KING'S INSTITUTE
FOR ARTIFICIAL
INTELLIGENCE

King's
College
LONDON

Annual Report 2022

Establishing a presence in artificial intelligence

Contents

Message from the Director

It is a very exciting time for artificial intelligence at King's. For example, in science and engineering we host a range of world class research activities relevant to artificial intelligence and data science.

This includes: the UKRI Trustworthy Autonomous Systems Hub co-hosted with Southampton and Nottingham; the UKRI Centre for Doctoral Training in Safe and Trusted Artificial Intelligence and the EPSRC Centre for Doctoral Training in Smart Medical Imaging, both jointly with Imperial College London; the London Medical Imaging & AI Centre for Value-Based Healthcare, a consortium of academic, NHS and industry partners led by King's and based at St Thomas' Hospital; and the Wellcome EPSRC Centre for Medical Engineering. In addition, we have a range of other investments from external partners, not least of which is our engagement with NVIDIA, where King's is the sole university partner on Cambridge-1, the UK's most powerful supercomputer with the aim of accelerating research in AI and healthcare.

But artificial intelligence is more than just science and engineering. If we are to reap the benefits to be gained by technical advances in AI for society and make the world a better place, then we must also pay close attention to the societal impact of AI and to the challenges that it brings. While with any technology we must ensure that we undertake *responsible* research and innovation, the potential of AI technologies is so profound that there is a particular need to ensure *responsibility* here. In considering the legal, social, ethical and philosophical implications of AI, there are numerous important issues to address, whether it be in ensuring the avoidance of bias or in providing explanations of the behaviour of such systems (for example to ensure compliance with GDPR). Indeed, the need to develop systems that are safe, fair and trusted has never been greater. In this respect, human involvement is crucial in ensuring a diversity of those invested and involved in designing, developing, evaluating, certifying, deploying and using such systems, as well as in working with them. Here, *augmented intelligence* is the vision of machine working together with human, supporting people rather than replacing them, enabling people to do more and better, but still with human control in the loop.

The disciplinary base required to rise to these challenges is broad, yet it is precisely our interdisciplinarity at King's that is a key strength of our artificial intelligence and data science research, with

The King's Institute for Artificial Intelligence is working to bring together and coordinate our artificial intelligence research and education across the university, to provide more opportunities for multidisciplinary teams to rise to the challenges of AI, and to give a greater coherence to the overall agenda at King's in a supportive AI community. To tell us about your work, or find out more about ours, email **ai-institute@kcl.ac.uk**.

internationally leading centres of activity in both the faculties of Natural, Mathematical & Engineering Sciences and Life Sciences & Medicine, complemented by relevant research across King's. This richness of interdisciplinary research activity, which includes a very strong STEM centre of critical mass with exceptional links to other disciplines, combined with a diverse and talented community of researchers, puts us in a unique position in the UK artificial intelligence landscape and places us well to contribute to the UK's national priorities in this area.

It is in this context that King's has invested in an Institute for Artificial Intelligence to bring together colleagues working in AI, showcase and promote their work, facilitate collaboration, and generate links with external organisations. The role of the King's Institute for Artificial Intelligence is to act as a focal point to bring together and coordinate our artificial intelligence research across the university. It is not the role of the Institute to displace the AI research and teaching taking place across departments and faculties but instead to give researchers and educators a better environment and more opportunities to build multidisciplinary teams to rise to the challenges above, a greater coherence to the overall agenda at King's, and a sense for colleagues that we undertake our work at King's in an enriched AI community.

Against this background, although this is the first annual report of the King's Institute for AI, work to establish the Institute only really began in January 2022. Since then, much has happened at pace. We secured a Turing Network Development Award for King's from The Alan Turing Institute, we launched an exercise to map AI expertise at King's, and we have delivered an extensive programme of events and activities. As we turn our attention to the first full academic year of operation in 2022–23, this report allows us to reflect on our early achievements, to outline progress against our objectives, and to celebrate and showcase AI at King's.

Professor Michael Luck
Director
King's Institute for Artificial Intelligence

Artificial Intelligence at King's

2021-22

AI as strategic priority

In response to the Hall-Pesenti report, the UK Government has committed to remaining a world leader in AI as a strategic priority, allocating substantial investment in growing capability via universities and industry.

Published in October 2017, the report is a key contribution to the UK Government's Industrial Strategy (in which Artificial Intelligence and Data is one of the four initial Grand Challenges) and emphasises the opportunity to gain advantage from retaining our lead in AI and applying it more widely. It is estimated that with adequate support and investment, AI technologies could add £630 billion to the UK economy by 2035; another estimate suggests that AI could contribute up to $15.7 trillion to the global economy by 2030. Since the report was published, the Government has created the AI Council and the Office for AI (to implement the £950m AI Sector Deal, designed to catalyse AI research, development and adoption in the UK), and the Centre for Data Ethics and Innovation.

In 2021, UKRI published its AI Review, stating that, '*In order to realise the full benefits of AI, we will need to act to support the growth of the UK's AI research and innovation capabilities, building on strong foundations. This is likely to require substantial investment over a sustained period.*' The AI Council also released its AI Roadmap with two key messages: '*that we need to "double down" on recent investment the UK has made in AI*; and *that we must stay at the forefront of the development of AI and integrating approaches to ethics, security and social impacts and planning for the next 10–50 years.*' Both of these indicate that the significance of the opportunity is only increasing.

Building on the legacy of British computer scientist Alan Turing, the UK is still regarded as a leader in AI expertise with an exceptional record in AI research. Increasingly powerful computers and volumes of data generated in recent years have increased the capability of AI and broadened its application to most sectors, from healthcare to financial services and education. The use

'This is a particularly timely moment in the development of research at King's as we invest in a major expansion of our engineering and natural sciences capability as part of King's Strategic Vision 2029. This growth and investment has led to a number of exciting developments at King's including, most recently, the launch of the King's Institute for Artificial Intelligence.' *Professor Reza Razavi, Vice President (Research) at King's College London*

of AI has the potential to deliver major social and economic benefits, with profound impacts, many of which are yet to be defined and understood. This unknown nature of the profound impacts of AI is one of the compelling reasons to take an interdisciplinary approach to AI, from the ground up – in its development and in its application. Universities, rather than industry or the private sector, are more likely to have the breadth of expertise required to apply such an interdisciplinary approach to advances in AI and therefore contribute to greater public acceptance.

While there are institutional centres for AI elsewhere, King's can provide a meaningful contribution to this landscape. Specifically, what many consider to be the distinctiveness of King's, our interdisciplinarity and multidisciplinarity, also provides a context that is hard to match, and that is increasingly and absolutely recognised as the crucial prerequisite for success. As the 2021 UKRI AI Review puts it, UKRI will seek to ensure that the UK has the right environment by '*promoting the interdisciplinarity and cross-sector working needed for successful advances in AI.*' Perhaps unlike other institutions, our internal porosity, our close-quarters working, and our self-styled desire to break down barriers, exemplified by initiatives such as the King's Together awards, makes King's an ideal place to pursue this agenda. The aim is not to compete with The Alan Turing Institute or with other institutional centres, but instead to collaborate and support in the national interest. Because of the distribution of expertise across King's, because of the importance of AI to our disciplinary interests and to our strategic agenda, and because of the need for AI nationally and internationally, we should value the benefit of a more coherent internal activity in its own right.

Skilled experts in AI are in short supply; the UK needs more experts with deep AI knowledge as well as those with distinctly non-technical skills to work effectively with

King's Strategic Vision 2029 sets out King's ambitions for itself and for the society it serves. Our vision for the Institute reflects the central principles of King's Strategic Vision 2029 and answers its recurring call: that it is by bringing our disciplines together that we can leverage most impact from our expertise.
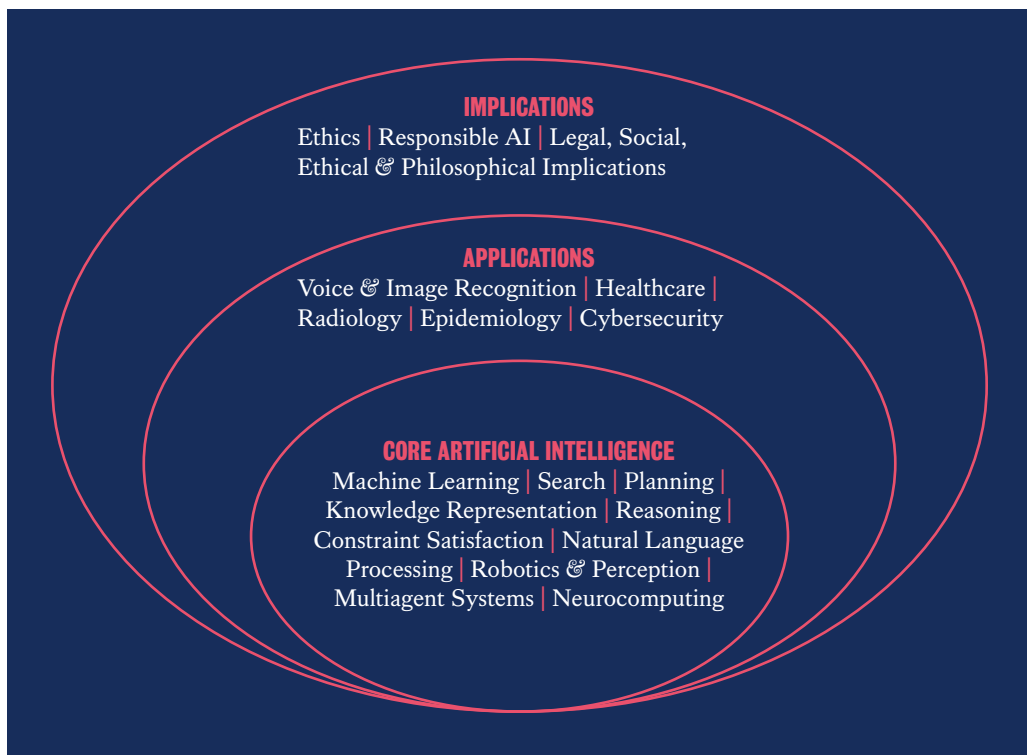
IMPLICATIONS
Ethics | Responsible AI | Legal, Social,
Ethical & Philosophical Implications

APPLICATIONS
Voice & Image Recognition | Healthcare |
Radiology | Epidemiology | Cybersecurity

CORE ARTIFICIAL INTELLIGENCE
Machine Learning | Search | Planning |
Knowledge Representation | Reasoning |
Constraint Satisfaction | Natural Language
Processing | Robotics & Perception |
Multiagent Systems | Neurocomputing

Figure 1. The breadth of AI: artificial intelligence, applications and implications

AI. As highlighted in the Hall-Pesenti recommendations, there is a major role for universities in developing AI skills, in both research and education, and King's is well placed to contribute to growing AI capability and leading its development. Yet crucially, AI researchers need to consider the wider implications of AI in society, its impact on business and industry, the relevance of legislation and regulation and emerging issues that need to be addressed. A holistic perspective on AI must draw on social sciences, law, and philosophy, and involve experts from diverse application domains. At King's, AI lies in every faculty across the entire university, with activity spanning core artificial intelligence (technical underpinnings), applications and implications, as shown in Figure 1.

This combination of the reach across the breadth of our disciplines and the depth of our expertise allows us to be distinct from other institutions in the focus of our work. The challenge now for King's is to bring together this diverse expertise to maximise the benefit and impact for society as a whole.

'The roots of most global challenges are complex and span academic disciplines. King's cultivates an interdisciplinary approach and our academics not only bring expertise in their given fields but also share their expertise to help bring about change.' *King's Strategic Vision 2029*

Mapping AI across faculties

The inherent and distinctive interdisciplinarity of King's brings a unique perspective to AI and its wider societal implications.

Reflecting this interdisciplinarity, and also multidisciplinary, there is significant activity in AI taking place across King's faculties and departments. However, not all of these projects and initiatives have sufficient visibility or critical mass. Among the aims of the King's Institute for AI is to promote a strong, cohesive, and sustained AI agenda at King's that leverages this interdisciplinary strength, requiring that we first surface the extent of the relevant work and make visible those undertaking it.

An immediate priority for the Institute, therefore, has been to map AI at King's across all areas including, but not limited to: research, education, and public engagement. In April 2022, the Institute launched a university-wide survey that received over 100 individual responses within three months. Respondents, who represent all career stages from professor to PhD student, were asked to summarise the main AI-related activities in which they are involved at King's and to categorise their work appropriately.

While this remains an ongoing exercise, the data so far has begun to help identify different sources of both expertise and activity, and to establish how this spans the university. It is also allowing us to determine how to align and link with The Alan Turing Institute, the national institute for data science and artificial intelligence, and to satisfy a key objective of our Turing Network Development Award (see page 17).

Mapping AI at King's will remain a key part of the Institute's operation, and it is critical that we capture changes in the King's AI landscape as projects conclude and new initiatives become established. However, the initial exercise provides a valuable snapshot of AI at King's in 2022, with collected data informing the Institute's agenda as we establish a longer-term programme to support the AI communities at King's.

'There's a real lack of understanding when it comes to AI. It's not just machine learning but a whole set of techniques and technologies, each with distinct benefits and challenges. If we focus only on some of these techniques, we just won't achieve the full potential of AI, and run the risk of doing more harm than good.' *Dr Elizabeth Black, Reader in Artificial Intelligence, Faculty of Natural, Mathematical & Engineering Sciences and Co-Director of UKRI Centre for Doctoral Training in Safe and Trusted Artificial Intelligence*

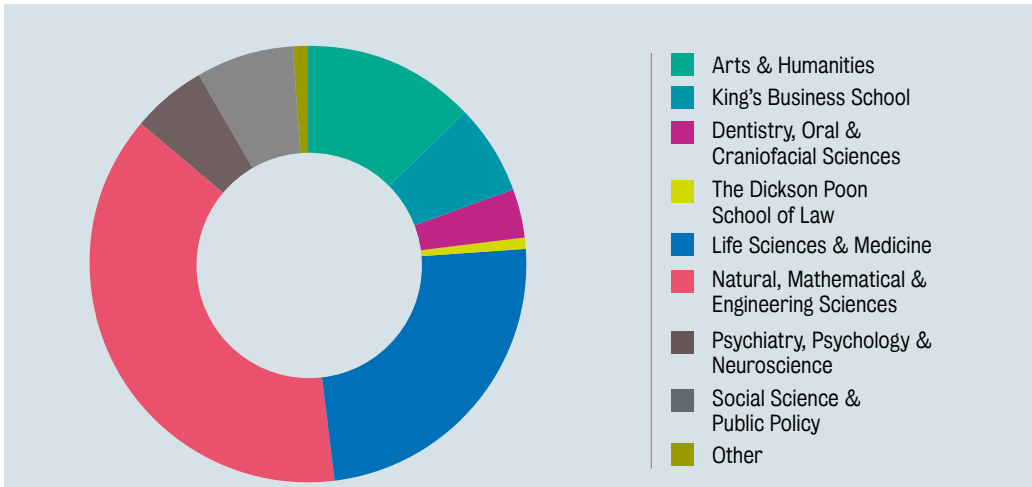Tell us about your work in artificial intelligence at King's. **Complete our survey.**

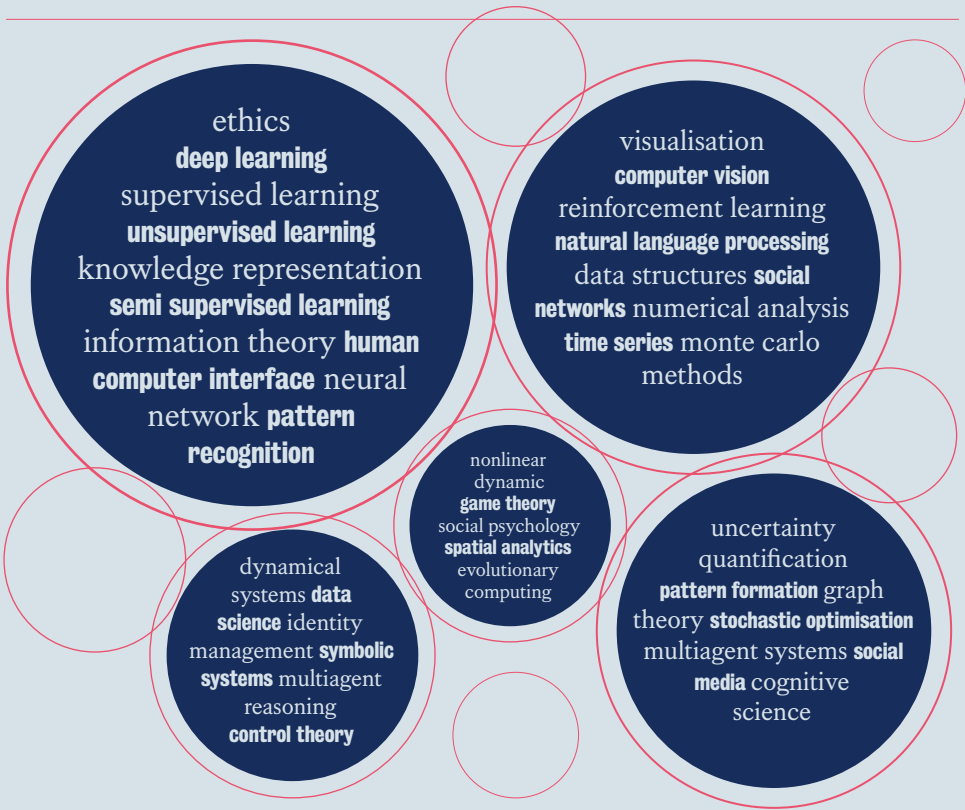**Figure 2.** Distribution of AI activity across King's faculties

Legend:
- Arts & Humanities
- King's Business School
- Dentistry, Oral & Craniofacial Sciences
- The Dickson Poon School of Law
- Life Sciences & Medicine
- Natural, Mathematical & Engineering Sciences
- Psychiatry, Psychology & Neuroscience
- Social Science & Public Policy
- Other

Figure 3. A selection of research areas in AI and data science identified as relevant to King's researchers

AI in action

UKRI Trustworthy Autonomous Systems Programme

The UKRI Trustworthy Autonomous Systems (TAS) Hub is an £11m partnership involving the University of Southampton, the University of Nottingham and King's College London (led by Professor Luc Moreau of the Department of Informatics in the Faculty of Natural, Mathematical & Engineering Sciences, and also involving academics from the Dickson Poon School of Law, the Faculty of Arts & Humanities, King's Business School, the Faculty of Life Sciences & Medicine and the Faculty of Social Science & Public Policy).

The Hub sits at the centre of the £33m TAS Programme, funded by the UKRI Strategic Priorities Fund.

The role of the TAS Hub is to coordinate and work with the six TAS research nodes, and four TAS responsibility projects, to establish a collaborative platform for the UK and to enable the development of socially beneficial autonomous systems that are both trustworthy in principle and trusted in practice by individuals, society and government.

The TAS Programme is driving multidisciplinary research structured around three initial grand challenges, informed by previous research on robotics and AI, which represent contexts of significant public concern and risk to potential economic and societal growth. Ongoing work within the grand challenge programme will identify new emerging areas. These initial challenges are:

- to ensure autonomous systems improve rather than harm our physical and mental wellbeing;
- to ensure autonomous systems safeguard rather than undermine our personal freedoms; and
- to ensure autonomous systems benefit rather than damage our society and the economy.

Among the six research nodes, the Verifiability Node is led by Professor Mohammad Mousavi of the Department of Informatics at King's, and is developing novel rigorous techniques that automate the systematic and holistic verification of autonomous systems: their increasing technological significance ensures that advances will have a real impact. The Node provides a focal point for verification research in the area of autonomous systems, linking to national and international initiatives.

In addition, Dr Hana Chockler, Reader in the Department of Informatics at King's, is co-investigator on the Governance and Regulation Node which focuses on devising a framework for the regulation of autonomous systems and exploring how to help them respond to complexities of the world they function in.

King's Institute for Artificial Intelligence partnered with the TAS Hub and the Department of Informatics in June 2022 to host Professor Oussama Khatib, Director of Stanford Robotics Lab, who delivered a public keynote lecture, discussing human-robot interaction in the context of deep-sea exploration.

Creative AI Lab

The Creative AI Lab is a collaborative research initiative that brings together knowledge and expertise from different cultural institutions and artistic practitioners using AI in their practice, inquiring how the arts can contribute to the discourse and development of artificial intelligence and machine learning.

Led by Dr Mercedes Bunz from King's and Eva Jäger from the Serpentine Gallery, Creative AI Lab is a collaboration between colleagues in the Department of Digital Humanities at King's (including Dr Daniel Chávez Heras, Alasdair Milne, and Professor Joanna Zylinska) and the Serpentine.

New and different approaches to aspects of artificial intelligence/machine learning (AI/ML) from building datasets to training the models, to their employment, have emerged from artistic practices. The aim of the Lab is to surface this 'back-end' knowledge of artistic practitioners and its relevance, for example in order to overcome existing 'black-box' narratives regarding AI. Through the lens of art-making, the Lab produces knowledge for cultural institutions, artists, AI and ML engineers and researchers on how to engage AI/ML as media. Additionally, the Lab aims to develop institutional capacities to engage with these media for the benefit of the wider cultural sector.

CogStack

Led by Professor James Teo and Professor Richard Dobson, CogStack is an information retrieval, extraction and natural language processing platform developed by researchers at the NIHR Maudsley Biomedical Research Centre (BRC) and King's College Hospital in partnership with the University College London Hospitals NHS Foundation Trust BRC.

It uses artificial intelligence to reveal important data locked in patient health records to support clinical decision making and healthcare research.

At the King's College Hospital deployment, over 12 million free text documents and over 250 million diagnostic results and reports have been processed within CogStack, with live updates processed at near real-time. The tool has allowed clinical trials to find and recruit patients who would have otherwise been difficult to locate, pharmacovigilance use cases for patients who are or could be at risk of adverse drug events, and population health management via interactive, real-time dashboards and alerting.

CogStack was awarded the Artificial Intelligence in Health and Care Award in July 2021, and the funding received as a result will enable work to build on the core technology and establish a more efficient way to read and code records in collaboration with five NHS Foundation Trusts including South London and Maudsley NHS Foundation Trust, King's College Hospital NHS Foundation Trust, and Guy's and St Thomas' NHS Foundation Trust.

Racially-biased AI models

Using the UK Biobank, a large-scale biomedical database, researchers from the School of Biomedical Engineering & Imaging Sciences have found that AI models can be racially biased if they are trained on unbalanced databases, meaning that where AI models are used, misdiagnoses could occur for under or non-represented races.

Lead researchers Dr Esther Puyol-Antón and Dr Andrew King looked at the performance of AI models based on cardiac MR imaging that are used to derive biomarkers of the heart. It was shown that if those biomarkers are used for the diagnosis of heart failure, for instance, there would be more misdiagnoses in minority races than there would be for majority races.

The conclusions are that researchers need to consider the training data when they are deploying these models into clinical practice to ensure that there is adequate representation of racial groups.

AI is being increasingly used to automate a range of medical imaging tasks, but there hasn't been adequate consideration of the issues around racial bias. As Dr King says, 'AI techniques are starting to be used in the real world including in high-stakes applications like medicine. If we don't make sure that AI techniques are fair then it may erode public trust in their use. Future research should bear this in mind and ensure that all sectors of society benefit equally from AI.'
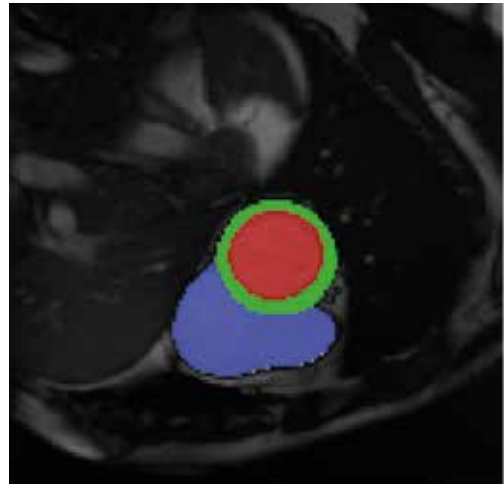
Majority group
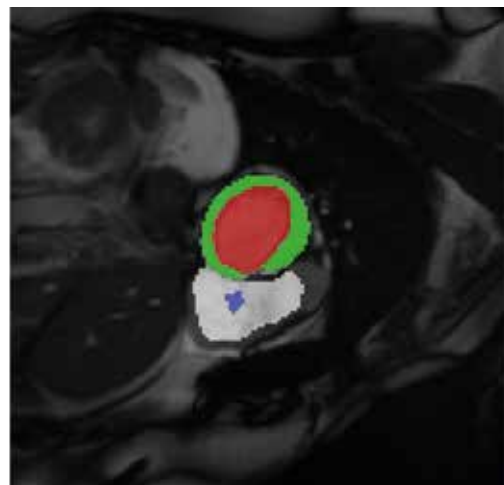
Minority group

Above Examples of a high-quality cardiac MR segmentation (majority group) and a low-quality segmentation (minority group)

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Global Dam Watch knowledge base

Research into social and environmental concerns around dams has been limited by a lack of consistent data and assessment tools. Members of the Department of Geography and King's Water Centre, Professor Mark Mulligan and Dr Arnout van Soesbergen, in collaboration with Global Dam Watch (GDW) partners around the world, have developed the Global Dam Watch knowledge-base (GDWkb): a collection of dam databases and associated tools for data curation, visualisation and analysis of dams and environment at the national and basin scale.

GDWkb is freely available and enables users to curate, analyse and download comprehensive dam data and analyses at national and basin scales. GDWkb is a live and evolving set of data and tools focused on local rather than global applications, visualisation and analysis. GDWkb complements two other foci of GDW: a static global database of locations and attributes for medium sized dams and a collection of links to other databases.

Currently comprising more than 150,000 georeferenced records, GDWkb aims to provide easy-to-use online tools for better understanding the benefits, costs and risks associated with dams, including impacts of climate change and land use change on the operation of dams. A particular focus is on the risks of nature loss to dam operation, and the risks of dam operation to nature loss.

Part of Mulligan and Soesbergen's work with GDWkb involves the use of AI in identifying the location of dams in remotely sensed imagery. This is joint work between the Department of Informatics (Dr Miaojing Shi) and the Department of Geography at King's. Another part involves the use of AI in helping curate attribute information associated with individual dams such as size of dam, name of dam, name of reservoir, age of dam, height of dam, use of dam, and so on.

The Synthetic Brain Project

The Synthetic Brain Project is focused on building deep learning models that can create artificial 3D MRI images of human brains, powered by the Cambridge-1 supercomputer.

The AI models were developed by King's College London, and NVIDIA data scientists and engineers, as part of the London Medical Imaging & AI Centre for Value-Based Healthcare.

The aim of developing the AI models is to help diagnose neurological diseases based on brain MRI scans, but it may also be used to predict diseases that a brain may develop over time and enable preventative treatment. The use of synthetic data has the additional benefit that it can ensure patient privacy and will open up research to the broader UK healthcare community.

As part of this synthetic brain generation project, King's will make the code and models available as open-source and NVIDIA has already made open-source contributions to improve the performance of the fast-transformers project, on which The Synthetic Brain Project depends. 100,000 synthetic brain images have been made available free to healthcare researchers, and could accelerate understanding of dementia, aging or any sort of brain disease.

'What happens next in AI, over the coming years and decades, will affect us all. Electricity, computers, the internet, smartphones and social networking have all changed our lives, radically, sometimes for better, sometimes for worse, and AI will, too.'
Gary Marcus, The Guardian, 7 August 2022
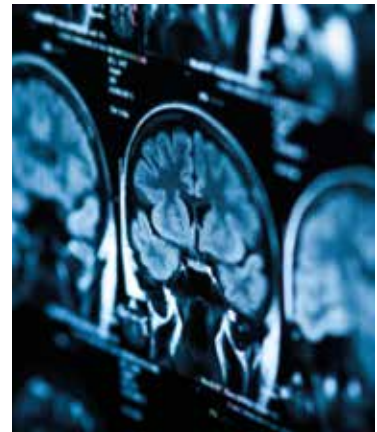
EPSRC Centre for Doctoral Training in Smart Medical Imaging

The EPSRC Centre for Doctoral Training (CDT) in Smart Medical Imaging brings together King's and Imperial, with their complementary strengths in basic physical sciences, engineering and clinical translation.

The CDT is looking to build smart new technologies into the entire medical imaging process. There are four research themes: AI-enabled imaging; smart imaging probes; emerging imaging; and affordable imaging. The AI-enabled imaging theme spans research on improved image acquisition and reconstruction (faster, cheaper and more quantitative images) as well as image analysis and surgical support (real-time biomarkers, pathology detection and enhanced screening). There is significant industrial support for a wide range of applications, including:

- synergistic image analysis of longitudinal cardiac MRI (with Perspectum);
- brain abnormalities and neuroimaging in the clinic: optimisation using artificial intelligence (with Siemens Healthineers);
- intra-procedural updating of cardiac digital-twins for automated arrhythmia ablation target guidance (with Philips Healthcare);
- MultiHeart: fusing CT and MRI with Space-Time Transformation Networks (with HeartFlow);
- unveiling the stiffening trajectories of the heart by physics informed machine learning (with Ultromics);
- real-time event detection in simultaneous EEG-fMRI: application to epilepsy and brain development (with Brain Products).

KCL DRIVE-Health

The King's Centre for Doctoral Training in Data-Driven Health is training the next generation of PhD health data scientists within an active NHS environment with the skills they need to develop new models of data-driven care, leveraging significant recent investment and infrastructure in Health Data Research within the UK.

Its four scientific themes are:
- learning from big data for health;
- knowledge representation for clinical decision support;
- informatics for next-generation clinical trials;
- translating informatics research into practice.

The PhD programme in Data-Driven Health offers the opportunity for students to work on internationally-competitive research projects, equipping them to exploit excellence in medical and informatics research for improving the health of local and national patient populations. Students will benefit from multidisciplinary supervision and opportunities for visits to international partners.

UKRI Centre for Doctoral Training in Safe and Trusted Artificial Intelligence

The UKRI Centre for Doctoral Training (CDT) in Safe and Trusted Artificial Intelligence aims to train a new generation of scientists and engineers to be expert in methods of safe and trusted AI.

Bringing together academic supervisors from King's and Imperial, the CDT focuses on the use of symbolic AI techniques for ensuring the safety and trustworthiness of AI systems. Symbolic AI techniques provide an explicit language for representing, analysing and reasoning about systems and their behaviours. Explicit models can be verified, and solutions based on them can be guaranteed as safe and correct; and they can provide human-understandable explanations and support user collaboration and interaction with AI – key for developing trust in a system.

The CDT's rich training programme includes a strong focus on Responsible Research and Innovation (RRI). Students are encouraged to engage diverse stakeholders and to consider the possible unintended implications of their research – this is particularly important for the development of AI systems, which have the potential to impact significantly on both individuals and society.

Industry partners for the CDT include Royal Mail, Ericsson, BT, Vodafone, Ocado, Thales, the Mayor of London's Office for Policing and Crime, ContactEngine, Codeplay, FiveAI, Greenshoot Labs, National Archives, British Library and more.

This academic year saw the CDT welcome its third cohort with projects on a range of topics including using natural language datasets to support human and AI debates, embedding principles of conduct in machine learning systems and service robot adaptation for users with different abilities.

Founding co-Directors of the UKRI Centre for Doctoral Training in Safe and Trusted Artificial Intelligence, Dr Elizabeth Black and Dr Natalia Criado (now at Universitat Politècnica de València)

Turing Network Development Award

In February 2022, following an application by the King's Institute for AI, King's received a Turing Network Development Award from The Alan Turing Institute, as part of its inaugural network funding programme. 25 universities across the UK were awarded Turing Network Development Awards, enabling them to cement links with the Turing.

The awards require universities to identify areas in which their AI expertise aligns with the priority research areas at the Turing, and to host activities that promote new connections and collaborations between AI and data science communities across the network.

The King's application demonstrated its proven research excellence, having long been at the forefront of work on AI and data science, from foundational computational work to applications in healthcare and humanities, as well as addressing the social and legal implications of these technologies. Led by the Director of the King's Institute for AI, Professor Michael Luck, colleagues working in AI across the university contributed to the award proposal, highlighting the strength of a coordinated interdisciplinary approach.

Some of the aims of the Turing Network Development Award commit the King's Institute for AI to activities that correspond with its own immediate priorities. For example, during the award term, the King's Institute supported the growth and networking of AI communities at King's by delivering institution-wide and community events designed to bring together researchers and academics from different disciplines across King's, and by establishing a network of people working in AI across King's with a range of initiatives and coordination tools. These activities have contributed to the broader objective of supporting King's to incubate, nurture, and connect communities of people who bring different disciplinary perspectives to dialogues in AI. Similarly, the survey launched by the King's Institute in April 2022 has allowed meaningful data and insights about AI expertise at King's to be mapped both for the benefit of King's and for the Turing.

When the Turing Award concludes in September 2022, the King's Institute for AI will continue to ensure that we take steps to sustain the work undertaken during the Award term in the form of a lasting and coordinated AI agenda at King's, and a meaningful relationship with the Turing. Indeed, King's investment in the Institute for AI is itself a commitment to supporting a sustained AI agenda at King's, across the entire breadth of the university.

'The Turing Network Development Award has motivated King's to bring together a community in AI and Data Science from across all faculties, link these to existing Turing activities and propose new directions for the Turing itself. A series of successful and well attended workshops have been underway at King's since the start of the award and will run on until the end of the award in September. It's clear that the TNDA provides a great opportunity to link the world-leading research at King's with the strengths at the Turing.' *Professor Nick Holliman, Professor of Computer Science, Director of CUSP London, and Award Lead for the Turing Network Development Award at King's College London*

TIMELINE 2022	AWARD TERM									
	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
MAPPING Map King's AI activities against Turing research programmes	■	■	■							
INFORMING Increase awareness of Turing activities at King's	■	■	■	■	■					
ENGAGING Increase King's presence in Turing interest groups				■	■	■	■	■		
HOSTING Host Turing-linked activities of interest to King's			■	■	■	■	■	■		
DEVELOPING Initiate King's-Turing workshops on specialist areas						■	■			
SUPPORTING Feed results of Award into further developing King's AI activities									■	■

Table 1. Timeline of the Turing Network Development Award workstreams

King's Institute for Artificial Intelligence

Our vision

Our vision for AI at King's is captured in six key themes. Via these themes, we seek to bring together the very significant AI activity across the breadth of the university to achieve a critical mass, and invite researchers, educators and students to contribute to scientific and technical developments, as well as to the legal, societal and ethical issues involved. In this way, the Institute aims to add value to relevant AI activities taking place within departments and faculties, supporting and promoting them, and coordinating larger-scale and cross-institution efforts where these are valuable.

1 **COORDINATION**
Provide a point of research coordination within King's for funding calls, consortium building, selection panels, matchmaking, etc. For example, the Turing Network Development Award

2 **COMMUNITY**
Bring the research community together across King's by delivering an events programme and internal communications for networking and collaboration in support of a King's AI research culture and community

3 **REPRESENTATION**
Provide all-King's representation for external partnerships, for example with The Alan Turing Institute, collaborating institutions, donors, funding agencies, and more

4 **EDUCATION**
Coordinate development of educational offerings, drawing on the strength across the institution, potentially to include undergraduate modules, online modules, executive education, and less formal staff upskilling

5 **ENGAGEMENT**
Develop opportunities for wider public engagement, working on new initiatives and in collaboration with, for example the Policy Institute, the Culture team, the Entrepreneurship Institute, Science Gallery London, etc

6 **VISIBILITY**
Create a coherent and visible external presence/profile for King's as a whole, across the breadth of the university, eg website, news stories, marketing collateral

COMMUNITY WORKSHOP
Building a community in AI hardware: lights, neuromorphics and beyond

In April 2022, King's hosted 'AI hardware: lights, neuromorphics and beyond', a workshop coordinated by Professor Rosalyn Moran and supported by the King's Institute for Artificial Intelligence. The need to bring together a community around AI hardware at King's was accelerated by an earlier plan to develop an optical brain, proposed by over 15 principal investigators at King's. The ambition was to work collaboratively to develop next-generation computing devices for artificial intelligence applications that mimicked neurobiological function and operated on an energy-efficient nanophotonic platform.

Professor Bashir Al-Hashimi, Executive Dean of the Faculty of Natural, Mathematical & Engineering Sciences, delivered the opening remarks at the workshop, stressing the need to broaden the horizons of neuromorphic computing research and hoping that the workshop presented a step in this direction. Speakers came from across four faculties at King's and delivered talks in three broad sections: neuromorphic computing hardware and memristor devices; neuroscience research in AI; and environmental and social impacts of AI.

The workshop presented the first opportunity for a new interdisciplinary community to gather at King's, during which they were able to explore possibilities of collaboration and inspiration to further develop and enhance the community. A report outlining the presentations is also being published by the King's Institute for AI.

'The workshop allowed us to figure out what our research overlaps were – in terms of building brain inspired AI devices. There were surprisingly many. We also started to work out interdisciplinary language barriers and began to remove them.' *Professor Rosalyn Moran, Deputy Director of the King's Institute for Artificial Intelligence & Professor of Computational Neuroscience in the Institute of Psychiatry, Psychology & Neuroscience*

LOOKING AHEAD (2022–23)

The King's Institute for Artificial Intelligence is still in its infancy, having only really started in January 2022. The 2022–23 academic year will be the first full year of operation, and will begin to drive forward our vision for AI at King's over the coming years in support of King's and the national AI agenda.

Three main phases of development are envisaged for the Institute: Initiate, Thrive and Sustain. These terms characterise the natural phases of the Institute's growth over an extended period. A measure of success for each phase will be how well a diverse and engaged AI community at King's achieves visibility and traction, how it flourishes, and how it remains embedded in King's future successes across research, education and service. The diagram below exemplifies one possible set of indicators across the Institute's development.

'The King's Institute for Artificial Intelligence offers the opportunity to act as a central hub for all researchers at King's aiming to use or develop machine learning or AI methods. From my own perspective this brings the chance to engage with a diversity of researchers from a biological background who are keen to apply AI methods to their work. I anticipate this will enable new collaborations enabling me to apply novel AI techniques for interpreting image data during tissue regeneration.'

Dr Robert Knight, Senior Lecturer in Developmental Genetics, Faculty of Dentistry, Oral & Craniofacial Sciences

INITIATE 2021–23	THRIVE 2022–25	SUSTAIN 2024–27
Create an identity for the Institute and establish its presence within King's and externally.	**Establish educational activities** to develop training materials for staff upskilling and courses.	**Explore educational opportunities** for alumni and training of external stakeholders.
Establish collaborative events across faculties, building an AI community at King's.	**Develop and promote case studies** highlighting the best of AI at King's.	**Engage with government and industry** in support of regulation for ethical autonomous systems.
Provide a coordination and representation service for AI at King's.	**Develop best practice guidance** to support ethical research and case studies.	**Support the full range of King's activities**, including research and technology transfer.

Table 2. Example indicators of the three main phases of development for the Institute

STEERING GROUP 2021–22

Dr Marina Riabiz
Lecturer in Statistics, Faculty of Natural,
Mathematical & Engineering Science

Professor Nick Holliman
Director of Centre for Urban Science and
Progress (CUSP) London, Faculty of Natural,
Mathematical & Engineering Science

Dr Arianna Ciula
Deputy Director at King's Digital Lab, Faculty of Arts
& Humanities

Professor Joanna Zylinska
Professor of Media Philosophy & Critical Digital
Practice, Faculty of Arts & Humanities

Dr Kenneth Payne
Deputy Head, Director of Research, Faculty of
Social Science & Public Policy

Professor Mark Mulligan
Professor of Physical & Environmental Geography,
Faculty of Social Science & Public Policy

Professor Paul Luff
Professor in Organisations and Technology,
King's Business School

Dr Stefan Bernritter
Senior Lecturer in Marketing, King's Business School

Dr Andrew King
Reader in Medical Image Analysis, Faculty of
Life Sciences & Medicine

Dr Aleksej Zelezniak
Senior Lecturer in Computational Biophysics,
Faculty of Life Sciences & Medicine

Dr Mads Bergholt
Lecturer in Biophotonics, Faculty of Dentistry,
Oral & Craniofacial Sciences

Dr Robert Knight
Senior Lecturer in Developmental Genetics,
Faculty of Dentistry, Oral & Craniofacial Sciences

Dr Crina Grosan
Senior Lecturer, Florence Nightingale Faculty of
Nursing, Midwifery & Palliative Care

Dr Mateja Durovic
Reader in Contract and Commercial Law,
Dickson Poon School of Law

SPOTLIGHT ON

Dr Crina Grosan
Dr Grosan's main research interests are in the field of artificial intelligence, optimisation and data analytics. She has developed, adapted, and applied methods and algorithms for data analysis, systems of equations, many-objective, multimodal, and combinatorial optimisation problems and decision making. Dr Grosan's work has an interdisciplinary focus, exploring the application of AI in healthcare through the development of AI-driven health technologies, new methods of healthcare delivery, AI-driven data-centric approaches for biomedical and healthcare data, fairness in machine learning for healthcare and statistical design of machine learning experiments.

SPOTLIGHT ON

Dr Robert Knight
Dr Knight's research aims to identify molecular mechanisms regulating tissue repair and stem cell behaviour. The Knight group uses a combination of advanced live cell imaging, gene manipulation and transcriptomics in zebrafish and human cells. Current projects are focused on understanding how ageing affects muscle stem cell function and to identify molecules driving stem cell behaviour in vivo. They are currently working to build AI tools for integrating descriptions of cell behaviour with molecular function in order to make predictions of how specific molecules affect the ability of stem cells to maintain effective muscle function.

INSTITUTE LEADERSHIP & OPERATIONS

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Professor Rosalyn Moran
Deputy Director
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INSTITUTE OPERATIONS

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INSTITUTE BUSINESS CASE

Pauline Lam
Strategic Programmes Manager, 2021–22
King's Together project to establish
King's Institute for AI

GET INVOLVED

One of our immediate and ongoing priorities is to map the breadth and depth of artificial intelligence activity at King's, including but not limited to: research, education and external engagement. This is an important piece of work for King's that will help to locate expertise, interest and activity in AI across disciplines and allow us to build better internal and external collaborations.

The Institute has a mailing list for those at King's who have an interest in AI and the work of the Institute. This takes the form of periodic email round-ups sent out on a regular basis which includes content such as events and activities, news and updates from across King's, funding opportunities, and grant awards and successes.

● Complete the **Artificial Intelligence at King's mapping survey.**

● Sign up to the **King's Institute for Artificial Intelligence email round-up.**