

# Research Newsletter

## School of Computer Science

Issue 9 – Spring 2017



The School of Computer Science - Kilburn Building

### In this issue

p.2 Head of School Editorial and Research News

p.4 Feature – MAMBO

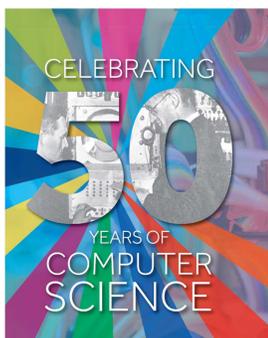
p.4 Recent Appointments and Promotions

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### About us

At The University of Manchester, we have one of the longest established schools of computer science in the UK and one of the largest. We are constantly building on our strong research history with research groups operating across the spectrum of computer science, from fundamental theory and innovative technology, through novel hardware and software systems design, to leading-edge applications.

The School is consistently ranked highly; top 5% in the UK (REF2014, GPA); assessed as *the best environment* in the UK for computer science and informatics research (REF2014); and the expertise and achievements of our staff are well-recognised internationally.

# Editorial by the Head of School

In this edition, there's a focus on our excellence in publishing and other outlets where the School's staff and research are showcased. It's fantastic to see our work being recognised in this way and to see its effect on the community and further afield.

I hope that you enjoy reading about these successes and congratulations to everybody involved.



Professor Robert Stevens

## News

### Our world-leading papers 'In Abstract'

The second edition of The University of Manchester's '[In Abstract](#)' series has been published. The array of recent world-leading publications featured come from across the University's Faculty of Science and Engineering.



The School of Computer Science have three out of the 24 selected from across the Faculty. The selected Computer Science papers in this edition can be seen via [www.mub.eps.manchester.ac.uk/in-abstract/computer-science/](http://www.mub.eps.manchester.ac.uk/in-abstract/computer-science/)

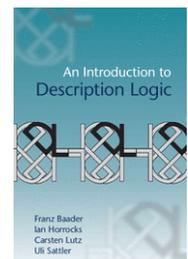
This work is judged by former REF panel members as world-leading in their respective areas. Computer Science's Director of Research Dr Gavin Brown was guest editor of this latest edition of 'In Abstract'

Congratulations to **Drs Gavin Brown, Eva Navarro-Lopez, Antoniu Pop**, and their co-authors, for their papers.

### New book: An Introduction to Description Logic

Description logics expert **Professor Uli Sattler** has co-authored the book *An Introduction to Description Logic* (Cambridge University Press), which was published on 20 April 2017. It is **the first textbook on description logics to ever be published.**

*'In knowledge representation and reasoning, Description Logic is a well-established area with a range of exciting applications, e.g., as the logical basis of the Semantic Web ontology language OWL. I am very happy to see this textbook published and hope that it will serve as a good starter to this exciting area and to logic in general'*



Prof. Uli Sattler

Description logics (DLs) have recently gained increased importance since they form the logical basis of widely used ontology languages, in particular the web ontology language OWL. Starting from a basic DL, the book introduces the reader to their syntax, semantics, reasoning problems and model theory and discusses the computational complexity of these reasoning problems and algorithms to solve them. It then explores a variety of reasoning techniques, knowledge-based applications and tools and it describes the relationship between DLs and OWL. [www.cambridge.org/9780521695428](http://www.cambridge.org/9780521695428)



### Best Student Paper for Henry Reeve

Congratulations to **Henry Reeve** (supervised by Dr Gavin Brown) who's been awarded Best Student Paper at the European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning (ESANN 2017) in Bruges.

#### ***Degrees of Freedom in Regression Ensembles***

Henry W J Reeve and Gavin Brown  
European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning 2017.  
[www.cs.man.ac.uk/~reeveh//DegreesOfFreedomInRegressionEnsembles.pdf](http://www.cs.man.ac.uk/~reeveh//DegreesOfFreedomInRegressionEnsembles.pdf)

## Making a Difference Awards 2017

The Making a Difference Awards recognise the outstanding achievements of Manchester's staff, students, alumni and external partners and celebrate how they are making a difference.

Over 130 entries were received for the Making a Difference Awards 2017. Out of the 48 shortlisted, the School are represented through the following projects:

### Team #Britain Breathing for Outstanding Public Engagement:

Sheena Cruickshank, **Andy Brass**, Jennie Evans, Lamiece Hassan, Hannah Hope, **Caroline Jay**, Jon Kudlick, Natasha Little, Indira McClean, **Markel Vigo** (Infection,



Immunity & Respiratory Medicine, Faculty Biology, Medicine and Health and School of Computer Science) - [#BritainBreathing](#) (see Summer 2016 Research Newsletter for more information)

### For Outstanding Contribution to Widening Participation:

**David Rydeheard** and Sarah Zaman with team members Dave Ames, Carol Murray, Carl Simmons - [Computing At School](#).

All shortlisted entries are invited to the award ceremony Thursday 11 May 2017 in the University's Whitworth Hall.

The Awards celebrate the impact our staff, students, alumni and external partners are having on the social well-being of our communities and wider society and offer the opportunity to share best practice about social responsibility initiatives and encourage others to get involved.

## Women of Wonder

For International Women's Day on 8th March, Manchester Faculty of Science and Engineering interviewed Senior lecturer **Dr Caroline Jay** and a number of other inspirational women championing changes in the workplace and within their disciplines to ensure they are more gender inclusive and to change commonly held perceptions about them.

[www.mub.eps.manchester.ac.uk/science-engineering/2017/03/06/women-of-wonder/](http://www.mub.eps.manchester.ac.uk/science-engineering/2017/03/06/women-of-wonder/)



**Dr Jay** also featured in the **Sunday Telegraph** on 30<sup>th</sup> April talking about working in Computer Science.

## Machine Learning and Marketing



**Dr Gavin Brown** was interviewed by the online marketing magazine "The Drum" on how best to deploy Machine Learning in advertising and how there exists a skills gap in the sector for well-trained data scientists. The report, Machine Learning: Empowering the Next Generation of Marketing can be found at

[www.thedrum.com/system/files/iotec\\_final\\_digital\\_0.pdf](http://www.thedrum.com/system/files/iotec_final_digital_0.pdf)

## Best paper (ISPASS 2017)

A paper by PhD student **Andrey Rodchenko** (second from left), Christos Kotselidis, Andy Nisbet, Antoniu Pop and Mikel Lujan was nominated for the best paper award as part of the 2017 IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS 2017) conference

(<http://www.ispass.org/ispass2017/>).

In April Andrei presented the work in California and received the award. Congratulations Andrey!!



MaxSim is a simulation platform based on the Maxine VM, the ZSim simulator, and the McPAT modeling framework. MaxSim is able to simulate fast and accurately managed workloads running on top of Maxine VM. It features pointer tagging, low-intrusive microarchitectural profiling based on tagged pointers and modeling of complex software changes via address-space morphing.

Source code for MaxSim is available at

<https://github.com/beehive-lab/MaxSim>



# Feature: MAMBO - A Binary Instrumentation Tool for ARM

**MAMBO is the lowest overhead dynamic binary instrumentation tool for ARM and is able to run standard benchmarks, e.g. SPEC CPU 2006, PARSEC, SLAMBench, as well as real applications, e.g. Gimp and LibreOffice.**

The benefits of ARM processors, being used where size, heat and power are important factors, means that their use is incredibly pervasive; for example in mobile phones, tablets and TVs. In fact, over 100 billion ARM processors have been produced as of 2017 and ARM is the most widely used instruction set architecture.

While ARM has traditionally been a 32-bit architecture, the ARMv8 version of the architecture introduced a new 64-bit execution mode and instruction set, called AArch64. While AArch64 has many benefits, there is a large ecosystem of existing 32-bit applications that need to be able to run on ARMv8 systems. The current generation of ARMv8 processors is capable of running legacy 32-bit ARM code directly in AArch32 mode, but maintaining this support comes at a cost with increased hardware complexity, power usage and development time.

**Researchers at Manchester have developed MAMBO-X64, a dynamic binary translator which translates AArch32 Linux programs into AArch64**, with the aim of allowing AArch32 applications to run on ARMv8 processors which do not support 32-bit compatibility in hardware. This enables pure 64-bit ARMv8 processors to run the many existing 32-bit ARM applications while benefiting from simpler and more efficient hardware as well as significantly reduced verification times compared to existing ARMv8 processors.

Last April, MAMBO was released as open-source together with the publication of our paper in ACM Transactions on Architecture and Code Optimization <http://dl.acm.org/citation.cfm?id=2896451>. The license is the industry friendly Apache 2.0.

Since its publication, it has appeared continuously in the list of **the top 10 most downloaded articles** in the journal (<https://lnkd.in/gzjb8EU>).

The viability of MAMBO-X64 as a replacement for hardware-level AArch32 support is strengthened by its very low overhead compared to native execution on existing ARMv8 processors, thanks to the great work of PhD students **Cosmin Gorgovan** and **Guillermo Callaghan**. The thread-shared code cache architecture of MAMBO-X64 also allows it to scale well with multi-threaded applications, which are becoming increasingly common as the number of cores in the latest smartphones keeps growing.

Looking at who is following the repository, MAMBO seems to be popular for cybersecurity as well as computer architecture. We will continue improving MAMBO and look forward to more developers, researchers and companies getting involved. <http://apt.cs.manchester.ac.uk/people/mlujan/>

Thanks to @EPSRC, @ARM Research and The Royal Society for their support.

## Recent appointments & promotions



**Dr Christos Kotselidis** has been appointed as Lecturer in the School of Computer Science as the "Chips" part of the People to Data to Chips theme following a three-year fellowship at the Advanced Processor Technologies group. Prior to joining the University he worked as a Principal Member of Technical Staff at Oracle Labs and as a Senior Research Scientist at Intel Labs where he has been awarded the prestigious Intel Divisional Recognition award for his work on future hw/sw co-designed processors. During his industrial experience he worked across the entire stack of computing including chip design, performance methodologies, micro-architecture research, hw/sw co-designed CPUs, Compilers, Virtual Machines and Garbage Collection. Finally, he (co-)authors over 20 referred papers and 8 patents. Currently, he is

leading the EU-funded ACTiCLOUD project where he researches memory management and compilation techniques for hyper-converged scale-up and scale-out cloud platforms.