The Ring

The journal of the Cambridge Computer Lab Ring

Issue XLV— May 2017

Improbable

Improbable's software simulates systems on a massive scale with a level of detail not previously possible. While SpatialOS was initially created for the video games industry, it's clear that the technology can be used to model complex real–world systems.

The Cambridge Computer Lab Ring's 2017 company of the year specialises in the simulations of worlds, both real and imagined.

From Christopher Marlowe and John Milton to Douglas Adams and Zadie Smith, Cambridge has always nurtured writers who've dreamed of other worlds. Computer scientists aren't as famous for the creation of fictional worlds, but tech firm Improbable is set to change that. They're attempting to create other worlds, crafting both simulations of physical reality and of entirely new realms of the imagination. Unsurprisingly, the company itself comes from the imagination of two graduates from Cambridge University's Computer Laboratory.

Computer Lab graduates Herman Narula and Rob Whitehead founded Improbable in 2012, after meeting at a dissertation review. They discovered a shared love of games: Whitehead had developed a lucrative sideline selling items he had crafted in the virtual world of Second Life. Soon, they were sketching out their own game, which was intended to combine complex systems into a living world. As they worked, it became clear that this new type of game would need new world–building technology: the idea of creating the framework for a range of simulations became more compelling than making a game themselves.

Just five years later, Improbable employs over 170 people in London and San Francisco, and has partnered with a number of gaming, corporate and government clients, who are exploring Improbable's technology with a mission to create both immersive games and simulations of the real world.

Simulations are the next step from mining 'big data'.

Building virtual worlds isn't new. It's what video games developers have done with Massively Multiplayer Online Games (MMOGs) since the late 1990s. Yet Improbable's mission isn't simply to simulate worlds; it's to do it at an unprecedented level of fidelity, scale and detail.

Using the computing power of clusters of cloud servers, Improbable's SpatialOS platform takes multiple instances of an existing simulation process (e.g. a game engine) and merges them together to make enormous, seamless worlds. Multiplayer games normally face hard limits on their capabilities imposed by the single server they are running on, but with SpatialOS the limitations are entirely down to the level of computing power the developer wants to employ.

The 'merging' description simplifies Improbable's technology; it's actually based on a much more fundamental idea, a way of solving the class of parallelization problems where a set of entities interact spatially. Using SpatialOS, developers can behave as if a complex, persistent simulation running across multiple cores is running on a single machine, and not worry about the underlying complexities of a large distributed system, whilst the platform dynamically adjusts server usage to cope with the computation load.

As our technology advances, live data will allow the simulations to provide real–time responses, supporting decision makers.

The potential applications for games and elsewhere were convincing enough that Andreessen Horowitz, an investment firm known for its early backing of Skype, Twitter and Facebook, invested $20 million in the company in March 2015. Google has also chosen to partner with Improbable to create an innovative development subsidy, 'the SpatialOS Games Innovation Program', which provides up to 100 development studios as much as $500,000 each in SpatialOS credits to cover the costs of their cloud usage while developing and testing their games. Improbable hopes that this will promote experimentation, earlier user testing, iteration of games, and an explosion of new ideas.

Potential applications of Improbable's simulation technology are also being explored to address complex problems in biology, urban planning, transportation, disease prevention, economics, and cyber security. Simulations are the next step from mining 'big data': where big

data analysis allows you to extrapolate trends from the past, simulations let you model the interactions of complex systems accurately to explore their variables rapidly and give deeper insights.

For example, Immense Simulations is a British firm spun out of the UK Transport Systems Catapult, which has been funded by Innovate UK to examine the impact of driverless vehicle fleets on traffic. By using SpatialOS to model the weather, traffic and environment around cars, the firm was able to coordinate their movements more efficiently. Similar projects focusing on other elements of complex urban systems could help optimise the way cities function, and provide vital decision support for critical decisions with real–world consequences.

Simulations like these should one day go even further, becoming integrated with the real world. As our technology advances, live data will allow the simulations to provide real–time responses, supporting decision makers. This live mingling of realities will not only allow us to model multilayered, complex, real–world systems, but also create new forms of entertainment, such as highly–social, truly–multiplayer experiences, where players can interact in meaningful ways, potentially with consequences for the real world.

The combination of these approaches has transformative potential; to create a safer, more efficient world through simulation, and to give the people living in it new opportunities to meet, learn, work and play in virtual environments, which are as meaningful to them as any physical counterparts. Despite its great advances in simulation technology, it seems that Improbable's journey is just beginning.

Improbable was named Cambridge Computer Lab Ring Company of the Year 2017 at the Hall of Fame Awards, held at Queens' College on April 5th 2017.

SpatialOS, Improbable's distributed operating system for spatial simulation, is available as an open beta for game development at http://spatialos.improbable.io

More information about working at Improbable can be found at https://improbable.io/careers/opportunities

Who's Who

Ray Anderson (CAI BA80), co–founder and CEO of Bango, has been elected to the Global Board of the Mobile Ecosystem Forum (MEF). MEF are the global trade body whose goal is to accelerate the growth of a sustainable and inclusive mobile ecosystem.

Marko Balabanovic (CC BA90) has been appointed a non–executive director of NHS Digital.

Simon Bone (CC MA98) is a partner at Zoom Labs and White Heat VC.

Peter Cowley (F MA77) was recently appointed a board member of the World Business Angels Investment Forum.

Michael Crogan (CASM05) is working at Airbnb as a security engineer.

Geoffrey Cross (MEng96) has been appointed a Managing Director at the Winton Group in the San Francisco Bay area.

Jay Foad (T BA97) is CTO at Dyalog Ltd.

Mícheál Ó Foghlú (MPhil89) has recently joined Google where he leads the Developer Tools & Signals group in the Munich office.

Amongst his many advisory roles, **Chris Galley** (CC MA87) has been appointed a consultant at Intuitus Ltd.

Roy Hamans (PhD, RA08) works at Samsung's Catalyst Fund, a $100 million evergreen seed and early–stage VC fund, focused on leading edge technologies and disruptive innovations.

Aidan Hobson Sayers (F BA12) is a developer at Hadean.

Peter Jarvis (DOW BA87 MEng88) has been appointed a director at JPMorgan Chase.

Aled John (DOW MBA15) has started Paytogether, a new free–to–use payment gateway for group bookings or purchases in a single transaction.

Martin Kleppmann's (CC BA06) book, 'Designing Data–Intensive Applications', has been published by O'Reilly.

James Pitt (MA98) is head of devops at Tantalum Corporation Ltd.

Steve Marsh (CHU PhD14) has been named in the inaugural Forbes 30 Under 30 Europe List. The list features 300 of the top young leaders and creative inventors and entrepreneurs in 10 different sectors. Steve is named in the Science and Healthcare sector. In 2013, Steve co–founded GeoSpock with the aim of creating an 'extreme data' search engine for the rapidly–changing, multi–dimensional, physical world.

Steve Marsh

Ronjon Nag (W PhD88) is now a Distinguished Careers Institute Fellow at Stanford University

Peter Scott (JN BA83) has written 'Crisis of Control: How Artificial SuperIntelligences May Destroy or Save the Human Race' (Nitrosyncretic Press, February 2017) about the need to merge human ethical and consciousness development with AI development.

Lucas Sonnabend (CHU BA15, MPhil16) recently joined Smarkets (from Improbable) where he is a software engineer.

Alistair Stead (G MPhil11, PhD15, RA16) is CTO at Oodle Finance in Oxford.

Tim Ward (CHU MA77) recently joined Origami Energy where he is a senior software engineer.

Matt Wiseman (T MA97, MPhil02) recently joined Facebook in the San Francisco area, where he is a product manager.

The Ring, Issue XLV May 2017
Web: http://www.cl.cam.ac.uk/ring/
E-mail: cam-ring@cl.cam.ac.uk
Tel: +44 1223 763585
Post: William Gates Building, Cambridge CB3 0FD
Published three times a year. Copy deadline for the September 2017 issue is August 15th 2017.

The Ring is the journal of the Computer Lab Ring, which is the graduate association of the University of Cambridge Computer Laboratory.

Hall of fame news

DroneDeploy

DroneDeploy has launched Fieldscanner, a tool that makes it possible to capture a 2d, a low–resolution field map as the drone flies so that farmers can make crop management decisions on the spot.

Having access to timely accurate information in the field is key to identifying and minimising the impact of pests, disease and other crop issues. Fieldscanner can capture a field map in minutes as the drone flies so that farmers no longer have to wait days for airplane or satellite imagery, or spend hours uploading and processing a typical drone map.

As Fieldscanner is built for use in the field, no laptop or data connection is required; Fieldscanner can operate entirely offline with no need for cellular or data coverage.

FanDuel

FanDuel launched its first fantasy golf product ahead of the 2017 Masters.

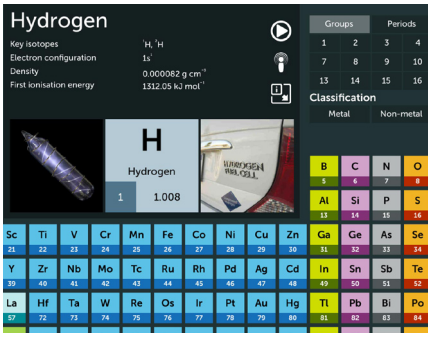
The product is the latest to be released by FanDuel following the roll-out of its NBA InPlay product, which it launched in partnership with the National Basketball Association in December 2016, and its US-focused fantasy soccer product in October 2016.

Green Custard

Green Custard has acquired Versio4 a Cambridge–based software development agency. (Green Custard had previously partnered with Versio4 on multiple projects.)

Versio4 was founded by fellow Computer Laboratory graduate Adam Twiss.

Green Custard's Periodic Table app (developed for the Royal Society of Chemistry) was nominated for a 2016 Bett Award in the 'free digital content' category. The hugely popular app includes an interactive slider which shows the elements change state as you increase the temperature, and allows you to discover the elements as you scroll through history.



Periodic table app developed by Green Custard

Improbable

Improbable was named Company of the Year 2017 at the annual Cambridge Computer Lab Ring Hall of Fame awards.

Co–founder Rob Whitehead with the Company of the Year award.

Improbable's software simulates systems on a massive scale: the economics of a national health care system, or the effects of a hurricane on a 100–mile stretch of inhabited coastline.

Co–founders Herman Narula (G BA12) and Rob Whitehead (R BA12) were named in the inaugural Forbes 30 Under 30 Europe List in the Enterprise Tech category.

Jagex

Jagex announced that it delivered double digit growth in 2016. Revenues grew 28% year–on–year to £74.4m. Profit after tax saw growth to £28.8m, while profits excluding exceptional costs were £37.8m, representing growth of 21.5% and 50% respectively compared with 2015.

Jagex was acquired by Chinese mining company ZhongJi Holding last year, and has subsequently become the western arm of a new global games group founded by the company called Fukong Interactive.

Linguamatics

Linguamatics has announced a partnership with premium news content provider Dow Jones.

The agreement allows pharmaceutical companies to extract key insights from Dow Jones Factiva utilising Linguamatics I2E text mining technology.

The Linguamatics I2E platform is currently used by 18 of the top 20 global pharmaceutical companies.

Masabi

Masabi's JustRide Mobile Ticketing Platform was named Public Transport App of the Year 2017 at the SmartRail Innovation Awards.

Masabi's JustRide platform is a cloud–based, end–to–end mobile and ticketing and fare collection system. It has been successfully deployed in cities across the world including Athens, London, Preston, Birmingham,

Boston New York, Los Angeles and Las Vegas. More cities are set to come on stream throughout 2017.

Moon Express

Moon Express has secured funding to become the first private entity to travel to the moon, with a planned 2017 voyage.

The Florida–based firm has raised US$20m in financing which will allow it to send a robotic spacecraft to the moon's surface later this year. This brings the total amount of private investment to US$45m from investors.

Raspberry Pi

Raspberry Pi turned five in February. It also released a new Pi Zero W model that has all the functionality of the original Pi Zero but with added connectivity consisting of 802.11n Wi–Fi, Bluetooth 4.1 and Bluetooth Low Energy.

RealVNC

RealVNC has launched VNC Connect for Raspberry Pi users. It offers them a range of exciting new remote access enhancements that include: the ability to connect 'Back to my Pi' from anywhere with VNC Connect's optional cloud service, a simpler way to manage connections across devices, and improvements to RealVNC's experimental 'direct capture' technology. All the VNC Connect features will remain free–of–charge for use on the Raspberry Pi in non-commercial and educational environments.

Sophos

Sophos has won the Best Technology award at the 2016 PLC Awards.

The PLC Awards recognise excellence and outstanding achievements amongst UK–listed companies.

In February 2017, Sophos announced the acquisition of Invincea, a machine learning–based antivirus company, to further strengthen its portfolio of next–generation endpoint and network protection.

Job listing

April 2017

Cubica
- *Software developer*

Reconfigure.io
- *Compiler engineer*

GRAKN.AI
- *VP/Lead engineer*

Telemarq
- *IoT/Cloud service software developer*

Bromium
- *Windows developer*

Tenzo
- *Full stack developer*

March 2017

Sanger Institute
- *Principal software developer*

EMBL
- *C++ developer*

Bromium
- *Customer support engineer*

PetaGene
- *C/C++ developers*

Catalyst
- *DevOps consultant*

If you have a job advert that you would like included in the weekly listiing, please send the details (as a word doc) to cam–ring@cl.cam.ac.uk

Part IB Group Projects

Dhruv Tapasvi reports on Team Echo's project Drone Safety

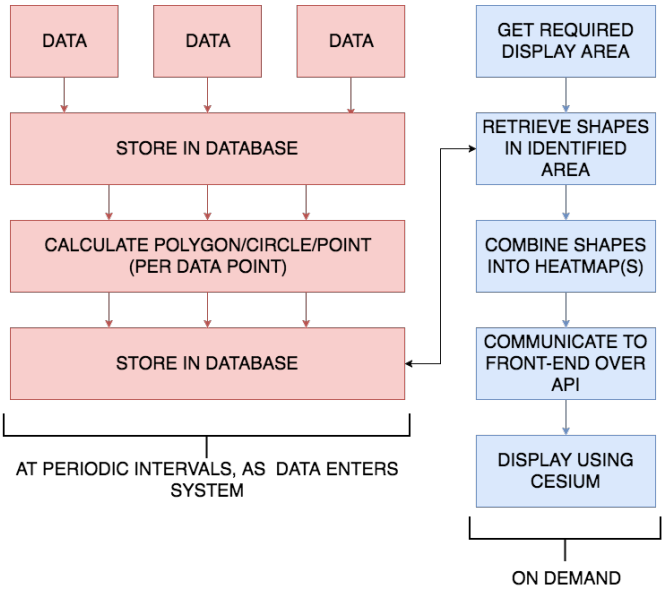
Every day, we imagine more and more potential applications for drones. An obvious use case is for the delivery of products by companies such as Amazon: using drones could save energy and manpower and may also be safer than more traditional methods. Hollywood is already employing drones to film more easily and quickly from all sorts of angles. There is even the possibility of using drones for search and rescue operations, especially in situations where it would be dangerous to use manned helicopter flight.

However, current UK law dictates that a drone can only be flown within the line of sight of its user, so as to avoid collisions. As a result, should Amazon wish to use a drone for delivery, they would have to follow in a manned vehicle, which defeats the whole purpose of using a drone in the first place. Clearly, users need to be able to easily perceive hazards that lie outside their lines of sight before this restriction can be lifted. Additionally, it would be useful if there existed some method for predicting the presence of hazards in the future, to make scheduling drone flights in the future easier.

Our group project aimed to address these two issues. We aimed to collect a number of live data sources which could indicate the presence of hazards, and combine them together to produce an interactive map to display these hazards in real–time. We also aimed to be able to view hazards as they existed in the past, and roll forward time to predict where hazards may emerge in the future. In addition, our system had to be: scalable, and work with a large number of concurrent requests from all around the world; general, so that it would be easy to integrate a new data source of any sort, from anywhere in the world to the existing framework; and accurate.

Keeping these design goals in mind, we decided upon the following pipeline for the project:

The boxes in red indicate the work performed by the backend, carried out periodically as data enters the system. We start off with a data



Project pipeline

point which represents a hazard. For us, this included examples such as the position of a bus in Cambridge or the number of connections to one of

the University's WiFi access points. Then we perform some preprocessing on the data point, converting it to one of a polygon, circle or point. This representation of a hazard as a simple shape along with a severity level is what gives our application its generality. For instance, a WiFi access point could be a circle, with the radius being the range of the router and the severity being proportional to the number of connections. Finally, we store the result in a database.

The boxes in blue indicate the work carried out by the front-end, upon request by the user. We begin by identifying the area the user is interested in, and communicate this using an API request to the back-end. We then fetch the shapes in this area from the database. These shapes are combined using an interpolation algorithm into a heat map, and relayed to the front-end as JSON through the API, where they can be displayed.

Here's an example of the heat map displayed by our application:

Heat map showing likely hazards in and around parts of Cambridge

While we were all very happy with our final result, there are of course some extensions to the project that we could have made, given more time. To better address the issue of scalability, we could have looked into the load balancing features offered by our hosting platform, Microsoft's Azure. Furthermore, our interpolation algorithm was based on a very simple linear model of combining hazards. Replacing this with a better model based on research could have helped us improve accuracy. And lastly, we could have expanded the scope of the project in terms of looking at areas beyond Cambridge as well in terms of including more data sources.

Candidates for Part IB of the Computer Science Tripos are required to undertake a group design project as part of their practical work.

Team Echo comprised Joshua Blake (JE), Thomas Davidson (CC), Mudit Gupta (CC), Bence Szépkúti (CHU) Dhruv Tapasvi (Q) and Ran Zmigrod (F).

Outreach

Research Associate Helen Oliver has been a judge and technical expert at the UK Space Design Competition National Finals since 2011.

Here she reports on the 2017 National Finals.

Every spring, around Easter, high school students gather in their hundreds, their mission eagerly accepted: to create a world in just two days.

Over one fateful weekend, they gather at Imperial College London for the national final of the UK Space Design Competition to design the space settlement of the future: its infrastructure, architecture, industrial operations and human habitat; all specified in a Request for Proposals (RFP) from the fictional, yet powerful, 'Foundation Society', an organisation founded for the specific purpose of establishing settlements of its members in space.

Five companies of students, aged 14–18, work feverishly into the night, in an exercise of industrial simulation and design fiction that would exceed the capacities of many adults. All too early on a Sunday morning, the companies present their creations, braving the slings and arrows of the judges, their eyes fixed on the coveted prize: a journey to the distant world of NASA Kennedy, where the winning company will send their chosen 12 to compete in the International Space Settlement Design Competition.

The story

The year is 2087, and the Foundation Society issues a RFP for the first large settlement on the surface of Mercury. Named 'Anconioh', the settlement's purpose is to expand production of the new metal alloy reardonium, which is composed of materials readily available on Mercury's surface. Whereas previous constructions on Mercury had been confined to the lava tubes, the Anconioh settlement is to move continuously around the planet, staying within four degrees longitude of the terminator, the line which divides day and night on that world. As it moves, Anconioh will receive ore from the mining operations, ship it to a reardonium refinery on the Aynah settlement in Mercury's orbit, receive reardonium parts made at Aynah, place the parts on the surface of Mercury to cure for three cycles of extreme heat and cold, and then ship the cured parts back to Aynah for delivery to customers.

The Students

This year, the five competing companies were:

• Dougledyne-Flechtel, with students from Henrietta Barnett School, Riddlesdown Collegiate, Sutton Grammar School, Westminster Academy, Westminster School and SPS Science Club;

• Spacebus Z, with students from Altrincham Grammar School for Boys, Haberdashers' Aske's Girls, Nonsuch High School for Girls and Queen Elizabeth's School;

• Grumbo Aerospace, with students from Cardiff Sixth Form College, St. Michael's Catholic Grammar School, Derby Grammar School and St. Olave's;

• Vulture Aviation, with students from Bede's Senior School, Craigmount High School, Dulwich College, Eltham College and West Kirby Grammar School;

• Rockdonnell, with students from The Brooksbank School, Canons High School, City of London Freemen's School, Darwin Aldridge Community Academy, Waid Academy and Woodchurch High School.

Each company has four departments: Structural, Operations, Automation and Human Engineering. They must work together to describe the design, development and construction of the settlement. Over the course of 50 slides and 35 minutes, they must specify all the needful things including atmospheric composition, systems for adjustment to gravity, water purification and recycling, food production, industrial facilities, worker allocations and shift patterns, security, evacuation plans and disaster recovery, robotics and automated systems, community facilities and layout, floor plans of the living quarters, transient populations and tourism, recreation, airlocks, dust management, spacesuits and donning and doffing procedures… have I left anything out? Very likely… all justified with a detailed cost and schedule.

The Volunteers

Throughout this Herculean ordeal, the students are supported by a team of dedicated volunteers, many of them experts in relevant STEM fields or education, from both industry and academia, with an increasing number of loyal alumni from past Challenges swelling the ranks. The volunteers may choose to lead the companies as Executive Chairs; brief and support the departments as Technical Experts; or evaluate the proposals as Judges.

The Magic Happens

The proposals are judged by four standards: thorough coverage of the design brief; scientific and logical credibility of the design; balance amongst the four departments of structural, operations, automation and human engineering; and innovation. As a Judge of the competition since 2010, my disbelief suspended by the incomparable skill of the students' creations, I must consciously remind myself that they are doing something that no–one knows how to do.

No–one knows how to build a settlement in space! How can we as scientists ask high school students to propose solutions to such hard problems? And yet, they do it, a feat scarcely distinguishable from magic. When fiction becomes reality, I expect that our competition alumni will be amongst the team that builds the first human settlement on Mars or the Moon. Many have pursued STEM careers as a direct result of the Competition's transformative power, which turns wallflowers into orators, and doubters into persuaders.

The magic of design fiction happens at the crossroads of science and art. The UK Competition's Founder, Dr. Randall S. Perry, is an astrobiologist, novelist and filmmaker who brought the competition to Imperial College London in 2010. He was directly inspired by his friendship with NASA/Boeing Space Shuttle Engineer Anita Gale who, with her late husband Dick Edwards, founded the US Competition in Houston. Anita will be hosting us again this July at NASA Kennedy, where last year the UK students, captained by Victoria Farrant, led their company to victory.

The UK Space Design Competition is brought to you by the Space Science and Engineering Foundation thanks to the generous support of Dangoor Education, the UK Space Agency, and the Royal Academy of Engineering. We are thankful to Imperial College London for their support and to our patron Marcus du Sautoy FRS OBE.

Members of the Computer Laboratory are involved in a variety of activities designed to inspire young people to think about a career in technology.

Helen Oliver is a Trustee of the Space Science & Engineering Foundation which organizes the UK Space Settlement Design Competition, a design challenge open to secondary and sixth form students in Years 10-13. She has been a Judge and Technical Expert at the National Finals, held at Imperial College London, since 2011, and has also judged the international finals at NASA Johnson and NASA Kennedy.

More information about the UK Space Design Competition can be found at: http://uksdc.org/

Further details about the National Finals 2017 can be found at: http://uksdc.org/wp-content/uploads/PB-v8-2017-Finals.pdf

Research Skills course

Chris Watts: Stealing an AI algorithm

Artificial Intelligence algorithms have been available to the general public via online APIs for several years. Companies such as Google and IBM offer Machine–Learning–as–a–service applications that perform complex calculations and tasks on the Cloud such as sentiment analysis, speech recognition and image–based scene analysis. Often, these services have a usage–based fee which poses the following questions: can these black–box algorithms be reverse–engineered or otherwise stolen to bypass usage fees?

According to researchers at Cornell Tech, this is indeed the case. Not only is it possible to reverse–engineer these algorithms to a high degree of accuracy, but they have labelled the task as 'blatantly obvious' and 'a high–school level exercise'. They start with an example of a binary classifier — such that it marks an input as being one of two categories — that uses a Logistic Regression (LR) formula. LR comprises a set of weightings and a bias to produce a class and a confidence rating. The number of weightings, n, is often the same as the number of required inputs to the classifier. The researchers show that given some trained model, you can reverse–engineer the weightings and the bias to achieve near–identical confidence ratings after $n + 1$ queries to the classifier service. They then go on to explain how this method can be extended to multi–class classifiers (with a matrix of weights rather than a vector) by minimizing a loss function until it reaches global convergence. At this global minimum, the 'guessed' model will predict the same classes with the same confidence as the real model for all available samples. This technique can be extended further for multi–layer perceptrons and, ultimately, deep neural networks.

For those who are particularly mischievous, the stolen model can then be used in a 'model inversion attack' — an attack that extracts the most likely training data given some trained model. If this model is a facial recognition system, it is shown that recognisable faces, ones that would have been used to train the system, can be obtained through this sort of attack. In conjunction with the previous reverse–engineering attack, the full training system can be stolen and used standalone without any dependency on the original service. Since some providers allow you to use your own machine learning algorithms, there may be trade secrets of businesses using the services which are at risk of being stolen.

The best essays from the Research Skills module of the MPhil in Advanced Computer Science course 2016/2017 are being published in 'The Ring'. This is the second of these essays.

Computer Laboratory news

Wheeler Lecture

The sixth annual Wheeler Lecture will be given by Professor M. Angela Sasse FREng, at 4.15pm on Wednesday May 24th 2017.

The lecture is titled 'Can we make people value IT security?'

If you would like to attend please register at www.cl.cam.ac.uk

Funding Successes

ERC Consolidator grant

Dr Rafal Mantiuk: 'Perceptual encoding of high fidelity light fields'
5 years, €1.9M

Dr Mantiuk's project will aim to characterise and model the performance and limitations of the human visual system when observing complex dynamic 3D scenes, and develop the first automated method for optimising the encoding and processing of high dynamic range data, in order to pave the way for future highly realistic image and video content.

EPSRC Programme grant

Dr Tim Jones : 'Automatic Binary Parallelisation'
3.5 years, £1m

Dr Jones' grant will continue work started by his PhD student in automatically parallelising application binaries. It will use a combination of static analysis and dynamic binary translation to drive parallelisation of program loops. He's partnered with ARM and Cancer Research UK to accelerate real–world scientific applications on commodity multicore processors.

Innovate UK

Professor Ted Briscoe: 'Virtual Investment Researcher' (in collaboration with All Street Research Ltd)

To develop the NLP technology to underpin an autonomous investment research system.

Microsoft Research PhD Scholarship Programme

Dr Andrew Moore and Dr Noa Zilberman : 'Power efficient rack-scale fabrics'
3 years, £71K

A fully–funded PhD studentship to study power efficiency and bottlenecks in existing rack–scale fabric topologies, and to develop new power–efficient architectures. At the same time, the student will develop a simulator for designing and evaluating rack–scale computing, which will be used on the new fabric architectures prior to their implementation in real systems.

Orange

Professor Ross Anderson and Dr David Modic
'Intrusion deception'
18 months, €108,000

Using insights from psychology and computer science to provide more attractive honeypots, in order to identify individuals trying to hack into networks and their incentives for doing so.

Outreach

The Computer Laboratory Open Days are on 6th and 7th July 2017.

The Laboratory will put on a series of subject talks as well as demonstrations of student projects and faculty research. Visitors will also have the chance to speak with Directors of Studies, while students will be on hand to talk to about student life at Cambridge

The Department is also taking part in the Sutton Trust Summer School from 14th–18th August.

The Sutton Trust was founded in 1997 to improve social mobility through education, and works to combat educational inequality and prevent the subsequent waste of talent.

The Sutton Trust Summer Schools offer an opportunity to young people to try university life. The free one–week taster courses consist of lectures, seminars and tutorials, as well as a varied programme of social activities, to give participants an accurate idea of life as an undergraduate at a research–led university.