

Department of Computer Science
and Technology

Annual Report of the Faculty



Photo by Nida Abassi of her colleague Micol Spitale elbow-bumping Nao, one of two wellbeing robots being developed in the Affective Intelligence and Robotics Lab

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INTRODUCTION

The Department of Computer Science and Technology continues to offer a world-class research facility, combining theory with practical activities, and significantly advancing both the field and computing in the wider world. The Department sustains active research across the breadth of computer science, and we encourage the development of new technologies and applications. Key elements of the Department's ethos are our focus on impact, and openness to working closely with both academic and non-academic organisations.

We have seen an increase in our undergraduate, master's and PhD student numbers for the 2022/23 intake. This has meant our teaching spaces are full to capacity and we are thinking creatively about the best use of space in the building.



2021/22 has been an extremely busy year with the focus on settling back into in-person teaching and a pattern of hybrid working for staff. We did not undertake any academic recruitment in 2021/22 but we plan to appoint 6 new Assistant/Associate Professors in 2022/23. 2021/22 saw the first year of the Academic Career Pathways (ACP) process, which replaced Senior Academic Promotions, and we enjoyed great success, with 2 staff promoted to

full Professorships and 5 more to Professor (G11) (details in the staff section below). We also achieved our aim of increasing the number of Professional Services Staff to support the administration of the Department. We anticipate that growth slowing down over the coming year although there are still a number of needs to address.

STAFF OVERVIEW

As of 30 September 2022, the Department of Computer Science and Technology consisted of 218 members of staff:

Academic staff	52
Professional Services Staff	50
Research Fellows	5
Research Staff	111

New Staff

Academic Staff

There were no new academic staff in 2021-22.

Research Staff

Rosie Baish, Research Associate

Soumya Banerjee, Senior Research Associate
Luca Benedetto, Research Associate
Michael W Dales, Senior Research Associate
Anjali Das, Research Associate
Manuel Henriques, Research Associate
Hilje Hudig, Research Associate
Sadiq Jaffer, Senior Research Associate
Zhe Jiang, Research Associate
Ambroise Lafont, Research Associate
Yang Liu, Research Associate
Carlos Molina Jimenez, Senior Research Associate
Peter Ochieng, DeepMind Academic Fellow
Dominic Orchard, Co-Director, The Institute of Computing for Climate Science
Sue Sentance, Director, Raspberry Pi Computing Education Research Centre
Micol Spitale, Research Associate
Mukesh Tiwari, Research Associate
Lianlong Wu, Research Associate
Ningning Xie, Research Associate

Professional Services Staff

Helen Averill, Undergraduate Teaching Manager
Anthony Bridgen, Research Centre Manager, Cambridge Global Challenges
Damien Briggs, Research Grants Coordinator
Thomas Bytheway, Hardware Specialist
Alison Digby, Building Services Manager
Harriet Hunnable, Head of Communications, Cambridge Centre for Carbon Credits (4C)
Helen Milton, HR Administrator
Daniel Porter, IT Support Manager
June Rix, Project Coordinator, Cambridge Centre for Carbon Credits (4C)
Kateryna Rybalochka, Postgraduate Course Administrator
Debbie Williamson, HR Manager
JungHa Woodward, Research Strategy Coordinator

Promotions

The following members of staff were successful in the 2021-22 Academic Career Pathway exercise. Their promotions take effect on 1 October 2022.

Professorships (G12)

- Timothy Jones
- Robert Watson

Professorships (G11)

- Nic Lane
- Anil Madhavapeddy
- Amanda Prorok
- Jamie Vicary
- Andreas Vlachos

Principal Research Associate

- Dr Jat Singh

Senior Research Associates

The following Research Associates were promoted to Senior Research Associate:

- Dr Angeliki Koutsoukou-Argyragi
- Dr Anthony Bordg
- Dr Ting Dang

Retirements

Professor Peter Robinson retired on 30 September 2022. We wish him well in his future endeavours.

College Fellowships

The Department continues to strengthen its links with the Colleges. The following UTOs hold College Fellowships:

Prof Ross Anderson, CHU
Prof Alastair Beresford, Q
Prof Alan Blackwell, DAR
Prof Ted Briscoe, G
Prof Paula Buttery, CAI
Prof Ann Copestake, W
Prof Jon Crowcroft, W
Prof Anuj Dawar, R
Prof Marcelo Fiore, CHR
Dr David Greaves, CC
Prof Timothy Griffin, K
Prof Hatice Gunes, TH
Prof Robert Harle, DOW
Dr Sean Holden, T

Dr Alice Hutchings, K
Prof Timothy Jones, CAI
Prof Srinivasan Keshav, F
Dr Neel Krishnaswami, T
Dr Markus Kuhn, W
Prof Nic Lane, JN
Prof Neil Lawrence, Q
Prof Pietro Lio, CLH
Prof A Madhavapeddy, PEM
Prof Cecilia Mascolo, JE
Prof Simon Moore, TH
Prof Richard Mortier, CHR
Prof Robert Mullins, JN
Prof Alan Mycroft, R

Prof Lawrence Paulson, CL
Prof Andrew Pitts, DAR
Prof Amanda Prorok, PEM
Prof Andrew Rice, Q
Prof Thomas Sauerwald, EM
Prof Peter Sewell, W
Prof Emily Shuckburgh, DAR
Prof Frank Stajano, T
Prof Jamie Vicary, K
Prof Andreas Vlachos, F
Dr Ian Wassell, CHU
Dr Jeremy Yallop, R

HONOURS, AWARDS AND ACHIEVEMENTS

We are pleased to report many staff and student honours, awards and achievements over 2021-22 (<https://www.cst.cam.ac.uk/news>). These include:

October 2021: Success for our students in two international competitions

<https://www.cst.cam.ac.uk/news/success-our-students-two-international-competitions>

November 2021: Support for student using machine learning to understand forest ecosystems

<https://www.cst.cam.ac.uk/news/support-student-using-machine-learning-understand-forest-ecosystems>

December 2021: Student cyclist's frustration over wind noise inspires award-winning research

<https://www.cst.cam.ac.uk/news/student-cyclists-frustration-over-wind-noise-inspires-award-winning-research>

January 2022: Pioneering computer processor security rolls out for industry testing

<https://www.cst.cam.ac.uk/news/pioneering-computer-processor-security-rolls-out-industry-testing>

March 2022: Students win awards for their designs

<https://www.cst.cam.ac.uk/news/students-win-awards-their-designs>

March 2022: 'Innovative' teaching wins Dr Amanda Prorok a Pilkington Prize

<https://www.cst.cam.ac.uk/news/innovative-teaching-wins-dr-amanda-prorok-pilkington-prize>

April 2022: Presenting the Hall of Fame Awards

<https://www.cst.cam.ac.uk/news/presenting-hall-fame-awards>

April 2022: Hybrid approach to 'Travelling Salesman Problem' produces best results

<https://www.cst.cam.ac.uk/news/hybrid-approach-travelling-salesman-problem-produces-best-results>

May 2022: Cambridge's global reputation in Computer Science recognised in REF 2021

<https://www.cst.cam.ac.uk/news/cambridges-global-reputation-computer-science-recognised-ref-2021>

May 2022: Dr Peter Ochieng appointed first DeepMind Academic Fellow in Computer Science at Cambridge

<https://www.cst.cam.ac.uk/news/dr-peter-ochieng-appointed-first-deepmind-academic-fellow-computer-science-cambridge>

June 2022: An OBE for Prof Simon Peyton Jones

<https://www.cst.cam.ac.uk/news/obe-prof-simon-peyton-jones>

June 2022: A plethora of professors

<https://www.cst.cam.ac.uk/news/plethora-professors>

July 2022: Award for student's work in addressing bias in machine learning

<https://www.cst.cam.ac.uk/news/award-students-work-addressing-bias-machine-learning>

July 2022: New analysis of noisy balanced allocations wins Student Best Paper Award

<https://www.cst.cam.ac.uk/news/new-analysis-noisy-balanced-allocations-wins-student-best-paper-award>

September 2022: Pioneering cybersecurity collaboration shortlisted for prestigious award

<https://www.cst.cam.ac.uk/news/pioneering-cybersecurity-collaboration-shortlisted-prestigious-award>

September 2022: Qualcomm Innovation Fellowship for PhD student

<https://www.cst.cam.ac.uk/news/qualcomm-innovation-fellowship-phd-student>

The Wiseman Prize

The [Wiseman 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 2021-22 were:

- Lucian Carata
- Nikhil Churamani
- Agnieszka Slowik
- Filip Svoboda

- Kieron Ivy Turk
- Huiyuan Xie
- Mateo Espinosa Zarlenga

RESEARCH

The Department continues to produce world-leading research and this is at the heart of the Department's activities (<https://www.cst.cam.ac.uk/research>). The total for the financial year 2021-22 was £14,088,593. The launch of the new Energy and Environment Group in the Department reflects our increasing research in this area. A selection of Research Grants received between October 2021 and September 2022 include:

Prof Alastair Beresford – Raspberry Pi Foundation: [Raspberry Pi Computing Education Research Centre](#)

Professor Jon Crowcroft – EPSRC: [Cloud Attestables on Morello Boards](#)

Professor Anuj Dawar – ERC Advanced Grant: [Limits of Symmetric Computation \(LimSymm\)](#)

Dr Alice Hutchings – University of Surrey funded by EPSRC: AP4L: Adaptive Pets to Protect and Empower People During Life Transitions

Prof Srinivasan Keshav and Prof Anil Madhavapeddy – [The Cambridge Centre for Carbon Credits \(4C\)](#)

Professor Pietro Lio – Horizon Europe (UKRI Underwrite): CHARM: Chemometric Histopathology Via Coherent Raman Imaging for Precision Medicine

Professor Pietro Lio – Horizon Europe (UKRI Underwrite): TROPHY: Ultrafast Holographic FTIR Microscopy

Professor Simon Moore – DARPA: Enabling Compartmentalisation Technologies

Prof Emily Shuckburgh and Dr Dominic Orchard – Schmidt Futures: [New Institute of Computing for Climate Science](#)

Dr Jat Singh – Alan Turing Institute: Enabling Trust, Security and Privacy for Policy Innovation in Tackling Modern Slavery

Dr Jat Singh – Information Commissioners Office: [Internet of Stings: Data Flow Auditing for Compliance in the Consumer Internet of Things](#)

Dr Micol Spitale – EPSRC IAA: Robot Coach for Promoting Mental Wellbeing in Workplaces

Professor Jamie Vicary – Royal Society: RS Fellows Enhancement: Higher Categories for Compositional Science

Professor Robert Watson – MIT funded by ONR: SWISH

Dr Damon Wischik – Alan Turing Institute: The Mobility Data Toolkit

ACTIVITIES

The Departmental Garden Party

A Departmental Garden Party took place on Wednesday, 7 September in the Clough Hall Gardens at Newnham College. The event was well attended by members of the Department, who enjoyed wonderful food, a jazz band, a magician, and non-competitive cricket.

Supporters' Club

Companies enrolled in our Supporters' Club pay a modest annual subscription in exchange for opportunities to interact with our students, mostly for the purposes of recruitment. Ranging from start-ups to multinational enterprises, they give Tech Talks, engage in Part IB projects, advertise opportunities / events to students and take part in the Department's annual Recruitment Fair. Membership has stayed stable over the last few years with a current level of around 90 members.



Subscriptions were formerly paid by donation, at an amount averaging around £1,000 per member per year. (The funds raised are used, where possible, for Department activities such as outreach, alleviating student hardship, supporting initiatives like women@CL and providing funding for early-stage research.) The payment model changed in early 2020, after it became apparent that subscriptions could no longer be considered donations, since members were receiving tangible benefits in return. As a result, the subscription was split into three parts: a basic membership, a fee for the Recruitment Fair, and a donation component for those able to contribute further. Despite donations now being optional, several companies still chose to give extra on top of their membership fee.

Most of the Supporters' Club activities, such as the Tech Talks, have continued as normal this year, although in virtual form in Michaelmas Term. We were able to start hosting events in person again in Lent Term, which included Tech Talks and the annual Supporters' Club dinner which we were unable to hold in 2021. The dinner was held at Downing College in March and was attended by around 30 companies. For the past two years the annual Recruitment Fair was held virtually. In November 2022 we will be holding the Recruitment Fair in person over two days, in the Department for the first time since 2019. Currently around 50 companies have signed up to attend the event.

Cambridge Ring

The Ring is our alumni association. Originally restricted to graduates of the Department, membership has been extended in the last few years to past staff members and longer-term visitors, and also graduates of other departments who were significantly involved with Computer Science while at Cambridge or who work in computer science now.

In the past, only a small fraction of those eligible to join actually signed up as members. But in 2019, the

Ring was brought under the management of the Department's Research Strategy Team, which put more membership management structure in place and undertook a significant recruitment and data-gathering effort in conjunction with the University's alumni relations department. We have also increased the frequency of communication with alumni and set up a Ring Forum at the end of 2020, an online discussion venue for peer-to-peer discussions, which has over 1,000 members. There is also a LinkedIn group with 600 members. Ring membership has more than doubled in the last few years. It continues to rise and is now over 2,000 members.

We were able to hold a Ring Dinner in April this year for the first time since 2019. The occasion was attended by over 60 alumni. The event began in the Department with a tea and talks from members of the Department and then moved to Queens' College for a drinks reception and a three-course dinner followed by speeches from the Head of Department Prof Ann Copestake and guest speaker Dr Rosemary Francis, and the Hall of Fame Awards Ceremony.

Our alumni event – The Long Reach of Computer Science – held in September 2022 as part of the University's Alumni Festival was a great success (<https://www.cst.cam.ac.uk/news/long-reach-computer-science>). It showcased a wide range of research here, from the development of social robots that could help detect mental wellbeing issues in children to a new study exploring the role of the cybercrime underground in the Russia-Ukraine conflict. It attracted many alumni from other departments as well as this one and generated so much positive feedback that we are now considering repeating it at the 2023 Cambridge Festival.

The 'Hall of Fame'

The annual Cambridge Ring 'Hall of Fame' awards are given in four categories: the company and the product of the year (from among the over 300 companies started by staff and/or graduates of the Department); the publication of the year (from among those produced by members of the Department); and the Better Future Award (to recognise those who have made significant contributions to humanity through technology). The 2021 awards were presented at the Ring dinner this year: <https://www.cst.cam.ac.uk/news/presenting-hall-fame-awards>.

The awards went to a tool for diagnosing Covid from recordings of coughing and breathing sounds; a novel AI-powered knowledge discovery business; a demonstration of ways to use Graph Neural Networks to plot the pathways of swarms of autonomous robots; and an analytics tool that helps HR directors with recruitment, and inclusion and diversity in their workforces.

Postgraduate Studies Open Day

The Postgraduate Education Office participated in the annual Postgraduate Studies Open Day in November 2021. As in 2020, the event was held online. In addition to sessions provided by the Postgraduate Admissions Office, the Department offered course talks from the Director of Postgraduate Education, Professor Mateja Jamnik. Staff from the research themes offered interactive talks and Q&A sessions, and recorded material. Research students offered posters and took part in a networking event with prospective students. The Postgraduate Education Office also hosted a live mini-conference of research students' work in March 2022 to which prospective PhD students were invited.

Wheeler Lecture

The annual Wheeler Lecture is held in memory of Professor David Wheeler, one of the pioneers of Computer Science. Unfortunately, due to the ill health of our speaker, the 11th annual Wheeler Lecture scheduled for May 2022 had to be cancelled. But thanks to a group of volunteer speakers who stepped

forward at extremely short notice, we were able to replace it with a Research Showcase event instead.

We heard a programme of short research talks, as follows:

- Head of Department Professor Ann Copestake: Introduction
- Dr Jennifer Cobbe: 'Compliant & Accountable Systems'
- Professor Srinivasan Keshav: 'Bringing Trust to Carbon Credits Through Computer Science'
- Andrea Ferlini: 'In-Ear Audio Sensing'
- Professor Simon Moore: 'Fundamentally improving security using capabilities'
- Dr Martin Kleppmann: 'Local-first software: Resilient and secure collaboration'

Research Showcase: Education

An Education Research Showcase in January 2022 highlighted some of the education projects being carried out here – including building chatbots that can help people who are learning a second language, and looking at ways to make the teaching of computing more culturally responsive. The event, comprising a series of lightning talks by early-career researchers in this Department, also highlighted the use of online platforms to support the teaching and learning of Physics at Secondary School.

This was the second Research Showcase run by the Research Strategy Team to raise awareness of the research being conducted in the Department. It attracted a range of attendees on the day, while the recording of it subsequently gained over 130 views on the Department's YouTube channel (<https://www.youtube.com/watch?v=KLu8CAKQ2aA>).

Cambridge Festival

For the first time, the Department organised a day of activities as part of the Cambridge Festival in March 2022. On Saturday 9 April, we opened our doors to the public to come and find out more about the research we do here. Those who came along were able to:

- meet and interact with Pepper and Nao, two wellbeing robots being developed here who might help make us more resilient to life's challenges
- join workshops to learn about spooky quantum phenomena like superposition, entanglement and teleportation and build their own quantum computer, and
- hear Professor Neil Lawrence encourage us to reframe our view of AI and pick up some tips on how to 'reclaim control' of our data.

Visitors also enjoyed impromptu tours of the Department, conducted by some of our PhD students.

We received many positive comments from our visitors – but also realised there was high demand for more activities, including both talks on our research and informal, drop-in activities for families. We have taken this on board during the planning of our Cambridge Festival day in March 2023 and will be offering an expanded range of events and workshops as a result.

Cambridge Coding Competition

In March 2022, 14 teams of students from local secondary schools took part in the inaugural Cambridge Coding Competition, run by the Department in conjunction with the Rotary Club of Cambridge. The competition, part of the Department's outreach activities and led by Tim Jones and colleagues, was deliberately aimed at enthusing Year 8 children about the possibilities of computer science before they go on to make their GCSE subject choices. Student teams were competing to win a trophy named after the

late Francis Hookham, a long-time member of the Rotary Club of Cambridge who had had a lifelong fascination with technology, especially computers. The competition will be held again in spring 2023 when the aim is to attract up to 40 teams drawn from state schools across the region.

University Open Days

On 7 and 8 July 2022, the Department participated in Open Days that took place as part of the wider, hybrid University Open Days that additionally offered opportunities to visit the colleges and find out about student life and finance. The Open Days gave Year 12 students the chance to visit the Department either virtually or in person and find out about the Computer Science course and the application process. Visitors were able to hear the Computer Science admissions talk explaining the admissions process, the structure of the Computer Science Tripos, the projects students undertake at different stages of the Tripos, and the skills they learn along the way. Visitors could also hear a sample lecture online to get a flavour of the learning here, and there were opportunities to take a tour and ask questions.

Sutton Trust Summer School

The annual Sutton Trust Summer School aims to give high-achieving Year 12 students from disadvantaged backgrounds an overview of computer science and insights into university life. The 2022 Summer School was in person, with 38 students in attendance for a week in August 2022. The students took practical classes in programming, algorithms, image processing and computer architecture; and attended taster lectures in other areas such as bioinformatics and graphics. The students also attended admissions lectures and activities. The aim was to give the students a taster of what it is like to be a student here and offer support for university applications. To be eligible to apply for the Summer Schools, students should have attended only state-funded schools and colleges and must be the first generation in their family to go to university.

TEACHING

Undergraduate Teaching

A total of 142 Part IA students were admitted in Michaelmas Term 2022. This includes 2 students who have returned from intermission, 1 student who is repeating a year, and 2 who have transferred from another course. This is an increase of 20 students on 2021 and above the Department's numbers target of 120. The numbers break down into 60% home students, 7% EU students, and 33% international students.



Percentages have followed a similar pattern to last year with a slight increase in EU and international students. The percentage of female students is 18.3% which is a drop from the figure of 22% for 2021. Numbers management continues to be in place for 2023 as applications continue to rise.

Undergraduate teaching for the year was of a hybrid nature with a gradual increase of in-person teaching as the academic year progressed. The 2022 Tripos examinations were once again held online using Moodle and were 'open book' exams as per the format for the 2021 examinations.

The classing boundaries were set at the percentages shown below. Class distribution reflects the expected boundaries as set out in the Department's Marking and Classing document, allowing for examiner discretion.

Marking and Classing		2020 Part II results		2021 Part II results		2022 Part II results	
Expected distribution		Final Distribution with safety net applied		Final Distribution		Final Distribution	
I	40%	I	40%	I	41%	I	42%
II.1	50%	II.1	48%	II.1	50%	II.1	48%
II.2	7.5%	II.2	9%	II.2	7%	II.2	8%
III	2.5%	III	3%	III	2%	III	2%

Postgraduate Teaching

The MPhil in Advanced Computer Science continued to run smoothly throughout 2021-22. We were able to teach entirely in person with some exceptions when staff were isolating. Material including recorded lectures was made available to all enrolled students and more especially to those isolating. The popular One-Minute-Madness session and project presentations were live events in 2022.

Application numbers for the MPhil commencing October 2022 exceeded previous years, with 107 Master's students. and we registered 76 MPhil students and a further 26 Part III students. We also expect between 43-46 PhD admissions in 2022-23.

Professor Ann Copestake
Head of Department, November 2022