

## UK Computing Research Committee Workshop – Friday 6<sup>th</sup> December 2019

### Opening Remarks – Jane Hillston

The Workshop was a joint UKCRC and EPSRC event and this was the second meeting with UKCRC and EPSRC that would look at the EPSRC Big Ideas activity.

The main role of UKCRC is to represent Computing Research to UK funders including UKRI and to engage, consult and inform the UK Government on important areas within Computing Research. There were challenges in organising the workshops and challenges currently for academics and Computing Research including Brexit.

This workshop will bring in multi-disciplinary speakers and this will lead to an “outside looking-in” approach that will help with conversations around Big Ideas that the CRC can discuss with EPSRC. The previous workshop had been much more of the CRC looking outwards to create the Big Ideas.

### Computing Research from the Outside In

#### [Health Data Research UK – Susheel Varma](#)

The HDRUK mission is to unite the UK’s health data to enable discoveries that improve people’s lives. It is funded from a number of government-funded organisations and has partners including universities, NHS and social care organisations, charities, industry, patients and the public.

HDRUK is a UK wide organisation, building a future model over the next 10 years to provide health data for the whole of the UK population over their lifetime. They know they have good data but infrastructure is required to bring it together. HDRUK is about to complete phase 1 of the plan and on 10/01/20, they will be curating and providing a gateway to a full UK health dataset. Phase 2 and 3 are progressing through [seven hubs](#) based in Edinburgh, Liverpool, Manchester, Leeds, Cambridge, London and Exeter.

#### Q&A

*What are the safeguards to protect against unintended consequences of holding patient data, for example – Insurance Firms giving financial value to data of an individual’s health?*

HDRUK are not the controller of the data they are just a cataloguer, control stays with the relevant NHS Trust and they control consent and risk management in terms of access, malicious attacks and unconsidered consequences.

*How does the patient benefit?*

Through clinical translation, i.e. research being taken to the bedside. It is understood that this translation will take time as research findings are tested. HDRUK consider the sharing of patient information as a future investment rather than a cost.

*How do patients give informed consent?*

The patient has the choice of who can see and use their data when giving consent. This providence is tracked throughout the patient’s information record and is regulated by the custodian of the data i.e. NHS Digital.

## IBM – Peter Waggett

There are opportunities and challenges around the classic computing model and Moore's law of the number of transistors on a microchip doubling every two years. Currently computers are built around a specific architecture which is challenged by Artificial Intelligence and there is a need to move from bits to neurons and qubits - quantum simulation is needed.

Oakridge US has SUMMIT, the fastest supercomputer in the world, built on a neural network, while IBM has TrueNorth based on Neuromorphic Computing.

Future machines based on qubits will not be desktop machines; queries will be sent to them via the cloud. Every growth in qubit doubles a system's processing power.

### *How far are you away from useful computation using quantum computation?*

There were 1 million experiments on a 20-qubit machine in last 4 years. It is expected that in the next 18 months 2 qubits will be added to the machine's capacity.

### *How will these developments change academic work?*

It will be revolutionary; it is believed encryption that existing thinking said would take tens of thousands of years using all the computers in the world could be solved by a quantum computer.

### *How will we educate people to write quantum algorithms rather than classical?*

IBM is working with a number of universities and UKRI has launched a number of quantum programming hubs.

## St Andrews – V Anne Smith

A Bayesian network (BN) is a graphical representation of a joint probability distribution, representing dependence and conditional independence relationships, and can show how the interaction of variables in networks can be mapped and modelled. The modelling can be used in Gene, Neurological and Ecological networks.

## University of Cambridge – Chander Velu

Productivity growth is declining and in particular in the UK. There may be a number of reasons for this including issues around small and medium sized businesses, the measurements being incorrect and the financial crash.

A new technology hypothesis may be that it is due to a lack in changes to business models to match new technologies. This is based partly on what happened when electricity replaced steam power. In this example, it took 40 years for productivity to increase as working practices needed time to catch up with the new technology and in the same way we need to innovate in our current business models.

The current business model is one of "Make and Sell To" when with changes in technology the move should be to "Sense and Respond". For example smart appliances that let manufacturers know when parts are going to fail and can be manufactured locally on demand rather than holding stocks of spares.

Business need to build intelligent business models and evolve Business Model Coherence Score Cards and the question is, how do we build these?

## Big Ideas Generation – EPSRC

The Big Ideas activity is an initiative to collect adventurous and exciting ideas from the wider research community, for universities and UKCRC, to submit boundary-pushing ideas to EPSRC. The ideas need a wow factor, to be interdisciplinary and be on a large scale, larger than programme grants.

The ideas, submitted through a smart survey, will be sifted by EPSRC for strategy alignment and if a fit is found will be passed to the Big Ideas Advisory Group.

The first Big Idea being taken forward is the £34 million [Trustworthy Autonomous Systems hub](#).

The group voted on topics for discussion and the top four were discussed. The ideas were not discussed with the rest of the group but the notes were left on flip charts for people to look at over lunch.

### **Chris Johnson - UKCRC**

As Head of Computing Science at Glasgow University, hears many issues around changes to the HE sector and, in general, the feeling is that things are being *done to* academics and this leads to negative comments. However, there are an enormous number of opportunities for computing science if it engages with the Government. All politicians are focussed on the target of [2.4% of GDP to be invested in research in the future](#).

As the Government Liaison for UKCRC, various consultations are put to him for comment but the response from UKCRC members is poor. Without UKCRC members' comments it falls to the Liaison to make comments on areas that he does not have expertise. If the community does not contribute, how can academics complain when the Government passes legislation that is not fit for purpose in the computer science area?

Consultation questions are specific, for instance, "What should the rules and regulations be for driving autonomous vehicles?" Such questions are interesting and in engaging with the Government, academics get to meet useful and connected people within Government and the academic community. *The take home message is if UKCRC members do not engage with Government Consultations then the 2.4% of GDP for research will go to Physics as many politicians think the research undertaken by computer science should be carried out by industry not academics.*

### **Panel Session on Regulations and Ethics**

Burkhard Schafer – University of Edinburgh

Alastair Irons – University of Sunderland, BCS Academic Accreditation Committee

Claudia Pagliari – University of Edinburgh

Chris Johnson – Glasgow University

*What are the most pressing regulation and ethical challenges within computer science and how will they be addressed?*

CP – There are many challenges including how we use increasingly linkable data, along with judgements on algorithms around healthcare, the judiciary and the defence industry. There is also the Government's obsession with AI and the plethora of nonsense surrounding it. Finally, there is

the problem of how are we going to fill academic posts in the future as the majority of students leave to join industry.

CJ – Regulations are concerning as there is a real disconnect between reality and the regulations being proposed by Government. AI will never be used, as the levels of safety required are unrealistic in terms of proving coding.

BS – The idea of staff being pitted against employers is difficult to imagine; how will new staff on probation or looking for progression etc. be able to act as whistle blowers? What will the role of legal technologist be, will they have to be members of the law society and will they be external to companies?

AI – Digital forensics is an interesting area that is pushing students to look at ethical dilemmas. Many of the current ethical questions being asked were raised 10 or 20 years ago and in a fast moving sector, we continue to struggle. From a British Computer Society perspective, there are questions of how the industry should be professionalised should practitioners be chartered or member of professional societies such as the Law Society?

#### *Should there be regulatory bodies in place for the IT industry?*

AI – This is worth discussing but the framework for doctors and lawyers has been around for centuries and things are moving quickly within our field. There is a need to embed ethics and consideration of legal concepts and social responsibility within our teaching and it should not just be a module within a course.

CJ – [The Cyber Academy](#) supported by GCHQ is developing cyber security skills and cyber security experts. Professionalism is not an end-point, for example, should non-accreditation disallow researchers from applying for Government funders

CP – Ethics should be supported through education and accreditation. Built in and embedded within courses and teaching, privacy and ethics by design needs to be considered at all levels.

#### *Do specific digital ethics vary from the norm?*

BS – It would be a mistake to consider digital ethics differently from first principles of no harm to humans: just because something is novel it does not preclude this. The student responses to ethics modules and training has been very positive and are excited by the intellectual challenges that ethical design places on them.

CP – There are different tribes within the area who use different terminology. The fundamentals should be the same but specific frameworks may need to be developed depending on where the driver is coming from i.e. business ethics. People confuse ethics with philosophy, law or compliance and there needs to be a nuanced conversation around all of this.

AI – The different applications of computing research, speed of change and scale makes the sector and the ethical considerations required different to the norm.

#### *Should there be accreditation, recognition of competence in ethics for IT specialists administered by the HE sector?*

AI - There are problems of what recognition of competence means as it would have different definitions amongst different groups.

BS – Within an academic setting there is a right and wrong answer to ethical questions but in real life the variances are much greater for example friends, finances etc. There is the problem of how do you show competence? What parts of professional practices in law can be translated to a different sector with different roles?

CP – Need to embed ethical competence and empathy early in courses. Global ethical standards are being worked on but are in different skilled areas including computer science.

CJ – As Head of School the question is what is the purpose of the accreditation? Computer Science has a long way to go to be a true professional discipline. What is the true costs of taking so many overseas students to UK students, the economy, skills and professionalism in the UK?

*Is there an argument to bring in legal requirements for ethics if education is not working?*

AI – The task of professionalising the industry is arithmetically difficult with the number of practitioners.

BS – There is no other profession where the narrative is that a school kid knows more than an experienced IT specialist.

*Should there be a shift from writing software to software engineering and using more robust stack systems?*

CJ – The issue with the stack system is one of putting all your eggs in one basket and only time tells if there is a problem with the system as people build upon it. There is also a need for competence in using a stack system and often problems are caused by the system not being used as per its design.

CP – There are issues of a chain of supposedly trustworthy devices being used repeatedly with no proper understanding of system nor checks in place.

*Through Government policies, can we create safety around design?*

AI – There are huge groups of society that have no idea of the data they are giving away nor of the dangers of doing this. Teenagers who people imagine are aware of the data issues appear disinterested in any impact.

CJ – European Law means that IT sector has to prove the safety of technology before it is released. This is opposed to the US where a system of waivers is giving US industry the opportunity to develop technology such as autonomous vehicles.