The Ring

The journal of the Cambridge Computer Lab Ring

Issue XLIII— September 2016

DroneDeploy

DroneDeploy users have mapped more than five million acres in over 100 countries. CTO and co–founder Nicholas Pilkington talks about the company's soaring success.

TR: Nick, I read that the FAA predicts that 2.5 million drones will be sold in the US in 2016, with big growth from companies that use drones to collect data. Can you explain how DroneDeploy turns drones into mapping tools?

NP: DroneDeploy encompasses two software products. The first product is a mobile application that performs flight planning and flight control to fly drones through a pattern of waypoints, and trigger cameras to collect a high quality dataset of aerial imagery. The second product is Map Engine which is a scalable image processing pipeline that processes all the imagery collected by the drones to geo–reference, align, stitch, blend, ortho–rectify and reconstruct, creating tens of thousands of point clouds, 3D models and mosaics a month.

TR: What benefits can DroneDeploy bring to its clients' bottom line? How do you measure ROI?

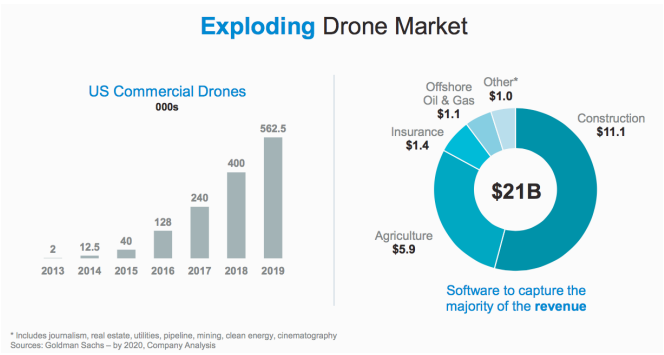
NP: Aerial data like ortho–mosaics, 3D models and point clouds are used to drive high ROI decisions in industries as diverse as construction, insurance, agriculture, mining, conservation, forestry, and infrastructure inspection. The ROI varies per industry and per use case, and can be assessed based on efficiency, removal of humans from tedious or dangerous operations or simply increased speed–to–data and better insights.

> *DroneDeploy was always intended to be a horizontal platform that provided value across a number of verticals.*

TR: What is DroneDeploy's advantage compared with others in the drone industry, such as Airware and Skycatch?

NP: Our core competency is software and our focus on this is what's given us an advantage. Both Skycatch and Airware are hardware businesses that are now looking to add a software component. As both companies are a lot larger than DroneDeploy it's more difficult to affect a change in the company's DNA at this stage. Also they have high price entry points making it difficult to try their solution without spending a lot of money.

DroneDeploy has a significantly larger user base and a more complete and polished product offering. Our competitors are trying to win both a hardware and software battle and we know how hard that is, just look at the battle between Intel and Microsoft. Hardware occupies a challenging space and the costs are being driven down as drone hardware becomes commoditized. Although the majority of revenue will go to hardware, the high profit margins will be extracted by software because it can be priced based on the value it provides. Our other advantage is our addressable market. We are a horizontal platform that is agnostic of hardware or industry. While our software can fly DJI drones we can process imagery from any aerial system. Skycatch and Airware focus on construction and inspection respectively. DroneDeploy is already being used in construction, mining, agriculture, inspection, conservation, forest and many other verticals around the world.



Sources: Goldman Sachs — by 2020 Company Analysis

TR: What is the business model?

NP: DroneDeploy was always intended to be a horizontal platform that provided value across a number of verticals. We were never going

to go too deeply into agriculture, construction or mining and get too specific because we knew that 90% of the functionality that our customers needed was the same across verticals, and we wanted to make it easier for others to extend the platform to tackle this long tail of specific problem domains. That said we are a pure software company operating a very similar business model to SalesForce or Box. In our tiered model we have a free option that allows you to use the software to make maps and 3D models. This is really important because we don't want people to be scared off by a cost of adoption for a trial. Then there are a number of paid tiers, from $99 per month up to $499, that increasingly add value features like data exports, in browser volumetric analysis and ground control points. Finally there is an enterprise level for customers looking for powerhouse features like team management and very high precision processing and concurrency.

TR: How do you adapt to the rapidly shifting legal landscape for drones?

NP: Global expansion is one strategy. We didn't wait on the US (which is a bit further behind) but instead released the software globally and have enjoyed adoption in Europe, Australia and South America where the regulations are more progressed. We know that regulation is holding back a lot of our enterprise customers from rolling out much larger drones operations. That is set to change soon and the flood gates could open. However either way, regulation presents an opportunity: if regulation turns out to be lenient then there is going to be a large uptake in drone usage; if regulation is more complex then we have an opportunity as our software can provide the functionality to make it easier for operators to comply. We already help users operate safely and reliably by running a number of automated checks and verifications of no–fly zones.

TR: You've mentioned that DroneDeploy works outside the US. How far does its reach extend? Can it be used with non–DJI drones?

NP: We initially released the software in the US but it has since been adopted in about 130 countries around the world. There has been very heavy adoption in Europe, Australia and South American, while Africa is a bit slower. Our mobile app can fly all DJI aircraft and in the future more will be added. Some customers don't fly DJI drones and use a different set–up to capture the imagery. In this case they can upload the images directly to Map Engine and get them processed in the same way. So we don't only support DJI drones and, if a user doesn't have one, we provide our app and recommend they use one.

TR: Can you tell me about the 'Phones and Drones' project with The Nature Conservancy?

NP: The 'Phones and Drones' project was one of the largest collaborative drone projects ever run. We encouraged users with access to a drone to map a small part of the Californian coastline and share it with us. We then aggregated the data into a large map of the coastline and this was used to analyse coastal erosion. The project was an important proof point in drone usage: much can be achieved with simple cheap drones and there is no need for specific domain experience or a lot of money. If this project had used a service provider it would have cost a fortune and taken even longer.

TR: What are the plans for the next 12 months?

NP: We will continue to grow the company, specifically the engineering teams.

We have seen a large increase in the number of users and, so far this year, we've mapped about 3 million acres, a number that appears to doubling every 4 months. We will continue to scale the image processing platform to cope with growing demand, allowing us to process larger and more complex maps and 3D models quickly and cheaply. We will also be releasing some exciting new pieces of technology. The one I'm most excited about will allow you to produce maps on a phone in real–time, without the need for any type of data connection. You can think of this as a flatbed scanner for the real world; while the aircraft is still in flight the user can start looking at the data. We'll also be looking to start working with more types of sensors like thermal imagers. It goes without saying that regulatory clarity is another big thing that is going affect us in the US in the next couple of months.

has raised $20 million in Series B funding to grow their drone data management platform.

Since talking to Nick, DroneDeploy has raised $20 million in Series B funding to grow their drone data management platform.

The Series B deal was closed just before the U.S. Federal Aviation Administration is scheduled to implement new rules governing commercial and industrial drone use.

Scale Venture Partners led the investment in DroneDeploy, joined by High Alpha, a fund started by ExactTarget co–founder Scott Dorsey. The funding brings the company's total capital raised to $31 million to date.

Who's Who

Abdul Alim (PhD11) is now working as a senior network engineer at IBM in Texas.

Jonathan Ayres (R BA92) now works at United Trust Bank where he is the CFO.

Si Beaumont (HO BA12) has recently joined Apple as a software engineer.

Mark Bingham (CC BA00) is currently working at TAP Biosystems.

Youssef Bouguerra (PEM Dip98) has joined ThoughtWorks in Brazil.

James Brady (F BA05) is director of engineering at Teespring.

Shaun Crampton (Q BA06) has recently joined Tigera where he is a senior software engineer.

Mícheál Ó Foghlú (MPhil89), CTO Red Hat Mobile, has joined Irish edtech start–up Code Institute's Advisory Council.

John Garbutt (CC MA06) has been elected to the Open Stack Technical Committee.

Laura James (CC MA00 PhD05) has been appointed technical director at Doteveryone.

Xiang Jiang (F BA11) is a senior engineer at ARM.

Mark Marr (MPhil10) has recently joined Supermicro in the San Francisco Bay Area.

Richard Mason (Q BA84 MBA04) has been appointed commissioner at the British Columbia Utilities Commission.

Matthew Lent (W MPhil13) is a business development lead at XStream in California.

Min Lin (CAI PhD09) is a senior technical director at China Unicorn in Guangdong, China

Nick McCarthy (CC BA09) is working in the press office at the BBC in Belfast.

James Moore (DOW MA05) recently co–founded F–LEX Legal, an on–demand paralegal service. James was previously CTO and Board Member at Redgate Software.

EeLee Ng (CC MPhil11) is a business analyst at HGST in Singapore.

Mark Nixon (R Dip90) is principal consultant at GO–ERP.

Lawrence Owusu (CLH MPhil08) is a senior java developer at Unicredit in London.

Marcelo Pias (CC RA10) is chief data scientist at Bravi Software in Brazil.

David Piggott (F BA11) is working at Cake Solutions as a software engineer.

Christian Richardt (CAI BA07 PhD12) has recently been appointed a lecturer at the University of Bath.

Alban Rrustemi (Dip04 PhD09)) is now working for Google DeepMind as a software engineer.

Nick Schweitzer (MEng13) has co–founded Metadrift, a tech startup that transforms video archives into immersive learning platforms that can be explored in VR.

Diarmuid Ó Séaghdha (PhD08) is working as a research manager in the Siri team at Apple

Sunil Shah (F MA09) is now an engineering and product manager at Mesosphere, responsible for Velocity, a continuous delivery tool for the Mesosphere Datacenter Operating System (DC/OS).

Congratulations to Sunil who completed the world's premier mountain bike stage race, The Absa Cape Epic 2016. The race, held in South Africa, was a gruelling 654km and Sunil had to contend with angry African bees, treacherous downhills and 40 degree temperatures. Sadly Sunil's riding partner was hospitalised so Sunil had to finish this tough race alone.

Sunil Shah competing in The Absa Cape Epic 2016

Muhammad Shahbaz (RA12) recently joined VMWare.

Salman Taherian (JN PhD07) is global head of data innovation at Reed Exhibitions.

Simo Tchokni (CAI BA12 MEng13) is working for Google in Zurich.

Matt Wiseman (T MA97 MPhil02) has recently started working for Liftoff Inc in the San Francisco Bay Area.

Assel Zhiyenbayeva (F BA10) has been appointed CEO at Zerde National Infocommunication Holding JSC. Zerde National Infocommunication Holding is the largest Kazakhstani state company, created for the development of modern infocommunication technologies.

Hall of fame news

ARM

ARM has agreed to a $32 billion takeover by Japan's Softbank.

Arm shareholders are expected to approve the deal at a meeting in London on August 30, with the acquisition set to complete by mid–September.

Bango

Bango's payment platform is comfortably handling $1 billion in payments using the same core technology and has the capacity to cope with a further anticipated increase in business.

Bango's platform is used by global heavyweights to allow users of their services to pay swiftly and painlessly for music downloads and other apps.

In a trading update for the six months ended 30 June 2016, Bango announced that annualized End User Spend (EUS) exiting June 2016 increased by 283% year–on–year to £159 million.

blinkx

blinkx Plc is changing its name to RhythmOne Plc, the name of its current main trading entity.

The company is trying to reinvent itself as a specialist in programmatic ads and has undertaken a 'broad restructuring', including cutting headcount.

Bromium

Earlier this year Bromium offered a £10,000 bounty to anyone who could find flaws in its technology, claiming the competition highlighted the importance of holding security vendors to account and ditching "marketing BS in favour of defensible design and rigorous evaluation."

White hat Tavis Ormandy found two bugs.

"Tavis found a bug in an early build of vSentry 3.1 with support for an old version of Chrome that was sent to a customer to evaluate a feature, and mistakenly uploaded. A skilled attacker armed with a chain of additional bugs could exploit our bug to achieve code execution in the host Chrome browser," co–founder Simon Crosby (JN PhD94)explained.

"Fortunately, in a typical Bromium production deployment the Bromium Enterprise Controller automatically updates Chrome protection via 'App Packs' soon after Google releases a new version. Recent Bromium Chrome App Packs, for example, fix the known bugs you'd need to be able to exploit our bug."

Mr Ormandy also found a similar vulnerability in the firm's protection for Internet Explorer, with Crosby arguing again that a "typical Bromium configuration" would mitigate the bug.

Mr Ormandy donated his £10,000 reward to Amnesty International, with Simon Crosby matching the sum with a personal donation of $15,000.

DroneDeploy

DroneDeploy has raised $20 million in Series B funding led by tech investment firm Scale Venture Partners and ExactTarget co–founder Scott Dorsey's fund. Venture studio developers High Alpha Capital also participated in the drone funding round. The funding will be used to help expand the product, make additional hires, advance market reach, and to support R&D. (For an interview with DroneDeploy co–founder Nick Pilkington see p.2)

Linguamatics

Linguamatics has been recognized by Frost & Sullivan with a 2016 Market Leadership Award.

Moon Express

The US Government has made an historic ruling to allow the first private enterprise, Moon Express, Inc. (MoonEx), permission to travel beyond Earth's orbit and land on the Moon in 2017.

The Ring, Issue XLIII September 2016
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 January 2017 issue is December 5th 2016.

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

This breakthrough U.S. policy decision provides authorization to Moon Express for a maiden flight of its robotic spacecraft onto the Moon's surface, beginning a new era of ongoing commercial lunar exploration and discovery, unlocking the immense potential of the Moon's valuable resources.

Moon Express received the green light for pursuing its 2017 lunar mission following in–depth consultations with the FAA, the White House, the State Department, NASA and other federal agencies.

Up until now all commercial companies have been limited to operations in Earth's orbit, and only governments have sent missions to other worlds. With this landmark ruling,
Space Launch Complex 17 at Cape Canaveral

Moon Express has become the first private company approved as a pioneer of commercial space missions beyond Earth orbit.

Space Launch Complex 17 at Cape Canaveral

Moon Express will be working with a Rocket Lab USA Electron rocket for the 2017 launch. It has also reached an agreement with the U.S. Air Force 45th Wing to license the historic Space Launch Complexes 17 and 18 at Cape Canaveral for its lunar lander development and flight test operations.

Raspberry Pi

In July Raspberry Pi and Code Club took over the science tent at Camp Bestival. To coincide with British astronaut Tim Peake's mission to the International Space Station, the theme was 'Space'. This gave Raspberry Pi the perfect opportunity to showcase their Astro Pi.

RealVNC

RealVNC has launched a beta program for their next generation VNC Viewer app on desktop platforms. The VNC Viewer makes it easier for you to manage and control your remote computers, across all the devices you connect from.

Sophos

Sophos has been named a Visionary, in the Gartner Magic Quadrant Report for Enterprise Mobility Management (EMM) Suites, for the third year in a row. Sophos is the only endpoint and network security–focused vendor placed in this year's EMM Magic Quadrant.

Job listing

August

Unicredit
- *eFX systems developer*

JPMorgan
- *Data scientist*

dividiti
- *Research engineers*

July

Building Intellect
- *Software engineers*

TVF
- *IT support and systems trainee*

Tab
- *Full stack developer*

RMS
- *Data scientist*

UENI
- *Junior developers*

June

Improbable
- *Software engineers*

Wakelet
- *Software engineer*

Graphmasters
- *Core engineer*

Metadrift
- *Data visualisation developer*

Symfact
- *IT project manager*

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

Hackers at Cambridge

Tom Read–Cutting, co–founder of Hackers at Cambridge, sees an exciting future for this new student society.

When people hear the word 'hacker' they usually think of those black hats who act illegally and maliciously.

However, before the advent of the black hats, hackers were viewed very differently. They were those who didn't agonize over decisions, had a collaborative work ethic, came up with ingenious, practical and yet unconventional solutions to a problem, in essence those who got things done in a practical manner using all the tools at their disposal. Think Steve Wozniak, Richard Stallman and John Carmack. It is the culture of these hackers that the University society, Hackers at Cambridge (HaC), wants to cultivate.

The idea for the society came after a Hackathon that a group of us had organised: Hack Cambridge (https://www.hackcambridge.com). Hack Cambridge was the University of Cambridge's first ever international Major League Hacking (MLH) approved hackathon, with over 400 attendees from Universities from all over the world including: Harvard Business School, Polytechnic University of Catalonia, and the National University of Singapore.

Hack Cambridge

We were really proud of what we managed to organise in just 12 weeks (which included the Christmas break!), and so wanted to take the momentum from the hackathon into planning a 2017 event. To make the hackathon a sustainable, annual competition we decide to create a society based around Hack Cambridge. However, we decided that the society should not only support the hackathon but do much more.

We noticed that, while the Computer Science Tripos gives us a well–rounded academic grounding, the framework available to pick up practical and enterprise skills is limited. As most students are self–taught, we decided to create a framework to allow us to share our knowledge, organise events (workshops, talks, mini–hackathons, work–parties, party–parties!) and even invite industry leaders to share their knowledge and experience.

Hack Cambridge

While HaC still has a long way to go, we are off to a good start. Last term we created a Facebook page with 160 likes and our Facebook group has 70 members. We organised multiple workshops covering a number of topics including how to use Git and Web Development.

This coming academic year we look forward to welcoming Freshers and increasing collaboration with other departments. We also plan to build long–term, useful software projects (first on the list is innovative presentation software for us to use), organise further workshops and

host work parties to allow students to come together to solve problems. As well as supporting Hack Cambridge II, we'll help form and prepare teams for competitions.

Our plans are ambitious, but we expect to grow rapidly and anticipate that HaC will become fully embedded in the University. As we have learnt from Hack Cambridge, there will be pitfalls, challenges, and plenty of blood, sweat and tears! However, one thing is certain — it will be very rewarding.

Hack Cambridge was started by the author Tom Read–Cutting along with Zak Bonnington, Maximilian Ge, Jakub Jurovych, Jared Khan, Christian Silver, Cameron Wallace, and Jordan Zhang.

If you are interested in sponsorship or mentoring please contact the Hack Cambridge team at team@hackcambridge.com

You can also keep up to date at https://www.hackcambridge.com, https://www.facebook.com/hackcambridge and on Twitter at @hack_cambridge

Student prizes 2016

G-Research Prize for The Best Part IA Student awarded to **Gary Guo (PET)**

G-Research Prize for The Best Part IB Student awarded to **Matthew Jadczak (ROB)**

ECM Prize for The Best Part II Student awarded to **Gellert Weisz (CHU)**

G-Research Prize for the Best Individual Project in the Computer Science Tripos awarded to **Sebastian Aebischer (PEM)**

The following students were highly commended for their project dissertations:

Joshua Landeau (F)
Matthew Lewsley (CHU)
Edgaras Liberis (HOM)
Priyesh Patel (ROB)
William Shackleton (ROB)
Gabriela Sklencarova (CHU)
Gellert Weisz (CHU)
Daniel Wong (CHU)

Winton Capital Prize for the Best MPhil Student awarded to **Adam Gleave (JN)**

Google Prize for the Best MPhil Dissertation awarded to **Shashwat Silas (JN)**

Metaswitch Prize for the Best Overall Part III Student awarded to **Eduards Kalinicenko (Q)**

Research Skills course

Ahmed Hasan Zaidi: Forecasting Direction Shift in Oil Market Using Twitter

The drop in oil price during late 2014 has had a significant impact across the globe. While some countries may have reaped the benefits of lower costs, others have suffered greatly. Russia, for example, loses approximately $2 billion in annual revenues for every dollar the oil price drops. As a result, it is no surprise that many have attempted to develop reliable models to forecast the price of oil.

Traditionally, economists have used financial models with features such as historical prices and production levels to Identify trends in the oil market. More recently, machine learning models including Artificial Neural Networks and Support Vector Machines have also gained significant prominence in this field. Despite the use of sophisticated models, oil forecasting accuracy remains highly unreliable, only marginally surpassing a coin toss. Recognizing the limitation of existing forecasting methods and the growing trend of social media as a corpus to extract key business insight, I decided to explore Twitter and its oil predictive capabilities as part of my undergraduate dissertation.

Half a million tweets, going back five years, were collected using the Twitter API. All the tweets were authored by various think tanks, oil corporations, and prominent energy journals. The features extracted from the data collected included the frequency of "oil", frequency of OPEC members, sentiment of oil companies, energy journal and think tanks. The Stanford NLP and SentiStrength sentiment analyzers were used to obtain the sentiment of the tweets.

The dissertation was divided into two main studies. The first study successfully identified a correlation between each of the independent features mentioned above and oil prices using the Granger–Causality Test. The second study used the features to build a supervised leaming model that predicted movements in the oil market (increase or decrease).

The results of the first study revealed a significant correlation between sentiment of the tweets and oil price. It also confirmed the hypothesis that the frequency of "oil" on Twitter is positively correlated with shifts in the oil market. Using the Granger–Causality Test, it was found that there is a seven week lag from when the tweets occur to them "granger" causing a change in price.

The second study aimed to investigate the significance of the features as inputs to a predictive model. This was done using Artificial Neural Networks, Support Vector Machines, and Naive Bayes classifiers. The models were built to forecast the directional shift in the oil market seven weeks in the future. Outperforming existing methods referenced in literature, the model achieved a classification accuracy of 74.29% (SVM).

The results of both studies indicated that there is indeed a significant correlation between Twitter and the future shifts in oil price. However, there remains substantial room for improvement in the model, specifically, in the area of feature selection and natural language processing.

The best essays from the Research Skills module of the MPhil in Advanced Computer Science course 2015/2016 are being published in 'The Ring'. This is the third of these essays.

Computer Laboratory news

New appointments

Dr Neel Krishnaswami has joined the Computer Laboratory as a University Lecturer. He joins from the University of Birmingham. Neel is no stranger to Cambridge, having done his postdoc at Microsoft Research.

Dr Damon Wischik joins the department as a University Lecturer on January 1st 2017. Damon completed his PhD at the Computer Laboratory under the supervision of Dr Frank Kelly. He was a Research Fellow at the University of Cambridge and a Royal Society Research Fellow at UCL. Damon has spent the last 5 years at Urban Engines in Los Altos, California, where he has been working as a data scientist.

Awards

Professor Andy Hopper CBE FREng FRS has been awarded The Bakerian Medal and Lecture 2017 for his outstanding research in computer technology, with significant economic impacts, in particular his work in computer networking and sentient computing systems with an aim to providing sustainability.

Professor Hopper will be presented with a medal, and a gift of £10,000 at the Premier Awards dinner in autumn 2016. The associated prize lecture will be delivered in spring 2017.

Funding Successes

EPSRC Global Challenge Research Fund pump-priming grants

EPSRC has offered Cambridge University an institutional sponsorship grant to support development of a portfolio of research projects and Knowledge Exchange activities compliant with the Official Development Assistance (ODA) guidelines under the Global Challenges Research Fund (GCRF). The Computer Laboratory has received four awards under the GRF compliant with the ODA guidelines (i.e. research primarily relevant to the problems of developing countries and where establishing economic development and welfare of developing countries is the main objective of research).

The award recipients are:

Professor Alan Blackwell: Visual analytics for African languages

Professor Jon Crowcroft and Dr Arjuna Sathiaseelan: African Internet Measurement Observatory

Dr Richard Gibbens and Dr Eiko Yoneki: Digital Epidemiology–collection and analysis of contact networks in developing countries for understanding disease spread

Professor Ian Leslie: Climate risk assessment of supply chains to support resilience–building

Leverhulme Trust Early Career Fellowship

Dr Noa Zilberman has been awarded a prestigious three year fellowship from the Leverhulme Trust. Her project, titled 'Systems for big data applications: revolutionising personal computing', will develop a new server–level computer architecture with a networking fabric at the core, in order to reduce costs, save power, and increase performance. In this 'tiny tera–bit data centre', every I/O transaction will be treated as a networking transaction.

Dr Robert Watson and Professor Simon Moore

Two DARPA–funded projects both in collaboration with SRI International.

Google Award

Dr Robert Watson

EPSRC Impact Acceleration Account

Dr Robert Watson and Dr David Chisnall

University Open Days

The Computer Laboratory recently opened its doors to students considering making an application in October 2016 for entry in October 2017 (or deferred entry to October 2018).

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