

A PROPOSAL FOR AN EPSRC CENTRE FOR DOCTORAL TRAINING IN:

ENHANCING HUMAN INTERACTIONS AND COLLABORATIONS WITH DATA AND INTELLIGENCE DRIVEN SYSTEMS

We are proposing a unique and timely training context and research outlook that will nurture 50 PhD researchers who can ensure applications of big data and machine intelligence are underpinned by innovations that prioritise human values, experience and capabilities. We will invert the science-first convention—which moves from fundamentals to applications—to a people-first approach that starts with challenging contexts to disrupt and direct new, adventurous and exciting computational science.

CONTINUED INDUSTRY CONSULTATION

First and foremost, we are seeking your feedback on this proposal to co-create our centre. Secondly are we also ultimately seeking support from partners so that every PhD researcher will have opportunities to develop and test their ideas with advice and support from an industry sponsor.

We would like to ask you three questions in response to our Proposal outlined over the three sections:

1. The National Need for the Centre

- We are seeking your feedback on the existing and forecasted demand from your organisation in, or related to, this context.

2. The Centre's Vision

- We are keen to talk to you about challenges, initiatives or projects that your organisation has in this or related R&D areas to help further shape our plans.

3. The Centre's Approach

- We would like to hear from you on how your organisation or one like yours could support and work with a research student in such a Centre.

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THE NATIONAL NEED FOR THE CENTRE

You do not need to look far for evidence that highlights **widespread and growing concerns around the coming transformations promised by big data and artificial intelligence**. Strikingly, the concerns are being voiced not simply by ethicists and policy makers, but by leaders in science in industry. For instance, in July 2017, Elon Musk said, *“AI is a fundamental existential risk for human civilization, and I don’t think people fully appreciate that, [. . .] (AI) is the scariest problem.”* In its January 2018 review, Deloitte warns us that, large “big data” and AI projects often fail to deliver because they did not ensure they were designed to help humans think better. **Social quantitative and qualitative studies indicate that worries are shared widely**: in a study commissioned by BEIS and the Royal Society surveying over 4000 young people, only 28 % agreed they would trust a computer to look after an elderly relative at home, and 24 % felt they would trust an autonomous car.

Our Centre addresses a clear and challenging need to put people at the heart of research and innovation for data driven and intelligent technologies. While there will be many—and essential— initiatives to train computational researchers in terms of fundamental data analytics and AI algorithms and processes, our Centre will lead breakthroughs in core aspects of computational science that can **enhance the human experience of and engagement with data and intelligence in challenging contexts**. We will meet the need to train researchers who can work to ensure that such systems are **trustable, understandable, usable and negotiable by and with humans**. Without such capability, the hoped for benefits of these key technologies for the UK will be severely undermined. We subscribe to and will work out a computational response to the urgent need articulated in the Royal Society and British Academy principle of **“human flourishing”** and the problems that will occur if this is not adopted.

The UK already has a strong track record in growing and attracting AI and big data enterprises. We believe **our cohorts will be sought after** in these contexts because of their outlook and abilities that celebrate and enhance human capabilities. We are also orchestrating substantial and attractive opportunities for the Centre’s graduates to establish their careers within the Swansea Bay Internet Coast City Deal Region. Through this £1.3Bn deal, signed in March 2017, the Centre will see private and public sectors working together to develop South West Wales into a vibrant test-bed for next-generation approaches in key challenge areas including health and wellbeing, smart manufacturing, energy sustainability and digital economy services, all underpinned by computational innovations, many fundamentally focused on data-driven and intelligent decision making.



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Specifically, we are seeking your feedback on the forecasted and existing demand from your organisation in, or related, to this context.

THE CENTRE'S VISION

Our vision is to train 50 PhD researchers (in cohorts of 10 per year) who will lead change in industry and academe by having deep technical skills and knowledge in core computational science that are honed throughout with a simple but profoundly important question.

That question is: **what breakthroughs in core computational science are needed to enable people to feel in control of, and central to, their futures rapidly being transformed by advances in data and intelligence driven technologies?**

Responsible innovation, then, will be embedded at the heart of every research question our cohorts tackle through their training. This viewpoint will always see the human as a first-class citizen in the future physical-digital world, not outwitted, devalued or marginalised by the expanding capabilities of machine computation, automation and communication.

To this end all of our graduates will ground and provoke their inquiries in and through one or more of the areas represented by cross-disciplinary expertise held by our Centre in the use and issues of big data and AI for core growth opportunities identified in the City Deal: **health and well being, smart manufacturing and next generation digital platforms and services**. In addition, through our strength in cyber law and ethics, researchers will be further pushed to innovate responsibly and effectively and in ways that have the potential to shape understandings of future regulation and ethical frameworks. This proposal has been co-created by a range of partners with interests in each of these areas, and every PhD researcher will have opportunities to develop and test their ideas with advice and support from these organisations. Our vision, then, is to provide a highly trained computational workforce that has the ability to drive the uptake of AI in key sectors in the UK, a vital need, identified by the Hall and Presenti review.

While having their perspectives challenged and shaped by both intra- and cross-disciplinary activities, graduates will become specialists in areas the Computational Foundry excels at (from theoretical understandings to experimental ones in human computer interaction—HCI—and visualisation). Others may assume that human-centred thinking and methodologies is the special remit of CS's HCI sub-discipline; but our vision is to be radically more adventurous and ambitious than this in training cohorts of computational scientists across a spectrum of theoretical-to-experimental topics so that all can contribute to the human enhancing overarching agenda of the Centre. Consider, then, the following sample questions that cohorts might tackle:

- How can we use visualisation and logical reasoning to explain to a user the decisions and behaviour of an intelligent machine?
- How can a user negotiate, through new forms of interface, with such a machine to shape and alter decisions and behaviour?
- What is needed in terms of formal specification, algorithmic and interaction terms to enable people to trust these new forms of technology?

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THE CENTRE'S APPROACH

The Computational Foundry, CHERISH Digital Economy Centre and the wider Internet Coast City Deal provide the foundations for a rich and supportive training environment. All PhDs of our Centre will be **hosted on the Bay Campus in the cutting-edge Computational Foundry building** (opening September 2018), which offers a number of dedicated CS labs (maker lab, theory lab, security lab, user experience lab, biometrics and vision lab, visualisation lab, IoT lab). Furthermore, the Foundry has dedicated collaboration and interaction spaces that will be used to bring the cohort(s) together in novel training contexts. Swansea has a Data Science facility, a member of the Farr Institute, (opened in summer 2015), that hosts super-computing facilities for data analysis and is also a major partner in the Supercomputing Wales project that will be able to provide additional computational resources.

The Centre will offer a high quality training environment, which will draw on existing programmes at the Master's level, e.g., the CS Masters in Safe and Secure Systems, Masters in Advanced Computer Science for HCI and Masters in Data Science in addition to modules across our represented disciplines such as ones from Law that will encourage students to explore the legal, regulatory and ethical impacts of the connected world. These technical training modules will be front-loaded in the first year of the four-year programme to ensure PhD researchers have the requisite technical knowledge and skills.

In addition, a suite of credit-bearing mechanisms will be deployed throughout the four years to bond and shape the cohort, ensuring that each group is an active resource for members of that cohort and for cohorts that succeed and precede them. Each of these mechanisms will be focused on developing intra and cross-disciplinary ways of working in conjunction with end user stakeholders. Students will develop an Innovation and Engagement Portfolio as part of these modules, evidencing the outcomes of their activities and designed in a way to provide compelling examples of their ability for future employers in industry and the academy.

- **Year 1:** Cohorts will take part in three **Sandpit style events** to form mixed teams (in terms of computational science specialism and emerging domain/context interest) to complete short focused projects with stakeholders. The events will be one of the ways we will help PhD researchers choose and shape their focused work for Years 2–4.
- **Years 2, 3:** PhD researcher-led **side projects, modelled on the 20%** projects seen in global industrial players such as Google. We will encourage entrepreneurial and proactive learning by enabling PhD researchers to devote a portion of their time in Years 2 and 3 to achieve something of scientific and stakeholder relevance that uses their emerging expertise in a “side-project”.
- **Year 3: Festival of Ideas.** When a cohort reaches Year 3 they will organise a conference open to submissions from all cohorts. They will be encouraged to use this activity as training for wider participation in academic communities and public engagement.
- **Year 4: The Launchpad Crucible.** Modelled on the successful Digital Economy Crucible pioneered in Swansea, this leadership programme will prepare the soon to be PhD graduates to make strong first steps in their career outside of the Centre.

All Years: Strategic Insight and International Mobility. PhD researchers will have the opportunity to bid for funding for short term visits and placements within industrial and academic settings. As well as the partners initially involved in the Centre, students will be encouraged to make the case for engagement with any relevant group to either understand a end-user issue better or to learn from an enriching academic environment.

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