



# UNIVERSITY OF CAMBRIDGE

Department of Computer  
Science and Technology

## Annual Report of the Faculty 2018-19\*

*\*A small number of items that fall into 2019-20 which are of current relevant interest are also included in this report.*

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### INTRODUCTION

This year was the first full year with Prof. Ann Copestake as Head of Department. The Department's strategy is to continue to be a home for the world's best computer science researchers, providing a flexible environment for working collaboratively with each other and partners of all kinds, in an open culture. Our people are part of a wider network of alumni and associates, and these connections sustain the creation of strong and revolutionary fundamental computer science research ideas, many of which will transform practice outside the academy. We continue to deliver exceptional research both individually and in dynamic teams working together across fields, connecting deep fundamentals with the wider context of research and applications in diverse fields, and we translate many of our ideas into practical innovations in whatever form is most appropriate.

The University's Strategic Research Review of the Department in September 2018 provided a valuable opportunity for reflection and strengthening how this strategy is enabled in practice. This year has seen a range of appointments which enhance our links with important fields, including climate change, and development of professional services teams to support the Department's current size. We continue to improve our support for early career researchers and postgraduate teaching, and to communicate more effectively about our work and opportunities to collaborate with us. In a time of great excitement about data science, almost all our research groups include machine learning activities in diverse forms, and we are exploring ways to unlock potential applications across Schools and build capacity across the research base.

### STAFF

Professor Srinivasan Keshav joined the Department on 1 October 2019 as the new Robert Sansom Professor of Computer Science. Professor Srinivasan Keshav will be working broadly on using techniques and technologies from computer science to encourage the adoption of renewable energy, reduce the carbon footprint of legacy systems, and to combat climate change. He will also continue his work on scalable blockchains and the use of blockchains in energy.

Professor Neil Lawrence was appointed on 1 October 2019 as the inaugural DeepMind Professor of Machine Learning, supported by a benefaction from the world-leading British AI company. He is also Professor of Machine Learning at the University of Sheffield, where he will retain a visiting position. Professor Lawrence's research interests are in probabilistic models with applications in computational biology, personalised health and developing economies.

Dr Cengiz Öztireli, joined the Department as University Senior Lecturer on 1 October 2019. Cengiz was previously a lecturer at ETH, Zurich as well as working as a research scientist for Disney Research, based in Zurich.

Dr Emily Shuckburgh, joined the Department as Reader in Environmental Data Science on 1 May 2019. She is currently seconded 80% time as Director of Cambridge Zero <https://www.zero.cam.ac.uk/>

Dr Stewart Carswell started on 14 January 2019 in a new role in the Department, IT Specialist (web and Moodle) and Jonathan Goddard also started in the new role of Digital Communications Coordinator on 25 February 2019. Both roles were created in response to the recommendations of the review of Research in

the Department to increase Professional Services Staff (PSS).

Jo de Bono formally took up her role as Executive Assistant to the Head of Department in May 2019.

Celia Burns joined the Department as Faculty Administrator in June 2019.

Helen Neal and Tara Leggett joined us on 30 May and 30 September 2019 respectively, to work in the Undergraduate Student Administration team. Their appointments have increased the PSS staff in the team from 1.5 to 2 FTE.

As at 30 September 2019 the Department of Computer Science and Technology consisted of 188 members of staff:

Academic staff	50
Academic-related & Assistant staff	35
Research Fellows	9
Research Staff	94

The following members of staff enjoyed personal promotions from 1 October 2019:

- Professor: Alastair Beresford, Paula Buttery, Mateja Jamnik, Andrew Moore
- Reader: Hatice Gunes, Robert Mullins

We were sorry to lose four key members of staff during 2018/19:

- Dr Nada Amin, University Lecturer
- Claire Chapman, Faculty Administrator
- Dr Andrea Kells, Research Facilitator
- Megan Sammons, Undergraduate Administrator
- Jan Samols, Corporate, Alumni and Communications Manager

We wish them all well in their future endeavours.

The following Research Associates were promoted to Senior Research Associate:

- Jonathan Ludlum, Systems Research Group
- Martin Kleppmann, Digital Technology Group
- Sandra Servia, Systems Research Group

The Department continues to strengthen its links with the Colleges the following staff have taken up a College Fellowship:

- Dr Hatice Gunes, Trinity Hall
- Dr Neel Krishnaswami, Trinity College
- Dr Amanda Prorok, Pembroke
- Professor Srinivasan Keshav, Fitzwilliam College

**We are pleased to report numerous staff and student honours, awards and achievements over 2018/19 (<https://www.cst.cam.ac.uk/news>). A selection of these include:**

PhD student **Andreas Grammenos** won a Distinguished Paper Award. The paper (co-authored by Andreas Grammenos, **Cecilia Mascolo** and **Jon Crowcroft**) was selected by a committee made up of 16 members

of the IMWUT Editorial Board and judged to represent an outstanding, exemplary contribution to the UbiComp research community.

**Krittika D'Silva** was recognised with Rising Star Awards in both Networking & Communications and AI, as well as a Top 25 Canadian Immigrant Youth Award.

**Simone Teufel** won the 2019 Pilkington Prize for outstanding teaching.

**Neel Krishnaswami** and **Jeremy Yallop** received a Distinguished Paper Award and Distinguished Artefact Award for their research paper, "A Typed, Algebraic Approach to Parsing," at the Programming Language Design and Implementation 2019 conference.

**Peter Pietzuch** and **Jean Bacon** won a Distributed Event-Based Systems (DEBS) 2002 Most Influential Paper Award for their 2002 paper, "Hermes: A Distributed Event-Based Middleware Architecture."

**Jon Crowcroft** was made an Honorary Professor at University College London.

**Andrew Pitts** and Jamie Gabbay (Heriot-Watt) were selected for the 2019 Alonzo Church Award for their work on nominal techniques, begun when Jamie was a PhD student with Andrew in late 1990s.

**Marcelo Fiore** and **Andrew Pitts** won a 2019 ACM/IEEE Symposium on Logic in Computer Science (LICS) annual Test-of-Time Award.

A team led by **Robert Watson**, Peter Neumann (SRI), **Simon Moore**, and **Peter Sewell** won best paper award at ASPLOS conference for their CheriABI paper. The lead for the paper was Brooks Davis (SRI), an industrial fellow in the Department.

**Cecilia Mascolo** was one of five Cambridge researchers to be awarded an Advanced Grant by the European Research Council (ERC), part of a total €540 million awarded by the ERC to fund researchers working on pioneering projects that aim to solve the world's most pressing challenges. Professor Mascolo's research focuses on the use of mobile devices for medical diagnostics.

**Alastair Beresford** received a 2018 Google Security and Privacy Research award. His research examines the security and privacy of large-scale networked computer systems.

**Amanda Prorok** received the Best Paper Award, at DARS 2018: 14th International Symposium on Distributed Autonomous Robotic Systems, for 'Redundant Robot Assignment on Graphs with Uncertain Edge Costs'.

**Robert Harle** was awarded the ACM UbiComp 10 Year Impact Award at UbiComp 2018 for his paper from 2008 (joint work with Oliver Woodman) entitled 'Pedestrian Localisation for Indoor Environments'.

**Noa Zilberman**, a Leverhulme Early Career Fellow and member of the Networks and Operating Systems Group, was named in the fourth list of "N2Women: Rising Stars in Computer Networking and Communications".

The Department's Wiseman Award has now been renamed as the **Wiseman Prize**. The prize aims to recognise students and research staff who make an exceptional contribution to the work of the Department, which is beyond their expected 'duties'. Their outstanding contributions make a real difference to our work. The recipients for their contributions during 2018/19 were:

- Andrew Caines
- Catalina Cangea
- Matthew Danish
- Andrej Ivašković
- Russell Moore
- Omer Sella

## ACTIVITIES

During 2018-19 the **Supporters' Club** hosted a successful recruitment fair and ran a full programme of

tech talks. Members acted as clients for the Part IB group design projects and continued to offer a wide variety of internship and graduate opportunities.

The annual dinner of the **Cambridge Computer Lab Ring**, a professional networking group for Cambridge Graduates working in the computing industry, was held at Queens' College on 3 April 2019 and featured the 15<sup>th</sup> Hall of Fame Awards. The awards, which celebrate the success of around 260 companies founded by Computer Lab graduates and staff were presented by guest speaker Steve Pope, co-founder and CTO of Solarflare Communications.

<b>The 2019 Winners</b>	
<i>Company of the Year:</i>	PolyAI
<i>Product of the Year:</i>	Pur3 Ltd for Pixl.js
<i>Better Future Award:</i>	Gemma Gordon for her work on bridging virtual reality with climate change education
<i>Publication of the Year:</i>	Noa Zilberman, Gabi Bracha and Golan Schzukin for "Stardust: Divide and Conquer in the Data Center Network"

The seventh annual distinguished **Wheeler Lecture** on 22 May 2019 was given by **Professor Jane Hillston**, Professor of Quantitative Modelling and Head of School in the School of Informatics within the College of Science and Engineering at the University of Edinburgh. Her lecture was titled 'Combining Formal Methods and Machine Learning'.

The fifth annual **women@CL** Oxbridge Conference was held in Oxford on 9 March 2019.

The **annual academic off-site meeting** was held on 3 July 2019 at Wolfson College.

The Cambridge Trust and Technology Initiative 2019 Symposium was held on 19 September at Churchill College. The Initiative, launched in September 2018 and headed by **Prof Simon Moore** and **Dr Jat Singh**, brings together and drives forward interdisciplinary research from Cambridge and beyond to explore the dynamic of trust and distrust in relation to internet technologies, society and power; to better inform trustworthy design and governance of next generation tech at the research and development stage; and to promote informed, critical, and engaging voices supporting individuals, communities and institutions in light of technology's increasing pervasiveness in societies.

## RESEARCH

The Department of Computer Science and Technology's research programme continues to produce world-leading work and research continues to be at the heart of the Department's business <https://www.cst.cam.ac.uk/research>. Research grant income in the last financial year was £8.7m.

In September 2018 the University undertook a Strategic Research Review of the Department's research. The review provided expert external advice to support the development of the University's research environment and we were grateful to panel members for their time and recommendations. Panel members were very positive about the Department and we found the process to be valuable and it gave us a chance to reflect on our processes and our future strategy.

Amongst the Department's portfolio of active research grants, we have a broad spectrum of topics. Grants awarded include:

- **Professor Alan Blackwell** is collaborating on Contextual Design of AI Tools for African Researchers funded by the Cambridge-Africa ALBORADA Research Fund from 1 July 2019 to 1 January 2021.
- **Dr Alastair Beresford and Dr Andrew Rice** are collaborating on the Isaac Physics (Cambridge Physics Project) funded by the Department for Education from 1 October 2018 to 31 March 2020.
- **Dr Alastair Beresford and Dr Andrew Rice** was awarded the Isaac Computing project Sponsored by the Raspberry PI Foundation funded by the Department for Education from 1 November 2018 to 30 September 2022.
- **Dr Paula Buttery and Professor Ted Briscoe** has been successful in securing follow-on funds for the Automated Language Teaching and Assessment (ALTA) Institute funded by Cambridge Assessment from 1 October 2018 to 31 October 2023.
- **Professor Anuj Dawar** has secured funding to work on Circuits, Logic and Symmetry funded by the EPSRC from 1 May 201 to 30 April 2022.
- **Dr Hatice Gunes** was awarded funding for Equipping Autonomous Marine Vehicles with Intelligence Interaction Capabilities funded by Autonomous Surface Vehicles Limited from 1 October 2018 to 30 September 2021.
- **Dr Hatice Gunes** has been successful in a consortium on Smart Working Environments for all Ages funded by H2020 Societal Challenges from 1 February 2019 to 31 January 2022.
- **Dr Markus Kuhn** has been awarded funds to work on Security Evaluation of Authentication Devices with Asymmetric Cryptography (SEISMIC) funded by Cambridge Consultants from 1 June 2019 to 31 May 2020.
- **Dr Amanda Prorok** was awarded funds for Resilient Path Coordination in Connected Vehicle Systems funded by the EPSRC from 1 March 2019 to 28 February 2021.
- **Professor Peter Sewell** has been successful in securing an ERC Fellowship on Engineering with Logic and Verification: Mathematically Rigorous Engineering for Safe and Secure Computer Systems funded by H2020 European Research Council from 1 October 2018 to 30 September 2023.
- **Dr Robert Watson *et al*** are continuing their work on Extending the CHERI Architecture for Trustworthiness in SSITH – ECASIS Phase II sponsored by SRI International funded by DARPA from 5 March 2019 to 5 April 2020.

Donations received between October 2018 and September 2019 include:

- **Professor Ann Copestake**, Huawei donated funds to support PhD Students between CST and ENG entitled Hisilicon Tech (Huawei) Studentship Fund
- **Professor Jon Crowcroft**, Microsoft Corporation continue to support Microsoft Cloud Computer Research
- **Dr Tim Jones, Professor Simon Moore, Professor Peter Sewell and Dr Robert Watson** have secured donations from ARM Limited to work on Rigorous Architecture Specification.
- **Professor Jon Crowcroft, Dr Tim Griffin and Dr Richard Mortier and Dr Sergi Skorobogatov, Dr Robert Watson and Professor Simon Moore** were awarded a donation for Research from Huawei Technologies Company Limited. **Dr Rafal Mantiuk** received a donation from Huawei Device Company Limited.
- **Dr Amanda Prorok** received a donation for Research.
- **Dr Anil Madhavapeddy** received a donation for work on VMWare from Vanguard Charitable.
- **Dr Alastair Beresford** received an unrestrictive gift for Security and Privacy Award from Google.
- **Dr Andreas Vlachos** received a donation for research from Amazon.
- **Dr Mark Hayter** made a very generous donation in the support of graduate students in the Department.

## TEACHING

Undergraduate numbers significantly increased in 2018-19; our first year intake was 130 students (102 in 2017-18). As a result of numbers management, our 2019-20 intake has fallen to 124. 117 students (~94%) have chosen the Computer Science 75% option, which falls in line with our planned withdrawal of the 50% option in 2020-21. The proportion of female students in 2019-20 has fallen to 19%, as opposed to 24% in 2018-19 and 18% in 2017-18. The number of students obtaining a First or II.1 in 2019 has remained stable.

2019 Part II results		2018 Part II results	
<i>I</i>	40%	<i>I</i>	41%
<i>II.1</i>	49%	<i>II.1</i>	51%
<i>II.2</i>	9%	<i>II.2</i>	7%
<i>III</i>	2%	<i>III</i>	1%

The MPhil in Advanced Computer Science continues to run smoothly with 30 modules spanning the wide range of research interests found in the Department as well as the Research Skills Programme (~30 individual units). 53 students started the course this year and application numbers remain very strong, with 284 applicants applying for entry for 2019-20. We also have a record number of PhD admissions in 2019-20.

## OUTREACH

The Department is engaged in a wide range of outreach activities with schools, colleges and communities. Our staff participate in public engagement activities to inspire, inform and foster debate. Full details of our outreach and public engagement can be found at: <https://www.cst.cam.ac.uk/outreach>

The Department participated in the University Open Days in July 2019 opening its doors to students, parents and teachers. Around 520 potential students attended, of which approximately 25% were female. The 2018 Postgraduate Open Day was held on 1 November 2018. It provided opportunities for prospective postgraduate students to meet with academics, explore the Colleges, and find out more about the application process and funding opportunities.

The Sutton Trust Summer School took place in the Department from 12-16 August 2019, with 32 attendees of which 9 were female (28%). The week-long programme was organised by **Dr Timothy Jones**. Student feedback reported attendees appreciated the mix of lectures and practical work, and the summer school demonstrating the breadth of topics available in the subject.

In January 2019, the Graduate Education Office provided talks on applying for graduate study to Haute École Francisco Ferrer, University of Electronics, Brussels; in conjunction with Christ's College, Dr Richard Mortier hosted a school visit from the Nobel School in Stevenage; and Dr Marwa Mahmoud represented the Department at a Higher Education Careers event at the City of London School for Girls. In October 2018, Mariana Marasoiu gave a talk titled 'Computers are my Pencils' at the Stephen Perse Foundation as part of their Ada Lovelace Celebration Day.

**Professor Ann Copestake**  
**Head of Department, November 2019**