GET WITH THE PROGRAM

The microchip has brought amazing technology into our lives, but at the sharp end of UK computing even more exciting innovation is taking place. And, as Dave Hall discovers, the UK is a great place to study the subject whether you plan to go into research or business

Predicting human casualties resulting from volcanic eruptions; using games technology in lifesaving operations on the other side of the planet; and being able to control objects with the power of thought alone. These may sound like the plots of the latest Hollywood blockbusters, but the common theme is actually the research being undertaken in UK university computer science departments.

At the University of Essex, home of the leading brain-computer interfaces (BCI) lab in the UK, technology that captures brain signals and translates them into electronic commands is now being tested outside laboratory conditions, in the real world.

Dr Palani Ramaswamy from the university's School of Computer Science and Electronic Engineering made the headlines recently by trialling BCI headgear on a woman with 'locked-in syndrome' who was paralysed following a stroke. By hooking her up to a computer using a cap with electrodes attached, researchers found the patient was able to make music by thought alone. 'Helping people like her take some control over their lives has always been the motivation for [developing] this technology,' says Ramaswamy. 'Potentially, it has many applications, because it allows people to affect their environment simply by moving their eyes.'

'It could actually be used for any other application: wheelchair control, even something as simple as turning a light off or on,' adds Ramaswamy, who has even been working with the European Space Agency to establish whether astronauts might be able to use this technology on space missions. Naturally, the computer games industry is interested too.

Also at the University of Essex, Dr Huosheng Hu has developed an incredibly lifelike robotic fish that has infrared sensors to enable it to detect its position and avoid collisions, a gyroscope to allow perfect balance and pressure gauges in its 'swim bladder' allowing it to control its depth – all controlled by four microchips. It's a technology that may one day be used in man-made craft deployed for real-world applications, such as monitoring water pollution and sea port security surveillance. For his part, Hu simply hopes his fish will one day be a staple in the world's fishtanks.

The science behind these applications is researched and taught at institutions across the country. The UK has always been at the forefront of developments in computing, and – nearly 200 years after Charles Babbage had the idea for his 'analytical engine' in Manchester in 1821 – it shows no signs of powering down. Most industries in the UK depend on computer technology far beyond the IT helpdesk, whether that means artificial intelligence, 3D technology, multimedia or software engineering, to name a few – and the number and variety of university courses here reflect that.
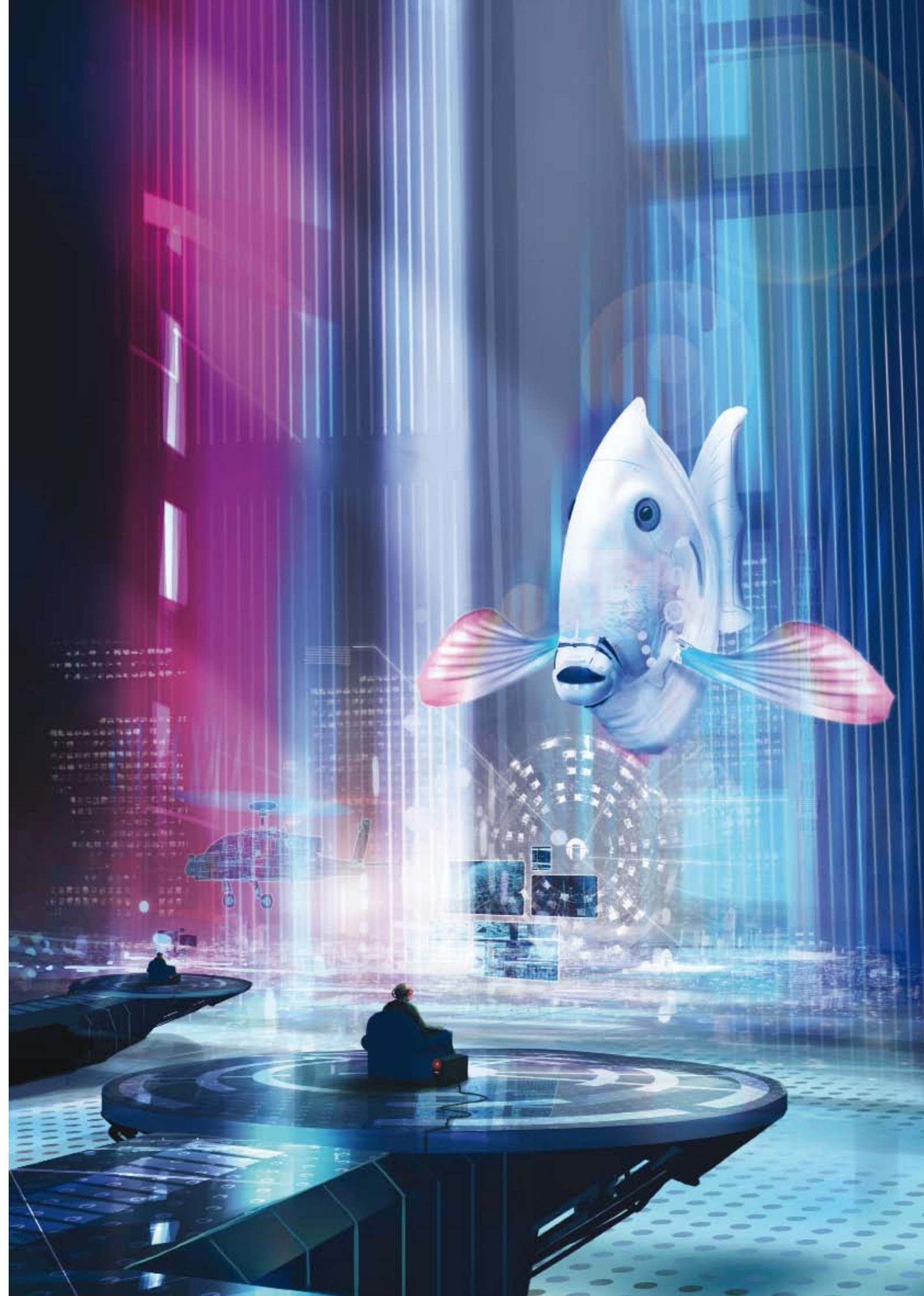
World-leading expertise

Take the University of Birmingham, for example. One of the first academic departments in the world to undertake research and teaching in computer science, it specialises in fundamental and applied computer science, artificial intelligence, optimisation, computer security and robotics, among other subjects, and boasts eight members of its teaching staff in the top one per cent of computer scientists on the planet (based on citations in academic literature). Or the Department of Computing at Imperial College London, one of the largest computing departments in the UK and a world leader in logic and artificial intelligence, high-performance computing, visual information processing, computing theory and financial modelling.

At University College London (UCL), Dr Gabriel Brostow's research focuses on the 'smart capture of visual data' – this data is then used to create complex algorithms used in everything from special effects and video to artificial intelligence and zoology. 'I love this field because it allows us to apply our expertise to a variety of tough problems, including film and photo special effects,' says Brostow. 'That includes computational photography, and action analysis – say, of people, animals and cells.'

Such research tends to attract a lot of interest. Brostow's work on tracking individuals in crowds on multiple monitors had security specialists keenly interested, while his work on blood-spatter trajectories – a profession immortalised in the US television series Dexter – can save forensic scientists hours of painstaking work. 'Motion reveals everything' is Brostow's motto.

Dr Tim Weyrich – also at UCL – is equally accomplished in his field of virtual environments and computer graphics. His research, and the courses he teaches, attempt to make virtual reality more … well, realistic. So if you find yourself

Fictional blood spatter analyst Dexter at work in the US television series Opposite: the new Nintendo Wii U game console

HD EXPERIENCE

THE KOBAL COLLECTION/SHOWTIME; GETTY IMAGES

> ## UNDERGRADUATE COMPUTER SCIENCE COURSES IN THE UK TEND TO BE HANDS-ON RATHER THAN RIGIDLY ACADEMIC

playing a particularly convincing console game, the chances are that the developers have used his software – which recreates the almost impossibly subtle changes of facial appearance caused by emotion, expression, temperature, shadow and changes in blood flow – to entertain you. It's a gift for digital animators.

With university computer science departments making developments like these, it's not surprising that more and more students are coming to the UK to study computer science. From India alone there were 5,600 students studying computer science in 2008-09, and the number continues to grow. In all there are 40,000 or so students from India studying in the UK. Indeed, India sends the second-largest number of students to study in the UK every year, after China.

For its part, the UK sees education as a vital way of securing valuable foreign partnerships with India, one of the UK's biggest trading partners and one of the fastest-growing economies in the world. It's a stance that appeals to students. 'I chose England for my undergraduate degree because of the collaborative approach of academics and industry, as well as its high standards of teaching and research,' says Sri Sri Perangur from Bangalore, who is in her fourth year of study at the University of York.

Chumang Sango, in his fifth year of an MEng in Computer Systems and Software

Engineering, also at York, came to the UK to learn from people at the cutting edge of the industry, but will be taking his expertise back home. 'My plan is to go back to Nigeria, to set up a consultancy to help with the growth of the software industry, which is in its infancy,' says Sango. 'I chose the UK because I needed to study somewhere where there are pioneers. There are people in the UK who actively drive the development of the industry worldwide.'

The teaching style, with its emphasis on critical analysis, seminars, and individual understanding of concepts is also attractive. 'Seminars here allow you to challenge what's being taught,' says Kazakhstani UCL computer science student Daniyar Turmukhambetov. 'In other places I have studied, you typically have 60 to 120 students in a lecture hall, and that makes it difficult to ask questions. Here the one-to-one teaching allows a deeper understanding of your subject.'

This is even more the case if you take the next step up to a higher research degree. 'The best part of study in the UK is that you can do your own research, rather than working as a small part of a large project, as is often the case in say China or the US,' says Xin Bao, who is studying for a PhD at the University of Manchester. 'I think it is very good practice for leading large-scale projects in industry.'

Top-notch computer science requires top-notch equipment, and that's also an

attraction for international students. 'The facilities at Manchester are exceptional,' says Xin Bao. 'You can browse thousands of volumes of precious literature in university libraries and download even more on the university network. The equipment is also superb – in my school, there's at least one powerful computer to each student.'

Sango also praises York: 'It's a really wonderful learning environment here, in the sense that you can simply focus on your studies. You don't need to worry about transportation, health, and other external concerns. It's a really nice set-up where you can just focus on education.'

Practical skills

Undergraduate computer science courses in the UK tend not to be rigidly academic. They're usually hands-on, and it's more than likely there will be an emphasis on practical application in industry. This is a new concept for many international students who, like Sri Sri Perangur, find it a big draw: 'I worked at BSkyB in London in the summer of 2009, which left a lasting impression on me. It was a fun and educational experience, and a dynamic yet welcoming environment. I would love to join the commercial technology development stream in London when I graduate.'

International businesses seek out and recruit UK-trained technology graduates, and while you're studying in the UK you're likely to be able to do placements at

computing giants such as Intel, HP, IBM or Siemens, where you can learn the ropes from experts in the field, as well as, perhaps, leaving a mark with your own talents.

Some courses bring in industry experts to teach on their academic staff, while others are honed with the help of employers in the field. Students can even develop and market their own ideas while at college, which looks great on the CV.

Guang Yang, now a postgraduate student at UCL, specialises in a new technique called digital breast tomosynthesis that makes accurate 3D images of a breast, revealing tumours that might be obscured in conventional ultrascan and x-ray images. His research is being developed in association with King's College Hospital, the Royal Marsden Hospital and St Bartholomew's Hospital, all in London, together with the Massachusetts General Hospital in the US. The Royal Society, the UK Department of Health, Cancer Research UK and other industry partners, including several pharmaceuticals giants, are involved as well, wise to the possible applications of this potentially lifesaving technology.

By the time you graduate, you'll have much more than a bank of knowledge. Commercial awareness, critical thinking skills and experience of working in a team are just some of the factors that can give UK graduates an edge. After all, employers want to know the person they're recruiting has a rounded set of skills, as well as academic ability.

UK graduates' skills are in big demand in India, a major global technology hub, where the information and communications technology (ICT) industry accounts for as much as 40 per cent of the country's GDP and 30 per cent of export earnings

as of 2006. India's annual revenue from the IT industry for 2010-11 was around $76 billion – twice as much as China's – and its outsourcing industry alone is expected to grow to some $225 billion by 2020.

Job prospects are comparatively rosy for UK computer science graduates. About two thirds of the class of 2010 were in employment six months after graduation – 40 per cent as IT professionals. Typical first positions are as varied as the courses taken, ranging from programmers and web developers to technology roles in non-IT sectors, such as the public sector, finance and banking, or games development.

Do the math

Ask UCL's Weyrich what qualifications you will need and he'll give you a simple answer: 'Maths. At one time, this wasn't a strict requirement, but at some level you do need some aptitude for mathematical thought,' he adds. Realistically, a good knowledge of computers and systems is usually the bare minimum. More often than not, you'll have an A-level or equivalent in maths or a science subject. The UK's higher education system usually requires eight high-school-level qualifications known as GCSEs and three A-levels or their equivalent. Check these against your own country's qualifications by contacting UK Naric (www.naric.org.uk).

It will all be worth it, when you secure that place – few courses offer the potential computer science does to shape the future. In fact, the only limits to studying here are those you impose on yourself. 'If studying here is your first experience by yourself, be brave and try different things,' says Xin Bao. 'And don't be lazy! The chance to study in the UK is precious – many people may dream of it but never get the chance to do it.' ◼