Queensland University of Technology** [goo.gl/aGZaVS](http://goo.gl/aGZaVS)



# GREEN POWER

COMPUTER SCIENCE RESEARCH AT MONASH UNIVERSITY IS FINDING NEW WAYS TO MAKE ELECTRICITY USAGE MORE SUSTAINABLE

You throw your clothes into the washing machine at 6 a.m. It beeps a warning: If you wash your clothes now, it will have to draw electricity from the grid, which will be expensive. It suggests you wait an hour until the Sun comes up, when electricity can be sourced from your solar panels.

While renewable energy is clean, often cheap and in infinite supply, a big drawback is that the flow can be intermittent – it changes depending on the amount of sunshine, wind or water. To make the most of it, we need to improve storage, enable the grid to both supply and absorb power, and equip houses and buildings to make the most of energy from renewable sources.

Throughout Victoria, smart meters are installed as standard. These digital devices measure in real time the amount of electricity used and send this data to energy distributors every 30 minutes. They are connected to the internet, making it possible to compile all the usage data and find patterns in it.

Monash University electrical engineer and computer scientist Lachlan Andrew is using data from these smart meters to determine how much electricity households are using. He is looking at more than 17,000 meter readings per year for each household – hundreds of millions of electricity readings overall.

By analysing this vast dataset, he can predict what time of day households use the most energy. For example, on a 40°C afternoon, thousands of people may turn on air con at the same time. This would be a huge draw on electricity and could force rolling blackouts across suburbs because there isn't enough power to go around.

"Even if there weren't climate change issues, in a few hundred years we'll run out of coal and, in just a few decades, oil will become scarce. So we need to move quickly towards renewable energy," says Lachlan.



CHRIS MEARS

SHUTTERSTOCK

Part of the solution could be improving storage at the source rather than connecting solar power to the grid. Another might be home automation, with appliances such as washing machines that self-monitor electricity prices based on popular usage times and turn on when electricity is cheapest.

Monash University PhD student Dora He is studying ways to process electricity usage data in real time. Her research relates to smart grids – computer technology added to traditional electricity networks to make production more efficient, reliable, economic and sustainable.

"One idea is to adjust electricity prices when the grid network is nearing capacity, to encourage people to reduce their power consumption," says Dora.

Whatever the answer, Lachlan says it's important to tease out problems with renewable energy now, so they can be resolved for a future where green power is a necessity.

"It's urgent not because we need to have everything renewable tomorrow, but because the transition is going to take decades," he says. "A change of this magnitude will only become harder if we put it off."

– Michelle Wheeler

TO GET THERE: [monash.edu](http://monash.edu)

# BRIGHT IDEA

**HARRY LUCAS IS A UNI STUDENT AND CO-FOUNDER OF A COMPANY THAT COULD CHANGE GLOBAL FOOD PRODUCTION**



JESS NEWELL

**TO GET THERE:**

Bachelor of Engineering (Hons) (Mechatronic), University of Adelaide [goo.gl/MoSLwj](http://goo.gl/MoSLwj)

Harry is studying mechatronics at the University of Adelaide – combining computer science with mechanical, electronic and telecommunications engineering. While an undergrad, he developed GrapeBrain – a technology that can calculate more reliable estimates of annual harvest yields.

He created the system with mechanical engineering and finance student Petros Bakopoulos and marketing and law student Liam Ellul. Their software won their university's inaugural Tech eChallenge competition in 2015. As part of their prize, they're going to Microsoft HQ in Seattle to pitch their product.

The software could be used to improve the efficiency of most

farming systems, and Harry's company, Seer Insights, has already been approached to adapt versions for other industries.

"There's so much pressure to decide what to study at uni that there's a danger of artificially narrowing your choices," he says. "Follow your curiosity. One of the most important things you can do is take time to explore new interests and build character."

Real world perspectives are also important, he says. Seer Insights came up with GrapeBrain after asking a winemaker for feedback on an earlier idea.

"They took time to tell us what would be of value to them," he says. "It was a great opportunity to come up with a better idea."

– Rosslyn Beeby

# CYBORG SIGHT

**ZAHRA BAGHERI IS USING MATHS AND CODING TO DEVELOP TRACKING SOFTWARE FOR MACHINES THAT MIMIC DRAGONFLY VISION**

Dragonflies chase prey almost faster than we can see and catch it with near perfect success, yet their brains are a tiny fraction of the size of a human brain. Zahra is a postgrad student at the University of Adelaide, where she and a team of researchers are studying the supreme tracking abilities of dragonflies to develop a way for robotic eyes to mimic these predatory insects.

First, the team looks at how individual dragonfly brain cells work and interact with each other. Then, they copy the processes of the dragonfly brain onto the circuitry of robots, creating tracking software that enables machines to see and respond like insects.

The tracking software has been tested in virtual reality simulations, where an artificial intelligence entity chases a virtual target against a complex background. The software



FATEMEH KOHESTANI

**TO GET THERE:**

Bachelor of Engineering (Hons) (Mechanical), Shiraz University, Iran

could be applied to drones, smart cars or surgical robots.

"This project is all about coding," says Zahra. "It's essential in order to program the hardware to interact with the software." Zahra has even used coding for her own convenience, to organise files and remote control a computer. "When you learn to code,

you start to think about all the ways you can program to make life easier."

Zahra enjoys maths, but says you don't necessarily need to be good at it to code. "Coding requires logic, and can be used for almost anything," she says.

Her tip is to "explore the things around you and see how the world works." – Jesse Hawley

# Power up

A smarter, safer electricity grid will make use of renewable energy and be able to repair itself

When a massive storm hits, downing power lines and plunging your home into darkness, how long you're left sitting in candlelight depends on the engineers working 24/7 to fix the problem.

The College of Engineering and Computer Science at the Australian National University (ANU) is researching ways to avoid blackouts altogether. They aim to have computers monitor the electricity grid and instantly detect power interruptions, rerouting the flow for minimal disruption. It's a big task, but this 'self-healing grid' is the dream of ANU's Smart Grid team.

A scientist on the project, Carleton Coffrin, says power engineers currently see a self-healing grid as an impossible goal. "It's a very controversial idea," he says, "It's a huge computational challenge to figure out the optimal way to reconfigure and resupply everyone's power."

Grid repairs are even more complex when you factor in renewable energy sources, including wind turbines, solar panels and electric cars. Instead of just drawing in electricity from a few large coal-fired power generators, the grid needs to adapt to flow in and out of hundreds of smaller power sources.

It's a global problem, but CS tools can help address the issue. Recently, students from around the globe gathered at the International Student Energy Summit in Bali to look at how technology will

transform the way we generate and conserve energy in the future. Gissela Uribe and Paulina Duchicela attended as part of their Masters in Business Information Systems at ANU.

"My dream career is to be the 'interpreter' between society and the science and business worlds," Gissela says. "I see technology as a part of life."

So does the municipality of Amsterdam, which is proposing a number of 'smart city' initiatives to reduce power usage. These include street lights that adjust brightness according to weather conditions, and buildings heated by waste heat from electricity usage.

Besides technical expertise, the challenge of building cutting-edge technology into an old electricity grid will call for ingenuity from software engineers. Paulina says she's well-equipped for the future, thanks to her degree.

"At ANU, I was motivated to research, challenge, question, argue and think outside the box," she says. "The skills I've developed are more valuable than the knowledge acquired, which tends to lose relevance over time."

Carleton encourages everyone to learn basic programming. "Everyone who's gone out on a limb and learnt to code has profoundly affected their career," he says. "When people learn about the software underlying the tools they use every day, they feel freed and empowered." – Brett Szmajda



CHANG-WOO LEE

SHUTTERSTOCK

TO GET THERE: [cecs.anu.edu.au/explorecomputing](https://cecs.anu.edu.au/explorecomputing)

# Amazing vision

The creative industries are a showcase of some of the most exciting uses of computer science.

Laura Boness reports

Filmmaking, the arts, education and journalism are just some of the industries harnessing the power of computer science to inform, entertain and communicate in creative and surprising ways.

“CS is an exciting area, especially if you’re willing to take some risks and think outside the box,” says Lidija Loridon, co-founder of Literatu, a cloud-based educational app that helps teachers combine learning resources with technology to engage their students and cater to different learning styles.

Lidija’s game plan is to bring technologies such as virtual laboratories and cloud computing into the classroom. “Asking students to put their tech away when they go into class is like asking them to close their eyes,” she says. “It limits them.”

Robyn Elliott, chief information officer at Fairfax Media and a passionate advocate for getting more women into tech careers, says media is dramatically changing as technology alters the way stories are told. It also offers more interactive engagement between the storyteller and the audience.

“More people are becoming storytellers and reaching bigger audiences,” she says. “We now use video, social media and games to tell stories, and this will continue to evolve through developments like virtual reality.”

The popular video game Minecraft – which involves using blocks to build a 3D virtual world – could also play a role in education, suggests research from QUT.

Entertainment is another massive tech sector. In 2014, it was estimated the Australian games industry was worth \$2.64 billion. There are around 100 games development companies in Australia, with CS roles ranging from animators and 3D specialists to programmers and quality assurance testers. Tech advances also mean you can play games in more places than ever before, including online, on mobile devices and through interactive TV.

At festivals like Vivid Sydney, you can see some of the most exciting and creative uses of CS in action. At Vivid, artists use technology to give audiences the chance to interact with their installations. In an event called A Game of Drones, for example, people could race drones controlled via tablet. Used in this way, CS can make the audience a part of the artwork.

Robyn says there are many different types of technology careers, from designing a website to communicating ideas behind future technology.

“Stay curious and be willing to try new things – technology changes quickly, and the skill you really need is to keep learning.”

## GET INTO CS + STORYTELLING

Check out some work and study options...

### CAREERS

Animator, tech journalist, web/video game designer, audio engineer, UX (user experience) designer + more!

### BACHELOR OF...

Creative Arts/Bachelor of Computer Science, **University of Wollongong** [goo.gl/lhUnDp](http://goo.gl/lhUnDp)

Information Technology (Games and Entertainment Design), **University of South Australia** [goo.gl/tZKUJe](http://goo.gl/tZKUJe)

Computer Science (Applied Computing), **University of Western Australia** [goo.gl/pQWgNi](http://goo.gl/pQWgNi)

Engineering (Hons) (Software), **University of Newcastle** [goo.gl/Hp9rji](http://goo.gl/Hp9rji)

Creative Industries/Information Technology, **QUT** [goo.gl/Lrh7hH](http://goo.gl/Lrh7hH)

Science (Computing and Software Systems), **University of Melbourne** [goo.gl/LZpdZM](http://goo.gl/LZpdZM)

Software Engineering, **University of Canberra** [goo.gl/jCdCbs](http://goo.gl/jCdCbs)

# Sky's the limit

Creative technologist Kat Clark has taken her web development business to new heights

She literally flies high on the weekends in her second job as a trapeze artist and trainer, but creative technologist and web developer Kat is scaling new heights at her company Hello Developers, where she's become one of Australia's top 50 female programmers.

Surprisingly enough, she was completely uninterested in computers as a child. "They made me all sweaty and uneasy," she says. "It wasn't until my cousin Lauren showed me some basic Photoshop magic that I started to dig computers," she says.

Kat took a Bachelor of Digital Media at UNSW Australia's College of Fine Arts, where she coded all of her 3D animation logbooks because she thought presenting an interactive webpage with animated gifs would be cooler than using Word documents. She also taught herself programming after uni. "People kept on asking me to code stuff because they couldn't get their heads around it," she says. "So I taught myself for them, really."

Kat says the word on the street is that people who are good at maths are also good at juggling (literally). At school, she and some of the other students used to juggle, and a teacher arranged circus classes for sport, as well as exchange programs with performing arts high schools.

After uni, Kat started going to flying trapeze classes. Now a qualified flying trapeze instructor, she works weekends at the Australian Recreational Centre for Aerial Arts in Sydney. There Kat trains new staff and uses her skills from Hello Developers to run the centre's website and help with business management.

She says it's important to exercise because "it makes you smarter". She also says to keep an eye out for simple solutions.

"If you did something six months ago, there's probably a better solution by now."

– Laura Boness



Check out Kat's video online  
[careerswithcode.com.au](https://careerswithcode.com.au)

**TO GET THERE:** Bachelor of Media Arts,  
College of Fine Arts, UNSW Australia [goo.gl/TTkLW8](https://goo.gl/TTkLW8)

# SOFTWARE NINJA

**SOFTWARE DEVELOPER MICHAEL QUANDT WORKS ON THE IMAGING TECHNOLOGY THAT GOES INTO CREATING FILMS AND IMPROVING OUR EXPERIENCES IN 3D**

Michael loves being a software developer at Animal Logic – an animation and visual effects studio based at Fox Studios in Sydney. He's working on animation software for upcoming films *LEGO Batman* and *Ninjago*, including the systems used for character faces and 3D viewing.

"You get to see the movies go from concept to completion," he says.

After studying Information and Communication Technology at the University of Technology, Sydney, Michael worked as a consultant for Microsoft, helping developers understand and take advantage of Xbox and Windows platforms. He's also worked on mobile games for Disney and Sony. Michael says computer-generated graphics are used everywhere from action films to advertising, enhancing viewing

experiences or showing action that's difficult or dangerous to film. They're also used in education, giving students a way to view and virtually interact with anything from atoms to stars and planets.

If you want to pursue a career in software development, Michael says it's crucial to keep up with the tech world, where new innovations are being made all the time.

"The more you learn, the easier it is to find ways to solve problems," he says. "Every time a new technique comes out, something old gets pushed aside. If you aren't up to date, you get left behind."

– Laura Boness



LAUREN TROMPP



**TO GET THERE:**

Bachelor of Engineering (Information and Communication Technology), **University of Technology, Sydney** [goo.gl/BlzYf8](http://goo.gl/BlzYf8)

## SHOUT OUT

**WAYNE DENNING AIMS TO MAKE THE WORLD A BETTER PLACE THROUGH DIGITAL MEDIA**

Wayne is founder and managing director of creative agency and production company Carbon Media, which makes digital campaigns, TV shows, websites and apps. And he's passionate about making a positive impact through digital media. While studying sociology, psychology, and political science in a Bachelor of Arts at CQUniversity Australia in Queensland, he became interested in social issues.

"As an Aboriginal person, I was frustrated by the way the media portrayed Indigenous issues and stories in a particularly negative light," he says.

But Wayne believes digital tech can shake up media and business. "Innovation and technology is fundamental to achieving social change. It lets us disrupt the norm and connect with a wide audience."

He did a Masters of Business Administration at QUT, focusing on entrepreneurship – the skills behind building a business. Now, at Carbon Media, he's running an online campaign to encourage Indigenous students to go to uni, and developing a TV series set in Cape York, which could bring new opportunities to the local people.

"If you believe in something, it's worth pursuing," says Wayne. – Bianca Nogrady

**TO GET THERE:** Bachelor of Arts, **CQUniversity Australia** [goo.gl/lkdVni](http://goo.gl/lkdVni)



ERIKA FISH

# CREATIVE CAREERS

## LATERAL THINKING AND COMPUTER SCIENCE GO HAND-IN-HAND FOR ALEX HAHN

Brisbane-based tech startup Gazellik focuses on developing "education apps and gamified tools for enjoyable learning experiences," says Alex, the company's CEO and founding director. "It's a wonderful and creative career path!"

Alex started her business with friends after a double degree in business and fine arts, followed by a postgraduate specialisation in digital technologies and games design, at QUT.

"QUT was the only uni that offered a business and creative degree all in one," she says. "I'm really glad I did the double degree – it put me ahead of a lot of people when I graduated."

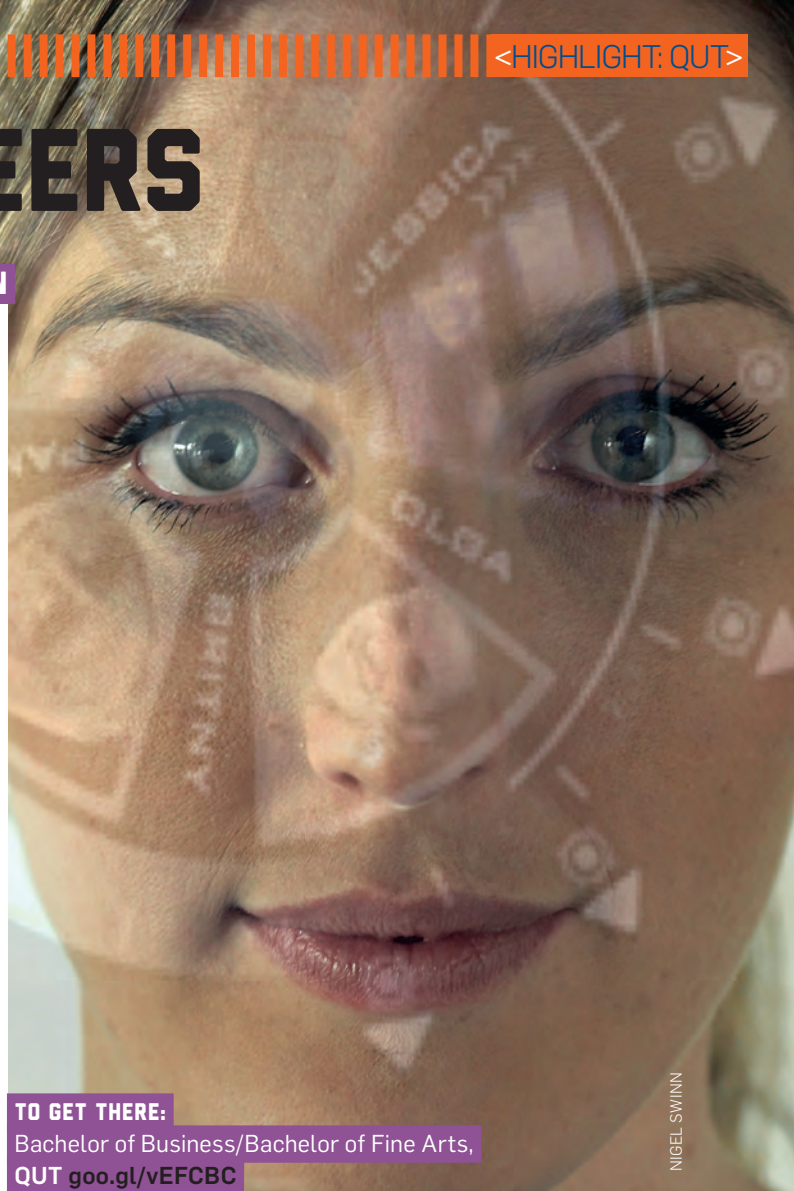
Alex's varied education means she brings multiple skills to Gazellik. "As an app designer, I work with an animator and a programmer with experience in games and software engineering," she says. "I also run the business side of things, and do all the marketing and advertising."

Alex believes strongly that creativity plays a crucial role in CS. "These days, businesses are looking for creative minds to tackle new problems in all industries," she says.

The name 'Gazellik' comes from a Dutch word 'gezellig' – describing positive feelings shared with others – and the animation term 'IK', or inverse kinetics, which is a process used for characters' limb control in a virtual world.

Fittingly, Alex and her team are currently developing an app to encourage school students to consider CS as an exciting career path.

"It's designed to give kids the message that computer science can be whatever you want it to be," she says. – Sarah Keenihan



NIGEL SWINN

### TO GET THERE:

Bachelor of Business/Bachelor of Fine Arts, QUT [goo.gl/vEFCBC](http://goo.gl/vEFCBC)

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- Mathematics
- Science.

Bachelor of Games and Interactive Entertainment with:

- Business
- Mathematics.

For more, visit [www.qut.edu.au/science-engineering](http://www.qut.edu.au/science-engineering)



### TIM PEUT

Computer and software systems engineering graduate

"QUT encourages you to think big. It is never enough to just solve a problem; you are taught to go above and beyond. I completed an internship with Google at their global headquarters in California where I designed and developed test infrastructure for a large software system. I now work there full time and as you would expect, it's amazing. Not bad for a first job! Knowing that your work can impact on millions of Google users around the globe leaves you with a great sense of accomplishment."



# Creativity in coding

Anna Emmerson makes Google products run effortlessly

Google site reliability engineer Anna wasn't one of those kids who was always playing around with computers. Instead, it was her love of maths and puzzles that led her to take a CS subject in high school, where she discovered coding.

"I didn't know a lot about computers, but I found that coding was a way of thinking that I was familiar with and good at – and, most of all, that I enjoyed," she says.

During her arts/engineering degree at uni, Anna applied for the Google Anita Borg Memorial Scholarship. She was a finalist, but couldn't make it to the finalists' retreat and didn't win. Two years later, Google sent her an email to say they were recruiting, and she landed a software engineering role.

An "engineer at heart", Anna eventually became a site reliability engineer in Sydney, responsible for the effortless performance of products like Google Photos.

"It's a pretty incredible engineering challenge – to store the photos of hundreds of millions of people, each of whom may have tens of thousands of photos, and allow them to be accessed anytime and anywhere, really fast," she says.

Anna says that anyone studying maths or science should try coding – not just because it's useful but because "you might just fall in love with it". If you're planning to study CS at uni, Anna says to go where the most challenging problems are, and keep pushing yourself.

"It's the tough things that ultimately turn out to be the most interesting and valuable!" – *Laura Boness*

## TO GET THERE:

Bachelor of Engineering (Hons)  
(Software Engineering)/Bachelor of Arts,  
University of Queensland  
[goo.gl/OavfRN](http://goo.gl/OavfRN)



Check out Anna's  
video online  
[careerswithcode.com.au](http://careerswithcode.com.au)

I FOUND THAT CODING WAS A WAY OF THINKING THAT I WAS FAMILIAR WITH AND GOOD AT – AND MOST OF ALL THAT I ENJOYED



# Leading the tune

Grace Chung fuses a brilliant career at Google with her passion for music

Computer programming is often seen as dry and boring, but the reality is that it's useful across a wide variety of careers and appeals to many different personalities.

"We shouldn't pigeonhole computer programmers into stereotypes," says Grace, who is both a Google software engineer and a professional musician.

She has performed in jazz clubs all around the world, from Hong Kong to Washington DC – wherever her coding job has taken her. "I fit music in between being a mum and my full-time role in technology," she says.

Her passion for singing is matched by her love of creating new software. As a team leader, Grace works with a crew of 19 engineers and product managers on projects like Google+, the social network and hub that brings together all of Google's most popular products. Grace's team is also improving Google My Business – an app that helps link companies with customers through their presence on things like Google Search and Google Maps.

One aspect her tech projects have in common is creating things that help people. "Most days, I think about how the technology we use should be more straightforward, so people of all ages and abilities can find apps intuitive and useful," she says.

"There is much more technology could be doing to help us lead better lives, be more effective at work and connect with communities – without pinning us to a screen." – *Ben Skuse*

#### TO GET THERE:

Bachelor of Engineering (Hons)  
(Electrical Engineering),

**UNSW Australia** [goo.gl/XQMH8r](http://goo.gl/XQMH8r)

Bachelor of Science (Mathematics),

**UNSW Australia** [goo.gl/gS8qXn](http://goo.gl/gS8qXn)



Check out Grace's  
video online  
[careerswithcode.com.au](http://careerswithcode.com.au)

# Startup strong

Small businesses are breaking into – and running – the digital arena.

Bianca Nogrady reports

**IT'S ABOUT GETTING WOMEN INTO THE INDUSTRY AND OPENING THEIR EYES TO THE FACT THAT WHILE IT IS PREDOMINANTLY MALE IT DOESN'T HAVE TO BE THAT WAY**

**T**ech startups are hot right now. Consider app development firm Appster. Its ambitious young Aussie co-founders Mark McDonald and Josiah Humphrey met 10 years ago and started their first online business at age 13. Then, in 2011, at age 19 they founded Appster – which now employs more than 200 development staff around the world, and has an app valued at \$14 million.

The time is ripe for tech startups, with reports suggesting Australia is at the dawn of its own Silicon Valley-style revolution. There are an estimated 1200 tech startups in Australia today. There are also more incubator programs and other opportunities than ever before for Australian innovators to take their tech ideas and turn them into viable, profitable businesses.

Computer science plays a role in all businesses, big and small. Sometimes, an industry requires tech that doesn't exist yet, and they need to find the CS knowhow to build a new product. So they call a CS expert – someone like Nicole Stark.

Nicole's company develops games, but it isn't limited to ones like Angry Birds or Halo. For example, Disparity Games, the small business Nicole runs on the Sunshine Coast with her husband, has worked with Northern Territory Libraries to create a simple flashcard-based language app to help people translate between English and several Indigenous languages.

"Small businesses are dominating the games development scene in Australia," says Nicole.

Angie Gove is also building a career that pairs CS with business. She began by teaching herself Ruby on Rails, a web app development framework, through an online workshop run by General Assembly. By day she now works at tech company Split It, which specialises in making digital platforms that help consumers compare prices and services. By night, Angie's studying a Bachelor of Business, majoring in information systems.

"What I'm hoping to get out of the degree is the room to grow, and from that I feel like I could go into project management, or even start my own development company if I want to. This degree opens up a lot of doors."

Angie is also an organiser for Rails Girls – a series of free events to help women get started in tech and build their ideas. She says the female developer community is incredibly active and supportive.

"I think it's fantastic in terms of the initiatives directed at getting women into the industry and opening their eyes to the fact that, yes, it is predominantly male, but it doesn't have to be that way," she says.

"We have fantastic support from pretty much every company that we speak to, so I definitely feel like things are changing. It's a slow process but everyone is behind it, which is so inspiring."

## GET INTO CS + BUSINESS

Check out some work and study options...

### CAREERS

App/games developer, systems analyst, network administrator, small business owner, information systems manager, web designer/developer/analyst + more!

### BACHELOR OF...

Business Information Systems, **Monash University** [goo.gl/Pq6DL7](http://goo.gl/Pq6DL7)

Information and Communications Technology/Business and Commerce, **Western Sydney University** [goo.gl/SqnYng](http://goo.gl/SqnYng)

Information Technology/Business, **University of Newcastle** [goo.gl/oNRXeV](http://goo.gl/oNRXeV)

Business/Science (Information Technology), **University of Technology, Sydney** [goo.gl/FW4odR](http://goo.gl/FW4odR)

Commerce/Science (Computer Science), **UNSW Australia** [goo.gl/lyelNk](http://goo.gl/lyelNk)

Business (Information Systems Management), **Victoria University** [goo.gl/sxZrrv](http://goo.gl/sxZrrv)

SHUTTERSTOCK

# MAD FOR APPS

**A NEW DEGREE AT FEDERATION UNIVERSITY PREPARES STUDENTS TO MAKE 'THE NEXT BIG THING' IN MOBILE APPS**

Love your phone? Can't get enough apps in your life? There's a course for that. Known as MADS, the Bachelor of Information Technology (Mobile Application Development and Security) at Federation University sets students up to create 'the next big thing' in apps.

"The world of mobile apps is massive," explains course coordinator Alastair Lansley. "The number of jobs in this area is only going to increase."

Alastair says the course is for anyone who wants to work in emerging fields. "You don't need to be super-technical: you just have to be keen."

The degree focuses on technical and design skills, and is linked to industry for practical training.

Hayley Borg is in her third year of the course. "When I started I had no knowledge in this area," she says. "Now I can program, design software and solve technical problems."

Hayley is also doing an extended Bachelor of Information Technology

(Professional Practice) degree, which involves paid work experience with IBM.

"I'm working on an app that gets rid of paper documents for hospice care. I love making it work from a technical point of view," she says.

"I found a course dedicated to being on my phone," she says. "And now I'm working with IBM." – Sarah Keenihan

**TO GET THERE:**

Bachelor of Information Technology (Mobile Application Development and Security), Federation University [goo.gl/qMAqZd](http://goo.gl/qMAqZd)

Bachelor of Information Technology (Professional Practice), Federation University [goo.gl/hCUQ8R](http://goo.gl/hCUQ8R)

FEDERATIONUNI



## BECOME THE ONE WHO CREATES 'THE NEXT BIG THING' IN MOBILE APPS

Apply now for the Bachelor of Information Technology (Mobile Application Development and Security) to equip yourself with the skills required to create the mobile apps that will drive the future. The mobile application industry is rapidly growing, with millions of people using apps each day the industry needs innovative, creative and skilled professionals.

**Apply now**  
[Federation.edu.au/bitmads](http://Federation.edu.au/bitmads)

CRICOS Provider No. 00103D



# INDUSTRY PLAYER

FOR BRONWEN ZANDE CODING IS A PASSPORT TO THE DIVERSE AND EXCITING WORLD OF BUSINESS

**B**ronwen discovered she was a natural at coding when she first tried it as a young girl. "I definitely don't think coding is just for boys!" she says. "It's good for anyone to do."

Bronwen is now a developer and director of Brisbane-based information technology company Soul Solutions. They use the latest Microsoft technologies like Kinect for Windows, which helps people interact with computers using voice and gestures.

One of Bronwen's favourite new pieces of tech is the HoloLens – a see-through, holographic computer. With it you could put a virtual custom skin on your bike to see how it looks, or find new ways to collaborate in Minecraft, she says.

While CS wasn't her first choice at uni, Bronwen quickly realised it suited her. "I'm a problem-solver, and I don't like letting the computer win!" she says.

Her company helps clients solve their real-world problems using technology – like creating an online student portal for a uni or an app to improve public health. She also organises DDD Brisbane – a non-profit community event run by developers – and judges school software writing competitions.

She says, as a programmer, you're constantly learning new technologies as well as playing with new cool devices. And you can use your skills almost anywhere. "You can work in any industry around the world, which is something you don't really get with other jobs." – Bianca Nogrady

**TO GET THERE:** Bachelor of Information Technology, University of Queensland [goo.gl/ZsnCYM](http://goo.gl/ZsnCYM)



JOHN OBRIEN

## Our challenge was to engineer a solution to change lives

Jeremy and Elliot, UQ graduates

Jeremy, Elliot and Gavin's final year thesis for their Bachelor of Engineering (Electrical and Biomedical) led to Pepster, the world's first breathing therapy device for cystic fibrosis. Paired with smart phones or tablets, Pepster allows patients to control video games with breathing exercises and lets clinicians accurately monitor their treatment. By learning to see the world differently, Jeremy, Elliot and Gavin are creating change. Learn more at [eait.uq.edu.au](http://eait.uq.edu.au)



THE UNIVERSITY OF QUEENSLAND AUSTRALIA

Create change



# SENSORY FEAST

**A NEW DEGREE AT JAMES COOK UNIVERSITY WILL TRAIN FUTURE GENERATIONS TO MASTER A GROWING NETWORK: THE INTERNET OF THINGS**

Drones hovering over a rainforest map the spread of invasive weeds. A buoy bobbing in the ocean near a reef measures sea temperature for climate change research. A tractor in a field uses GPS and soil sensors to tell farmers precisely where to sow for optimum crop yields.

Sensors and other devices are becoming more and more interconnected in what's called the 'Internet of Things' – a network of drones, phones, smart electricity meters and all other devices, which, like computers, have an IP address.

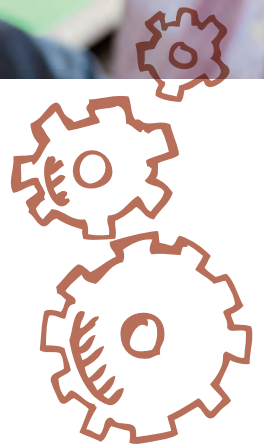
By 2020, there will be 29.5 billion devices around the world connected to the internet. Tech analysis firm, International Data Corporation, forecasts that almost a third of these devices will be in the Asia-Pacific region. This growth stems mostly from government initiatives, particularly in China, and companies worldwide are eager to grab their share of the market.

James Cook University (JCU) in Queensland is responding by introducing a Bachelor of Engineering



in Electronic Systems and Internet of Things in 2016. It's the first degree of its kind in Australia, and one of the first in the world.

"We're excited about this new degree," says Rabin Tuladhar, senior lecturer and associate dean at JCU's College of Science, Technology and Engineering. The program will combine engineering and business with technology, to train people in creating new internet-connected devices and managing the huge amounts of data they produce. "Our graduates will not just look for jobs – they'll create them. They'll be self-starters, problem-solvers and entrepreneurs," says Rabin. – *Carrie Bengston*



## An engineering degree to transform the future

Prepare for the next revolution in technology.

Study our Bachelor of Engineering (Honours) in Electronic Systems & Internet of Things.

Only at James Cook University, Cairns. Starts 2016.

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Graduates eligible for accreditation through Engineers Australia.

Cairns  
Singapore  
Townsville

1.2 million new digital jobs\*

\*Source: Committee for Economic Development of Australia (CEDA), "Australia's future workforce?" Report, June 2015

# On your marks...

Athletes and sports teams know it's good to have computer science in their corner. Ben Skuse reports

**R**ed Bull Racing driver Daniel Ricciardo has a team of computer scientists who plot his every move and use algorithms to optimise his race strategy.

Nowadays, computer science plays a major part in ensuring success in most sports.

The Wallabies' 2015 Rugby World Cup jersey, for example, was developed by the ASICS Institute of Sport Science in collaboration with the players. It's lighter, stronger, harder to grab and better fitted than any previously worn – improvements that couldn't have been made without CS in play.

Olympic 100 m hurdles champion Sally Pearson teamed up with podiatrist and coach Ashley Mahoney to stay injury-free and improve her personal best. Combining cutting-edge software with super slow motion cameras, Ashley can measure things like step lengths, velocities, flight time over hurdles and forces out of the starting blocks.

"With this information we can make precise judgments and determine if any program changes need to be made," he says.

Code-based skills are in high demand in the sports industry. "Mechanical, electronic,

software and materials engineering are all very relevant to sports technology," says Glen Charlton, a technical support engineer for Catapult Sports (see p31).

A sports-related CS career could involve searching through data to help coaches evaluate game strategies, identify talent and predict results. It might also include developing better sports simulators or more realistic 'exergames', which combine exercise with gaming for fitness and rehabilitation.

"Any given day, I can be thrown a new challenge, from building a prototype sensor system that captures an athlete's muscle movements, to writing a machine learning algorithm that automates manual data analysis," says Aaron Belbasis, a PhD researcher at RMIT University. He's developing 'Smart Apparel' that monitors muscles and ligaments during exercise, looking for actions that lead to injury.

Aaron says CS is a varied career. "I've had the opportunity to work with elite athletes, secure design patents, pitch my technology to investors, travel the globe to learn and share knowledge – and, ultimately, tailor the impact of my career upon the world."



SUZANNE PLUNKETT/REUTERS (PICTURE MEDIA)

## GET INTO CS + SPORTS!

Check out some work and study options...

### CAREERS

Sports trainer, sports coach, technical engineer, health data analyst, exercise physiologist, sports scientist, biomechanical researcher, mobile app developer, physical therapist + more!

### BACHELOR OF...

Exercise and Sport Science (Hons), **University of Newcastle** [goo.gl/Nc2n0q](http://goo.gl/Nc2n0q)  
Applied Science (Exercise and Sport Science), **RMIT University** [goo.gl/ixdSFB](http://goo.gl/ixdSFB)  
Engineering Science (Sports Engineering), **Victoria University** [goo.gl/KP9xq9](http://goo.gl/KP9xq9)

Sport Science (Human Movement), **Victoria University** [goo.gl/JKOqEW](http://goo.gl/JKOqEW)  
Science (Applied Statistics), **Swinburne University** [goo.gl/s8onxP](http://goo.gl/s8onxP)  
Applied Science (Exercise and Sport Science), **University of Sydney** [goo.gl/lwQVro](http://goo.gl/lwQVro)

# CAREER CATAPULT

**GLEN CHARLTON IS APPLYING THE CODING SKILLS HE LEARNED AT UNI TO BUILD CUTTING-EDGE TECH FOR ATHLETES**

**I GET TO WORK ON TOP ATHLETE MONITORING SYSTEMS AND HELP SOME OF THE WORLD'S BIGGEST SPORTING CLUBS**

**G**len combined his abilities in maths and science with his love of elite sport through a Bachelor of Engineering Science (Sports Engineering) at Victoria University. During the course, he developed a love of coding and electronics.

For one of his major uni projects he designed a touchpad that attaches to swimming pool walls to detect human contact and record swimmers' times. "The design was cheaper and more durable than traditional mechanical touchpads," he says.

Glen now works for Catapult Sports, a sports analytics company based in Melbourne, as a technical support engineer troubleshooting and testing products. "I wanted to work there because they are leaders in athlete monitoring technology," he says. "Their products give sports scientists and coaches an in-depth look into athletes' physical attributes, so they can optimise training plans and monitor the recovery of injured players."

One of his projects is a wearable device called ClearSky, which triangulates a player's every move. It's already being used in training facilities around the world.

"I get to work on top athlete monitoring systems and help some of the world's biggest sporting clubs," he says. — Ben Skuse

**TO GET THERE:** Bachelor of Engineering Science (Sports Engineering), **Victoria University** [goo.gl/KP9xq9](http://goo.gl/KP9xq9)

TINA SMIGIELSKI

# Cyber quest

UNSW Australia's winning streak in hacking competitions worldwide is helping to provide a more secure future for all

You may not expect your uni to assign you a task like *Mission: Impossible*, but that's just what's happening for cybersecurity students at UNSW Australia's School of Computer Science and Engineering. Computer code is their weapon and their shield, and they are trained well.

Cyber Security Challenge Australia (CySCA) has been running for three years, and students from UNSW Australia have dominated the prize pool and claimed first prize each time.

This celebrated hacking event is designed to excite, inspire and attract Australia's most talented coders to become the next generation of cybersecurity professionals. It's organised and conducted by the Australian Government and Telstra along with PwC Australia, ComBank, CISCO, Facebook, Microsoft and HackLabs.

Teams have 24 hours to hack into a series of increasingly secure systems, finding their weaknesses and exploiting them. Teams score points for how far into the systems they hack, how many systems they infiltrate, and the quality of their attacks. They earn extra points if they set up defences to keep other teams out. It's about building better defences by understanding the mind of an attacker.

There's also the chance to impress potential employers. John Cramb, who was on UNSW's 2014 winning team, now works for PwC and is helping to coordinate the 2015 competition.

Richard Buckland heads the cybersecurity training at UNSW Australia, and loves setting

students challenges that teach the art of defence through the different methods of hack attack.

"Competitions are important because they give recognition to people, and are good at motivating and setting a standard," he says. "You can't defend unless you know what attackers will do and how they think."

UNSW teaches cybersecurity from first year, training students to understand that even seemingly unimportant system flaws can be exploited by an attacker.

"So many of the vulnerabilities in security systems are low-level, and our students are very confident with them," says Richard.

In 2014, UNSW Australia students placed fifth in the world in the qualifying round of the massive Black Hat hacking competition, run yearly in Las Vegas. The UNSW Australia team called themselves '9447', in honour of their cybersecurity attack course code, COMP9447.

Cybersecurity is now one of the hottest areas in computing, and demand for specialists outstrips supply.

Huge tech companies like Google, major banks and large organisations – anyone with a website or system they want to protect – are all scrambling to hire cybersecurity specialists to protect them against criminal, malicious or even just frivolous attacks.

Hacking competitions attract some of the best computing minds from across the globe and are a hunting ground for recruiters. But, most of all, they're fun – much like studying cybersecurity.

"It's really popular with students because they have an incredible time," says Richard. "They solve puzzles all day long. It's exhilarating and rewarding." – Bianca Nogrady



TO GET THERE: [unsw.edu.au](http://unsw.edu.au)



# DRIVING TECH

**THE GOOGLE TEAM IS WORKING ON CARS THAT DRIVE THEMSELVES**

Getting around in a self-driving car that goes from point A to B with the touch of a button may sound like sci-fi, but Peter Morton and his team at Google are making it a reality.

Peter studied Mechatronics Engineering and Computer Science at Monash University in Melbourne, and did a PhD at the Australian Centre for Field Robotics (pictured right) at the University of Sydney. Now he's working in California on the Google Self-Driving Car Project.

Whether it's reducing the number of car accidents – 94% of which are caused by human error – giving people back the time they spend stuck in traffic, or making everyday destinations accessible for people unable to drive, this ambitious project could revolutionise transport.

Peter loves a challenge and is working at the edge of what's currently possible. He says it's vital to try new things.



CHRIS BRUNNER/AUSTRALIAN CENTRE FOR FIELD ROBOTICS

"It's easy to do what you're used to, but you'll learn much more by switching things up. Say 'yes' to every opportunity, and always be on the lookout for new challenges." – Carrie Bengston

**READ THE FULL INTERVIEW ONLINE:**  
[careerswithcode.com.au](http://careerswithcode.com.au)

**TO GET THERE:** Bachelor of Engineering (Hons) (Mechatronics Engineering), Monash University [goo.gl/YJFYs](http://goo.gl/YJFYs) Bachelor of Computer Science, Monash University [goo.gl/g7bceJ](http://goo.gl/g7bceJ)



# OPEN WORLD

Following his double degree in Arts and Engineering at UNSW Australia, Adam Brimo created an international, multi-million dollar business called OpenLearning – an online platform that "enables anyone to create, run, teach and enrol in a course," he says.

"Arts is a good complement to engineering," says Adam. He adds that the engineering mindset helps with problem solving in other areas, like politics and international affairs.

Adam immersed himself in opportunities at uni, including visiting China through the uni's involvement in the RoboCup competition. "That was a fantastic experience," he says.

During his degree, Adam worked part-time as a software engineer at Macquarie Bank, which directly related to his studies, he says. His degree focused on learning how to learn and included group projects that involved planning and project management, as well as software development.

"Make sure you do something you're passionate about," he says. "And if you fail, get back up and try again." – Jesse Hawley

**TO GET THERE:**  
Bachelor of Engineering (Hons)/ Bachelor of Arts, UNSW Australia [goo.gl/PKmcna](http://goo.gl/PKmcna)



# DREAM BIG

**BIDJIGAL MAN CHRIS TIMBERY DISCOVERED HE HAS A KNACK FOR HIGH STAKES CODING**

Chris originally had no interest in uni, or even in finishing Year 12. Then he joined the Australian Indigenous Mentoring Experience (AIME) – an educational program giving support to Indigenous students through high school and uni, or onto employment, at the same rate as all Australians.

Chris got a traineeship through Mission Australia that connected him

with employers, which helped give him the drive to complete Year 12 and do a CS degree. He's now in second year at the University of Wollongong, majoring in digital systems security. One of his ambitions is to make his own operating system like Windows or iOS.

Chris recently did an internship with Westpac's information security group,



where he searched for security loopholes. He wrote code that scans through a database to find hacking attempts.

"I saved the company money by writing the script, and it's still being used," says Chris. "I'm hoping for a graduate position with the team at Westpac, and then a full-time job with them." – Heather Catchpole

**TO GET THERE:** Bachelor of Computer Science, University of Wollongong [goo.gl/4wNm8q](http://goo.gl/4wNm8q)



STUART HAY

**TO GET THERE:** Bachelor of Software Engineering, Australian National University [goo.gl/nN7kVT](http://goo.gl/nN7kVT)

# BEAUTIFUL GARBAGE

**STUDENT PETER MARSHALL FOUND THAT TAKING OUT THE TRASH CAN SAVE MILLIONS OF DOLLARS**

Garbage collection may not sound glamorous, but Australian National University (ANU) student Peter flew all the way to Boston to try it at Facebook. Garbage collection is a programming method for dealing with 'junk' memory that's no longer in use. "It's about optimising programs for speed and memory efficiency," says Peter. As part of his Honours thesis, he's applying research on garbage collection to a real-world problem in the code that drives Facebook. For a massive company like Facebook, even small performance gains can translate into millions of dollars in savings. Peter is looking for software engineering work with companies like Google, Atlassian or Facebook. He's also interested in product management. "There's a focus on the business side of things, but it still requires a deep technical knowledge." – Brett Szmajda

## PASSION UNLOCKED

Chantel Garcia became interested in coding during her first year at uni. "I was really into art, and enjoyed using coding to create websites with transitions and moving art – it built on my passion."

Chantel studied Computer Science and Information Technology and Systems at Monash University, where she was a part of the Google Student Ambassador program, running events on campus to draw students' attention to programming competitions and other opportunities. "It was great getting like-minded people together to share ideas about the 'next big thing' in CS."

At uni, she was also a member of Google-sponsored networking group, Monash Girl Geek Coffee Club, and worked on a range of mobile and web development projects. This included an app that finds restaurants catering to certain dietary requirements.

It's always worth getting involved, she says. "Seize every opportunity – you never know who you'll meet or what you'll learn."

Chantel is now a software development engineer at Microsoft in the USA. "If you're passionate about what you do, the doors will open for you." – Heather Curry



MONASH UNIVERSITY

**TO GET THERE:** Bachelor of Computer Science, Monash University [goo.gl/yWfrJn](http://goo.gl/yWfrJn)  
Bachelor of Information Technology and Systems, Monash University [goo.gl/Lwqcli](http://goo.gl/Lwqcli)

## ADD IT UP



ERIKA FISH

When statistician Kerrie Mengersen steps into The Cube – an enormous digital interactive and learning display space at QUT's Science and Engineering Centre – a virtual Great Barrier Reef surrounds her in 3D, teeming with life.

The reef's health and biodiversity need to be monitored and managed carefully. But there's a vast amount of research data to process and understand, accessed from all kinds of sources like satellites and autonomous underwater vehicles.

As a statistician, Kerrie has the skills to work out what the data is saying. Natural resource managers then use her findings to make important decisions about the reef and its future.

"It's wonderful solving challenges using stats and computer science," she says.

Whatever your passion – environment, health, business – Kerrie says you'll be in great demand and have a fantastic career if you have skills in CS and maths. – Carrie Bengston

**TO GET THERE:** School of Electrical Engineering and Computer Science, QUT [goo.gl/eBnU8h](http://goo.gl/eBnU8h)

# DIGITAL SHAKE-UP

**BUSINESSES OF ALL KINDS NEED TECH EXPERTS TO LEAD THEM INTO THE FUTURE**

Digital technology has smashed barriers to industries that entrepreneurs wouldn't have dreamed of entering just a few years ago. From banking to health, innovators in all fields are improving the experiences and lives of customers.

A change manager, for example, helps established companies adapt to the digital marketplace. Digital experience designers, meanwhile, look at how best to attract and engage customers online.

The key to these careers is the right education. "Let's engage kids in game-making, website creation, robotics and wearable technologies," says Sarah Hobson, eLearning integration teacher at Good News Lutheran School in Brisbane.

Sarah is actively involved in the Digital Careers program – an Australian Government initiative to encourage young people to pursue careers in technology. Through this program, Sarah has enrolled her students in the Young ICT Explorers competition, which encourages school students to tackle their own tech projects.



SAP AUSTRALIA AND NEW ZEALAND

"Two of our primary school students wanted to make Tinkerbell's dress sparkle for a performance of *Peter Pan*," she says. They sewed strips of coloured programmable LED lights onto a skirt and attached them to a GEMMA – a tiny wearable platform that can be programmed using open-source coding software Arduino. To get the LEDs to sparkle, they used conductive thread, and then had to learn how to control the lights by programming the GEMMA.

"They started with a problem – and solved it with code," says Sarah. – Ben Skuse



digitalcareers

**IDENTIFY YOUR PATHWAY TO A FUTURE CAREER IN DIGITAL TECHNOLOGIES**

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[www.digitalcareers.edu.au](http://www.digitalcareers.edu.au)



Young ICT Explorers  
[www.youngictexplorers.net.au](http://www.youngictexplorers.net.au)



Bebras Computational Thinking  
[www.bebas.edu.au](http://www.bebas.edu.au)





# It starts here...

Here are just some of the available **Bachelor degrees** where you can study CS and build skills in another field at the same time.

## KEY

CS = Computer Science  
IT = Information Technology  
Eng = Engineering

## CS + BE CREATIVE

**arts, visual arts, digital design...**

**Australian Catholic University**

>>> Digital Media

**Australian National University**

>>> IT/Visual Arts

**Charles Darwin University**

>>> Creative Arts & Industries  
(New Media Design)/IT

**CQUniversity Australia**

>>> Digital Media

**Deakin University**

>>> Information Systems/Arts

**Edith Cowan University**

>>> Design (Games & Interactivity)

**Griffith University**

>>> IT/Multimedia

**Murdoch University**

>>> Graphic Design

**QUT**

>>> Creative Industries/IT

>>> Design (Interactive & Visual)

**RMIT University**

>>> Design (Animation  
& Interactive Media)

>>> Design (Digital Media)

**University of Canberra**

>>> Graphic Design

>>> IT/Arts

>>> IT/Media Arts & Production

>>> Web Design and Production

**University of Newcastle**

>>> IT (Digital Media  
& Entertainment)

>>> Visual Communication Design

**University of Queensland**

>>> Eng/Arts

>>> IT/Arts

>>> Multimedia Design

>>> Science (CS)/Arts

**University of South Australia**

>>> Media Arts

**University of Sydney**

>>> IT/Arts

**University of Tasmania**

>>> Information & Communication  
Technology/Arts

>>> Information & Communication  
Technology/Visual  
Communication

**University of Wollongong**

>>> CS (Multimedia & Game  
Development)

**UNSW Australia**

>>> Bioinformatics Eng/Arts

>>> Computer Eng/Arts

>>> CS/Arts

>>> Media Arts/CS

>>> Software Eng/Arts

**Victoria University**

>>> Creative Arts Industries

>>> Interactive Media

## CS + MAKE GAMES AND APPS

**software, mobile, interactivity...**

**Australian National University**

>>> Software Eng

**Bond University**

>>> Interactive Media & Design  
(Computer Games)

**Charles Darwin University**

>>> Software Eng

**Charles Sturt University**

>>> CS (Games Programming)

>>> CS (Games Technology)

**CQUniversity Australia**

>>> IT (Games Development)

>>> IT (Mobile Application Development & Security)

**Deakin University**

>>> Games Design & Development

**Edith Cowan University**

>>> Design (Games & Interactivity)

**Federation University**

>>> IT (Computer Games & Digital Media)

>>> IT (Mobile Application Development & Security)

**Flinders University**

>>> Eng (Software)

**Macquarie University**

>>> IT (Games Design & Development)

**Monash University**

>>> Software Eng

**Murdoch University**

>>> Games Art & Design

>>> Games Software

>>> Design & Production

>>> Games Technology

>>> Internetworking

>>> Mobile & Web Application Development

>>> Web Communication

**QUT**

>>> Business/Games & Interactive Entertainment

>>> Computer & Software Systems

>>> Games & Interactive Entertainment

>>> Games & Interactive Entertainment/Mathematics

**RMIT University**

>>> Design (Games)

>>> IT (Games & Graphics Programming)

>>> Software Eng

**Swinburne University**

>>> Applied Information & Communication Technology

>>> Arts (Games & Interactivity)/CS

>>> CS (Games Development)

>>> Eng (Software Eng)



**University of Melbourne**

>>> Science (Computing & Software Systems)

**University of Newcastle**

>>> Eng (Software)

>>> IT (Software Development & Applications)

**University of Queensland**

>>> Eng (Software)

>>> Multimedia Design

**University of South Australia**

>>> IT (Games & Entertainment Design)

>>> IT (Mobile Application Development)

>>> IT (Software Development)

>>> Software Eng

**University of Sydney**

>>> Design Computing

**University of Tasmania**

>>> Information & Communication Technology (Games & Creative Technology)

**University of Technology, Sydney**

>>> Science (Games Development)

>>> Science (IT)/Creative Intelligence & Innovation

**University of Wollongong**

>>> CS (Mobile Computing)

>>> CS (Multimedia & Game Development)

**UNSW Australia**

>>> CS (Computer Game Design & Construction)

**Victoria University**

>>> Interactive Media

**CS + GET INTO LAW OR BUSINESS**

finance, management, systems...

**Australian Catholic University**

>>> IT/Business Administration

**Australian National University**

>>> IT/Commerce

>>> IT/Economics

>>> IT/Finance

>>> IT/Law

>>> Software Eng/Actuarial Studies

>>> Software Eng/Business Administration

**Charles Sturt University**

>>> IT (Business Services)

**CQUniversity Australia**

>>> Business (Information Systems)

**Deakin University**

>>> Commerce/Information Systems

>>> Criminology/IT Security

>>> Information Systems/Laws

>>> Information Systems/IT

**Edith Cowan University**

>>> Eng (Computer Systems)/Business

>>> Eng (Computer Systems)/Law

>>> Science (Cyber Security)

>>> Technology (Electronic & Computer Systems)

**Federation University**

>>> IT (Business Systems)

>>> IT (Professional Practice)

**Flinders University**

>>> IT (Network Systems)

<continues p38>

**Griffith University**

- >>> Business Information Systems

**James Cook University**

- >>> Business (Business Intelligence & Information Systems)
- >>> Eng (Electronic Systems & Internet of Things)

**La Trobe University**

- >>> Business Information Systems

**Macquarie University**

- >>> Commerce/Science (Computing)
- >>> Commerce/Science (Software Technology)
- >>> IT/Laws

**Monash University**

- >>> Business Information Systems
- >>> Commerce/Business Information Systems

**Murdoch University**

- >>> Business Information Systems
- >>> Cyber Forensics, Information Security & Management

**QUT**

- >>> Business/Games & Interactive Entertainment
- >>> Business/IT
- >>> IT/Laws

**RMIT University**

- >>> Business (Information Systems)
- >>> Eng (Computer & Network)/CS

**Swinburne University**

- >>> Applied Information & Communication Technology
- >>> Business Information Systems
- >>> Eng (Telecommunication & Network Eng)/Business
- >>> Information & Communication Technology (Network Design & Security)

**University of Adelaide**

- >>> Laws/CS
- >>> Laws/Mathematical & CS
- >>> Mathematical & CS/Finance

**University of Canberra**

- >>> Software Eng/Business Informatics
- >>> IT/Commerce

**University of Melbourne**

- >>> Science (Informatics)

**University of New England**

- >>> CS/Laws

**University of Newcastle**

- >>> IT/Business
- >>> IT (Enterprise IT)

**University of Notre Dame**

- >>> Commerce/Communications & Media

**University of Queensland**

- >>> IT/Business Management
- >>> IT/Commerce

**University of South Australia**

- >>> IT (Hons) (Enterprise Business Solutions)
- >>> IT (Networking & Cybersecurity)
- >>> IT (Software Development)

**University of Southern Queensland**

- >>> Business/IT
- >>> Commerce/IT

**University of Sydney**

- >>> IT/Commerce
- >>> IT/Laws
- >>> Project Management (Software)

**University of Tasmania**

- >>> Economics/Information & Communication Technology
- >>> Information & Communication Technology/Laws

**University of Technology, Sydney**

- >>> Business/Science (IT)
- >>> Science (IT)/IT Professional Practice
- >>> Science (IT)/Laws

**University of the Sunshine Coast**

- >>> Information & Communications Technology

**University of Wollongong**

- >>> CS (Big Data)
- >>> CS (Cyber Security)

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PHOTO: TINA SMIGIELSKI

- >>> CS (Digital Systems Security)
- >>> CS (Enterprise Systems Development)
- >>> CS/Laws
- >>> Information Systems
- >>> IT (eBusiness)
- >>> IT/Laws
- >>> IT (Network Design & Management)
- >>> IT (Social Policy)
- >>> IT (Web Design & Development)

**UNSW Australia**

- >>> Bioinformatics Eng/Commerce
- >>> Bioinformatics Eng/Laws
- >>> Commerce/Information Systems
- >>> Computer Eng/Commerce
- >>> Computer Eng/Laws
- >>> CS/Commerce
- >>> CS/Laws
- >>> Information Systems
- >>> Software Eng/Commerce
- >>> Software Eng/Laws

**Victoria University**

- >>> Business (Information Systems Management)
- >>> IT (Network & Systems Computing)

**Western Sydney University**

- >>> Information Systems

**CS + BE A TEACHER**

early childhood, primary, secondary...

**Macquarie University**

- >>> Education/Science (Computing)

**University of Adelaide**

- >>> Teaching/Mathematical & CS

**University of New England**

- >>> IT/Teaching

**University of South Australia**

- >>> Education (Secondary Design & Technology)

**CS + BE A SCIENTIST**

physics, chemistry, mathematics...

**Australian National University**

- >>> Advanced Computing/Science
- >>> IT/Environmental Studies

**Deakin University**

- >>> Information Systems/Science

**Griffith University**

- >>> Science/IT

**Macquarie University**

- >>> IT (Data Science)
- >>> Science (Decision Science)

**Monash University**

- >>> Science/CS

**QUT**

- >>> Science/IT

**University of Adelaide**

- >>> Mathematical & CS

**University of Melbourne**

- >>> Science (Software Systems)

**University of Newcastle**

- >>> CS (Applied Computing)
- >>> Eng (Computer)/Mathematics
- >>> Eng (Computer)/Science
- >>> IT (Data Analytics)
- >>> Mathematics/CS

**University of Queensland**

- >>> Eng/Science
- >>> IT/Science

**University of Sydney**

- >>> IT/Science

**University of Tasmania**

- >>> Information & Communication Technology/Science

**UNSW Australia**

- >>> Bioinformatics Eng/Science
- >>> Computer Eng/Science
- >>> Science (Advanced)/CS

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## CS + WORK IN HEALTH medical, bioinformatics, sport...

### Australian National University

- >>> Advanced Computing/ Biotechnology
- >>> IT/Medical Science

### Deakin University

- >>> Information Systems/ Health Sciences

### James Cook University

- >>> Sport and Exercise Science

### University of Adelaide

- >>> Health Sciences/ Mathematical & CS

### University of Canberra

- >>> Science (Sport & Exercise)/IT

### University of Melbourne

- >>> Science (Informatics)

### University of Queensland

- >>> Eng (Biomedical)/Science

### University of Sydney

- >>> IT/Medical Science

### University of Technology, Sydney

- >>> Mathematics/Computing
- >>> Science (IT)/IT Professional Practice

### University of Western Australia

- >>> Science (Data Science)

### University of Wollongong

- >>> CS (Big Data)
- >>> CS/Mathematics
- >>> CS/Science
- >>> Medical Mathematics

### UNSW Australia

- >>> Bioinformatics Eng
- >>> Bioinformatics Eng/Science
- >>> Biomedical Eng
- >>> Computer Eng/Biomedical Eng
- >>> Software Eng/Biomedical Eng

## CS + BE AN ENGINEER robotic, electronic, mechatronic...

### Charles Sturt University

- >>> IT (Network Eng)

### CQUniversity Australia

- >>> Eng (Electrical)
- >>> Eng (Mechatronic)

### Curtin University

- >>> Eng (Computer Systems)/ Science (CS)
- >>> Eng (Electronic & Communication)/Science (CS)

### Edith Cowan University

- >>> Eng (Computer Systems)/CS
- >>> Eng (Electronics & Communications)
- >>> Eng (Mechatronics)
- >>> Technology (Electronic & Computer Systems)

### Griffith University

- >>> Eng (Hons) (Electronic & Computer Eng)/IT
- >>> Eng (Hons)/IT

### James Cook University

- >>> Eng (Hons) (Electronic Systems & Internet of Things)
- >>> Eng (Hons)/IT

### Macquarie University

- >>> Eng (Mechanical)
- >>> Eng (Mechatronic Eng)
- >>> Eng (Software)

### Murdoch University

- >>> Eng Technology
- >>> Industrial Computer Systems

### QUT

- >>> Eng (Electrical)
- >>> Eng (Electrical & Aerospace)
- >>> Eng (Mechatronics)
- >>> Eng/IT

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### RMIT University

- >>> Eng (Computer & Network)/CS
- >>> Eng (Electronic & Communication)/CS
- >>> Software Eng

### Swinburne University

- >>> Eng (Electronics & Computer Systems)/CS
- >>> Eng (Telecommunication & Network)/CS
- >>> Eng (Robotics & Mechatronics)/CS

### University of Adelaide

- >>> Eng (Civil & Environmental)/Mathematical & CS
- >>> Eng (Civil & Structural)/Mathematical & CS
- >>> Eng (Electrical & Electronic)/Mathematical & CS
- >>> Eng (Mechanical)/Mathematical & CS
- >>> Eng (Mechanical & Aerospace)/Mathematical & CS
- >>> Eng (Mechatronic)/Mathematical & CS
- >>> Eng (Mining)/Mathematical & CS

### University of Canberra

- >>> Network & Software Eng
- >>> Software Eng

### University of Melbourne

- >>> Science (Software Systems)

### University of Newcastle

- >>> CS (Computer Systems & Robotics)
- >>> Eng (Computer)/CS
- >>> Software Eng



UNIVERSITY OF QUEENSLAND

### University of Queensland

- >>> Eng/IT

### University of South Australia

- >>> Eng (Hons)(Electrical & Electronic)
- >>> Eng (Hons)(Electrical & Mechatronic)
- >>> Eng (Hons)(Mechatronic)
- >>> Eng (Mechanical & Advanced Manufacturing)

### University of Southern Queensland

- >>> Eng (Computer Systems)

### University of Sydney

- >>> Eng (Electrical, Computer)
- >>> Eng (Electrical, Telecommunications)
- >>> Eng (Mechatronic)
- >>> Eng (Mechatronic, Space)

### University of Tasmania

- >>> Eng (Biomedical)
- >>> Eng (Computer Systems)

- >>> Eng (Electronics & Communications)

- >>> Eng (Mechatronics)

### University of Technology, Sydney

- >>> Eng/Professional Eng Practice

### University of Western Australia

- >>> Science (Data Science)
- >>> Science (Engineering Science)

### University of Wollongong

- >>> Eng (Computer)
- >>> Eng (Mechatronics)
- >>> Eng/CS

### UNSW Australia

- >>> Bioinformatics Eng
- >>> Computer Eng
- >>> CS (Robotics)
- >>> CS/Eng
- >>> Software Eng

### Victoria University

- >>> Eng (Mechanical)

**Disclaimer:** Every effort has been made to ensure the accuracy of degree names at the time of publication. To find more degrees, quiz yourself on degree options and search degrees by topic and state, visit [careerswithcode.com.au](http://careerswithcode.com.au)

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# Changing the game

10 ways computer science is transforming our world. Laura Boness reports

1

## Helping hand

Tokyo startup Exiii is using 3D printing to construct a prosthetic hand and arm for as little as \$270. They're releasing the design data as open source software to speed up the development.

[exiii.jp](http://exiii.jp)



2

## On the block

The Block by Block project is a partnership between the United Nations Human Settlements Program (UN-Habitat) and Mojang, the makers of Minecraft, with gaming community FyreUK. Using Minecraft, people can join the project to redesign and improve public spaces.

[blockbyblock.org](http://blockbyblock.org)

3

## Hack for good

In December 2014, Random Hacks of Kindness – a community of volunteers who are “hacking for humanity” – invited people to participate in the Missing Maps initiative, to reduce the impact of Ebola by enlisting volunteers to map vulnerable areas using the crowdsourced OpenStreetMap.

[rhokaustralia.org](http://rhokaustralia.org)

4

## Guiding the way

Data from Facebook, Twitter and other social media helped to map areas of Nepal affected by the 2015 earthquakes. The huge amount of information was amalgamated by organisations like non-profit tech company Kathmandu Living Labs – and shared with authorities and relief groups.

[kathmandulivinglabs.org](http://kathmandulivinglabs.org)

5

## Spreading the word

Social media-driven relief team Rapid Response, founded by youth activist Saroj Karki, fielded requests after the Nepal earthquakes from people unable to contact family and friends. With phone networks overwhelmed, the team started a texting app helping people connect through social media.

[tremornepal.com](http://tremornepal.com)

6

## On the ground

Researchers at Curtin University in Perth are working with a community in the Kalahari Desert in Africa, helping people collect and map information about water and vegetation using mobile phones. The resulting ‘big data’ is harnessed into resources to improve access to water and grazing areas.

[goo.gl/biQUBd](http://goo.gl/biQUBd)

7

## Soil doctors

Scientists from the University of Maryland and Columbia University created SoilDoc – a soil testing kit to help farmers in developing countries improve crop yields. Mobile phones are used to send soil test data to a central website, where calculations can be made and recommendations sent back to the farmers.

[goo.gl/oKaN0q](http://goo.gl/oKaN0q)

8

## Bug detectors

Tech startup mWater, who are working with local authorities in Tanzania to strengthen water and sanitation services, has developed an app that uses mobile phone cameras and a testing kit to automatically detect colonies of harmful bacteria and generate an online map of safe water sources.

[mwater.co](http://mwater.co)

9

## Textbook case

To help the 74% of students in an average Kenyan classroom who don't have the textbooks they need, Kenyan entrepreneur Tonee Ndungu developed the subscription app Kytabu. It enables students to cheaply and conveniently rent textbooks, which are loaded onto a tablet or desktop computer.

[kytabu.org](http://kytabu.org)

10

## Critical response

Google's Crisis Map helps people find critical emergency information, such as the spread of bushfires. Launched in Australia in October 2013, it's easily accessible from any device and provides current details on fire location, size and alert level. It can also message those in affected areas.

[goo.gl/z0mibb](http://goo.gl/z0mibb)



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[cecs.anu.edu.au/explorecomputing](https://cecs.anu.edu.au/explorecomputing)

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\*Good Universities Guide ^QS World University Rankings by Subject.

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