RESEARCH NEWS

WELCOME TO THE RESEARCH NEWSLETTER FOR THE SCHOOL OF COMPUTER SCIENCE AT THE UNIVERSITY OF NOTTINGHAM.

NEW AWARDS

Mind the Gap: Unified Reasoning About Program Correctness and Efficiency
GRAHAM HUTTON, JENNIFER HACKETT, MARTIN HANDLEY

One of the key benefits of functional programming languages is the ability to reason about programs in a formal manner. However, while the high-level nature of the functional paradigm simplifies reasoning about program correctness, it also makes it more difficult to reason about program efficiency. This reasoning gap is particularly pronounced in lazy languages such as Haskell, where the on-demand nature of evaluation makes reasoning about efficiency even more challenging.

We have recently shown how a theory of program improvement can be used to address this problem, demonstrating the feasibility of a unified approach to reasoning that allows both correctness and efficiency to be considered in the same general framework. The aim of this four-year project, which was recently funded by EPSRC, is to build on the success of this work and develop new high-level techniques for reasoning about functional programs that bridge the correctness/efficiency gap.

Further information

ENLIVEN (Led by Education)
RONG QU, JASON ATKIN, ROBERT JOHN

The School of Computer Science has recently received a grant of £392k from the European Commission within ENLIVEN (Encouraging Lifelong Learning for an Inclusive and Vibrant Europe), a consortium of 10 European countries (Austria, Belgium, Bulgaria, England, Estonia, Italy, Scotland, Slovakia, Spain and Australia). This project is coordinated by School of Education (Coordinator: John Holford) at the University of Nottingham.

At the ASAP Group at Computer Science, we focus on knowledge discovery and text mining to establish case based reasoning systems to support policy making in lifelong learning across Europe, based on analysing large databases and documents collected from the consortium member countries.

Issue 2    January 2017
UnBias: Emancipating Users Against Algorithmic Biases for a Trusted Digital
DEREK MCAULEY

Contrary to public opinion, young people care about their personal data and want a digital world more transparent, a digital world they can trust. For example, little is known about how Amazon is able to tailor advertisements and recommend products that are actually interesting for potential online customers, or how Facebook decides which news Facebook users may be more inclined to read. All the mechanisms that support this filtering of information and products is obscure and internet users would like to know more about it, such as possible bias in their behaviour and, more importantly, have some control over these recommender systems.

This project aims to closely work with young people to further understand how aware ‘digital natives’ are about algorithm bias, their attitudes and main concerns and recommendations when interacting with such systems. This information will help us to better understand the way young people interact with such systems and identify youth-led solutions for teaching critical thinking toward digital information systems. We will apply different engagement tools and methodologies including focus groups, workshops and youth ‘juries’ to facilitate discussion, reflection and a deeper understanding of youth online behaviour and youth-lead software solutions.

This project will provide policy recommendations, ethical guidelines and a ‘fairness toolkit’ co-produced with young people and other stakeholders that will include educational materials and resources co-designed to support youth understanding about online environments as well as raise awareness among online providers about the concerns and rights of young internet users. This project is relevant for young people as well as society as a whole to ensure trust and transparency are not missing from the internet.

MyHome - A Game to Change Energy Consumption
HOLGER SCHNADELbach

The MyHouse project is lead by Legendary Games in collaboration with the University of Nottingham and the Centre for Sustainable Energy. My House is a simulation game, using game graphics but played using real world data from smart meters. During the course of play users will create a 3D version of their house in a web browser and compete with other players.

The aim is to create more energy efficient (reduce consumption) and healthier (avoid underheating) home environments. Through game missions, an intuitive user interface drawing on live data and competition between households, MyHouse will be designed to be engaging and educational.

Talking Heads: Audio-Visual speech recognition in the wild
YORGOS TZIMIROPOULOS

Audio-visual (AV) Automatic Speech Recognition (ASR) refers to the problem of recognizing speech using both audio and video information. Seminal work in psychology has shown that speech is not a purely auditory process but the way that the listener perceives speech is also through the tracking and recognition of the spatiotemporal visual patterns associated with the lips and mouth movement. Over the past years, this correlation of the AV information has been occasionally explored by the speech and computer vision communities in order to develop more robust ASR systems for cases in which the auditory environment is noisy (e.g. low quality audio, noise, and multiple speakers). However, the problem of AV ASR has been studied only within relatively small size data sets, most of which are collected in laboratory conditions.

TalkingHeads goes beyond the state-of-the-art in AV ASR in two important respects: Firstly, it proposes, for the first time, the problem of AV ASR in videos collected from real-world multimedia databases. Secondly, prior work on AV ASR has considered separately the tasks of extracting AV features, their fusion and the training of the ASR system. On the contrary, TalkingHeads proposes designing and training an end-to-end Deep Learning system in which all the aforementioned tasks are jointly performed.
In this new BBSRC project we will be considering the shape changes of cells in plant roots under low nutrient conditions, which give rise to important architectural changes in the root system. Using new microscopy technology, namely a light sheet microscope (see image above, showing cells in a plant root), we will be able to capture timeseries data of live root growth in 3D, over long time spans. Whilst a great advance in imaging, the amount of data produced will be large (terabyte-scale), so a new approach is required to be able to analyse and make sense of the dataset. One example challenge is identifying cell divisions in this data. We will develop computational methods to automatically identify such anatomical changes in the datasets.

By developing machine learning and image analysis approaches, and building novel software tools, we will automatically identify regions of interest. In addition we will build novel visualisation tools which will display the results of these approaches in intuitive ways, to allow biologists to intelligently navigate the data, rather than manually searching for the needle in the data haystack. With new and automated imaging approaches increasing the quality and amount of digital data available, we hope to show that the development of accompanying computational approaches is key to the success of future biological experiments.
PRIZES, AWARDS AND RECOGNITION

The School of Computer Science had two successes at the recent Knowledge Exchange and Impact Awards 2016. The biennial event, incorporating the Media Awards, took place on Thursday, 5 May 2016 at the East Midlands Conference Centre.

The Media Award was split into two categories, News and Current Affairs and Digital Media. The School of Computer Science (represented by Prof. David Brailsford), along with Physics and Chemistry, won in the Digital Media category, in a joint bid centred around their regular YouTube video channels – Computerphile, Periodic Videos, and Sixty Symbols. Collectively, these video sensations, led by filmmaker Brady Haran have clocked up a staggering 1.9m subscribers and over 100m views.

The other section of the Awards was the Knowledge Exchange and Impact award. Five entries were shortlisted from each faculty, with one winner from each. Dr Jason Atkin and Dr Geert De Maere, along with John Cook from NATS (National Air Traffic Services), won for the Faculty of Science with their algorithms for Heathrow airport. These algorithms predict aircraft take off times and decide when aircraft should leave the stands to make these times, so that they can start their engines later and save fuel. They allow for significant reductions in fuel burn and delays, as well as helping to improve the capacity of the airspace.

To be able to walk away with two awards, this is a huge win for Computer Science.
**Isaac Triguero** joined the School of Computer Science in June 2016 as Assistant Professor of Data Science.

Isaac received his M.Sc. and Ph.D. degree in Computer Science from the University of Granada, Spain, in 2009 and 2014, respectively. Prior to joining the University of Nottingham, he was a post-doctoral researcher at the Flemish Institute for Bioinformatics at Ghent University, Belgium. Isaac’s research involves multiple practical scenarios. During his post-doctoral stage, he was focused on the design of (big) data mining techniques for biomedical data.

He has been also a co-investigator in a number of research projects, including topics such as fingerprint recognition, cloud computing or railway maintenance. Currently, he aims to make fundamental advances in data science, specifically in data mining, data reduction, semi-supervised learning, extreme classification and big data learning.

Isaac has published more than 25 international journal papers as well as more than 20 contributions to conferences in the field of data mining. He develops new machine learning models that embrace the processing capabilities of newly arisen big data technologies to extract valuable knowledge from complex real scenarios. Isaac and his team won the Evolutionary Computation for Big Data and Big Learning Competition at GECCO conference in 2014.

**Ke (Adam) Zhou** is an assistant professor in School of Computer Science, University of Nottingham. His research interests and expertise lie in web search and analytics, user engagement modeling, evaluation metrics, text mining and human computer interaction. He has published in reputable conferences and journals (SIGIR, WWW, CIKM, TOIS, PLOS ONE), and served as PC member or reviewer for SIGIR, CIKM, WSDM, ECIR, AIRS, TOIS, IP&M and TKDE. He has also won the best paper award in ECIR’15 and CHIIR’16, and best paper honorable mention in SIGIR’15.

He served as a co-organizer for NTCIR-11/12 IMine task, TREC FedWeb 2014 task, Heterogeneous Information Access (HIA) workshop at WSDM’15 & SIGIR’16, and Poster & Demo Chair at AIRS’16. One of his current research interests focuses on information retrieval and specifically on Aggregated Search, the task of aggregating search results from heterogeneous search verticals (image, video, blog, news, etc.) to form search result pages that best help users in satisfying their information needs.

Prior to joining Nottingham, he was a research scientist working in user engagement/ad quality science team in Yahoo Research. Before joining Yahoo, he was previously a research associate in Language Technology Group in University of Edinburgh, working on text mining and information retrieval from 2013. Prior to this, he has conducted his PhD research on aggregated search at the Information Retrieval Group in University of Glasgow.
<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yousif Ahmed</td>
<td>Designing Technologies to support DJ’s work</td>
</tr>
<tr>
<td>Jabran Aladi</td>
<td>Handling Uncertainty from Type-1 to Interval Type-2 Fuzzy Sets &amp; Systems</td>
</tr>
<tr>
<td>Balsam Alsugair</td>
<td>Designing to motivate interaction between peers in learning contexts</td>
</tr>
<tr>
<td>Reem Alwashmi</td>
<td>Engagement and Collaboration in the Effectiveness of Games for Learning Primary School Mathematics</td>
</tr>
<tr>
<td>Edward Anstead</td>
<td>Many screen viewing: collaborative collaborative consumption of television media across multiple devices</td>
</tr>
<tr>
<td>Christopher Bayliss</td>
<td>Airline Reserve Crew Scheduling under Uncertainty</td>
</tr>
<tr>
<td>Paul Brindley</td>
<td>Generating Vague Geographic Information Through Data Mining of Passive Web Data</td>
</tr>
<tr>
<td>Anthony Brown</td>
<td>Domesticating Home Networks</td>
</tr>
<tr>
<td>Chris Carter</td>
<td>Understanding the professionally risky behaviour of young adults in using social media</td>
</tr>
<tr>
<td>Jimmy Chim</td>
<td>An Interpretive Investigation of Trust and Workflow in Advertising Communities</td>
</tr>
<tr>
<td>Leigh Clark</td>
<td>Exploring vague language use &amp; voice variation in human-agent interaction</td>
</tr>
<tr>
<td>James Colley</td>
<td>Making Sense of the Measurement, Feedback and Control of Energy</td>
</tr>
<tr>
<td>Sara Coverdale</td>
<td>Lost in SPACES: Exploring the Benefits &amp; Shortcoming of Spatial Presence &amp; Awareness as a Mechanism for Context Reasoning</td>
</tr>
<tr>
<td>Yuchun Ding</td>
<td>Novel Methods for Automatic Analysis on Vascular Images</td>
</tr>
<tr>
<td>Lesley Fosh</td>
<td>Getting Personalised Trajectories in Museums &amp; Galleries</td>
</tr>
<tr>
<td>Benjamin Haines</td>
<td>A GPU Parallel Approach Improving the Density of Multi-View Stereo Reconstruction</td>
</tr>
<tr>
<td>Diman Hassan</td>
<td>A Tree-Based Measure for Hierarchical Data in Large Databases</td>
</tr>
<tr>
<td>Adrian Hazzard</td>
<td>Guidelines for Composing Locative Soundtracks</td>
</tr>
<tr>
<td>Wenchao Jiang</td>
<td>Investigating Interactional Issues of Automated Planning Support for Disaster Response</td>
</tr>
<tr>
<td>Edward Kent</td>
<td>The effects of synchronisation &amp; other forestry commissioning constraints on vehicle routing problem solution methods</td>
</tr>
<tr>
<td>Alexander Ladas</td>
<td>Potential of Psychological Information to Support Knowledge Discovery in Consumer Debt Analysis</td>
</tr>
<tr>
<td>Josie McCulloch</td>
<td>Novel Methods of Measuring the Similarity and Distance between Complex Fuzzy Sets</td>
</tr>
<tr>
<td>Yujie Mei</td>
<td>An investigation into high dynamic range imaging technologies</td>
</tr>
<tr>
<td>Juan Carlos Saenz Carrasco</td>
<td>Functional Programming and Non-distributivity in Pathfinding</td>
</tr>
<tr>
<td>Jianhua Shao</td>
<td>Strategic Signals in the App Economy: An Empirical Study of Google Play Store</td>
</tr>
<tr>
<td>Diana Turcsany</td>
<td>Deep Learning Models of Biological Visual Information Processing</td>
</tr>
<tr>
<td>Bas Van Gijzel</td>
<td>A framework for relating, implementing &amp; verifying argumentation models &amp; their translations</td>
</tr>
<tr>
<td>Sameh Zakhary</td>
<td>Collaborative Location-Privacy-Aware Forwarding for Opportunistic Mobile Networks</td>
</tr>
<tr>
<td>Min Zhang</td>
<td>An Investigation of Query-by-Drawing Image Search on Mobile Devices</td>
</tr>
</tbody>
</table>