**Artificial intelligence and robotics theme**

The EPSRC AI and Robotics team has a key role engaging with UKRI colleagues, the research and innovation communities, and key organisations to continue to maintain and build the UK’s internationally leading position in AI and robotics research and innovation.

Many of the challenges in artificial intelligence (AI) and robotics require a multidisciplinary approach, both in terms of growing foundational capabilities and in developing technologies to address real world challenges for society, the economy and the environment.

The AI and Robotics team work closely with other thematic areas within EPSRC, such as [Information and Communication Technologies (ICT)](https://www.ukri.org/our-work/browse-our-areas-of-investment-and-support/information-and-communication-technologies-theme/), [Mathematical Sciences](https://www.ukri.org/our-work/browse-our-areas-of-investment-and-support/mathematical-sciences-theme/) and [Engineering](https://www.ukri.org/our-work/browse-our-areas-of-investment-and-support/engineering-theme/) themes to support a portfolio built on core disciplines, as well as addressing user needs and real world problems.

We also work closely with colleagues across UKRI to develop our understanding and to create an ecosystem where different disciplines work together to address key research questions.

[How UKRI works in artificial intelligence](https://www.ukri.org/our-work/how-we-work-in-ai/#contents-list).

To realise the huge potential of AI and robotics research and innovation for the UK, the team works closely with stakeholders from across the public, private and third sectors. Collaboration with colleagues across government is particularly important to the team, who have a strong relationship with the [UK government’s Office for Artificial Intelligence](https://www.gov.uk/government/organisations/office-for-artificial-intelligence).

Artificial intelligence (AI) and robotics hold great potential to benefit society and the economy. Advances in both fields have already driven extraordinary changes in areas as diverse as agriculture and energy, food and business productivity.

### AI and our approach

The UKRI AI review, led by EPSRC in collaboration with colleagues across all parts of UKRI, enabled us to better understand the current UK AI research and innovation landscape. This exercise included stakeholders from more than 300 organisations across the UK. The review also gave us a better understanding of the opportunities and barriers to progress, to shape a vision for what is needed to optimally support AI research and innovation in the UK.

The review led to the publication of the [AI Review: Transforming our world with AI](https://www.ukri.org/about-us/what-we-do/strategies-and-reviews/ai-review-transforming-our-world-with-ai/#contents-list). This document sets out our vision and aspirations to support a world leading, highly interconnected and interdisciplinary UK AI research and innovation ecosystem. Our vision is made up of four elements:

* to build ambitious new UK AI capability
* to sustainably grow UK AI research and innovation capacity
* to enable adventure and creativity in AI research and innovation
* to build high connectivity in the landscape.

[Read UKRI’s vision for AI](https://www.ukri.org/our-work/how-we-work-in-ai/#contents-list).

### Robotics

The AI and Robotics team work in collaboration with the [Engineering](https://www.ukri.org/our-work/browse-our-areas-of-investment-and-support/engineering-theme/) and [Information and Communication Technologies](https://www.ukri.org/our-work/browse-our-areas-of-investment-and-support/information-and-communication-technologies-theme/) (ICT) themes to set the strategic direction of robotics within EPSRC, understand the landscape, and support the development of the core capabilities that underpin these technologies. In addition, our team also leads on the stakeholder engagement in this area.

Robotics are key to building a more resilient, sustainable, and prosperous UK. Some of these technologies are already used across society, and it is forecasted that they will drive significant productivity improvements, economic growth and better quality jobs in all major sectors including construction, transport, energy, agriculture, health and defence.

Developing the robotics technologies required to unlock these benefits is complex. Advances to their physical attributes need to be accompanied by improvements in the way the technologies understand their surroundings and act as a result.

[View evidence sources used to inform our research strategies](https://www.ukri.org/publications/epsrc-research-area-evidence-sources/).

You can apply for funding to support research proposals in the area of AI and robotics at any time under [any open EPSRC scheme](https://www.ukri.org/councils/epsrc/guidance-for-applicants/types-of-funding-we-offer/) including standard funding opportunities, programme grants and fellowships. Standard (sometimes known as ‘responsive’) funding opportunities are open to a wide range of research and approaches within EPSRC’s remit.

In line with council remit we will support interdisciplinary proposals but the majority of the research must be within engineering and the physical sciences.

### EPSRC AI and Robotics Townhall

To learn more about our recently opened and upcoming funding opportunities, please see the [slides presented (PDF, 5MB)](https://www.ukri.org/wp-content/uploads/2022/12/EPSRC-201222-TownhallWebinarSlides.pdf) at and a recording of the EPSRC AI and Robotics Townhall event on 2 December 2022.

### AI hubs post-outline community engagement

The following proposals were successful at the AI hubs’ outline panels on 27 and 28 March 2023:

* [AI hubs for mathematical and computational foundations of AI: successful outlines](https://www.ukri.org/publications/ai-hubs-for-mathematical-and-computational-foundations-of-ai-successful-outlines/)
* [AI hubs for real data: successful outlines](https://www.ukri.org/publications/ai-hubs-for-real-data-successful-outlines/)
* [AI hubs for scientific and engineering research: successful outlines](https://www.ukri.org/publications/ai-hubs-for-scientific-and-engineering-research-successful-outlines/)

To grow the UK AI ecosystem, and to encourage further co-creation, we welcome further connections to be made between now and the close of the full proposal stage (8 June 2023 at 4:00pm UK time) between successful outline proposals and stakeholders in academia and industry. Unsuccessful bids are also welcomed to contact any of the submissions that they believe they have cross over with and could compliment the proposed work.

### Key strategic investments

The AI and Robotics team has been involved in the delivery of a number of key UKRI strategic investments in the last few years. The team continues to manage those investments, ensuring that the objectives of the programmes are met and the benefits for the UK are realised.

The team is responsible for key investments: Please follow the links for more information on each of them:

* [AI for Science and Government (ASG)](https://www.turing.ac.uk/research/asg)
* [Trustworthy Autonomous Systems (TAS) programme](https://www.tas.ac.uk/)
* [Turing AI Fellowships](https://www.gov.uk/government/publications/turing-artificial-intelligence-fellowships/turing-artificial-intelligence-fellowships)
* [UKRI AI Centres for Doctoral Training](https://www.ukri.org/what-we-offer/how-we-work-in-ai/ukri-artificial-intelligence-centres-for-doctoral-training/#contents-list)
* [UKRI Challenge Fund Robotics and AI in Extreme Environments](https://www.ukri.org/what-we-offer/browse-our-areas-of-investment-and-support/robots-for-a-safer-world/).

### AI for science and government (ASG)

In 2018, The Alan Turing Institute, the national institute for AI and data science, was awarded a £38.8 million research programme through wave 1 of UKRI’s [Strategic Priorities Fund](https://www.ukri.org/our-work/our-main-funds/strategic-priorities-fund/).

The programme (AI and Data Science for Science, Engineering, Health and Government) now commonly known as AI for Science and Government (ASG), is delivered by the Engineering and Physical Sciences Research Council in partnership with The Alan Turing Institute and in collaboration with a number of other research councils and research organisations, including BBSRC, STFC, NERC, the Home Office and the Ministry of Justice.

The investment delivers an integrated programme aimed at supporting UK priority areas which are nested within existing institute programmes and aims to deploy AI and data science through six themes:

* Digital Twins: Urban Analytics – underpinning the planning system
* Digital Twins: Complex Engineering Systems – in industry
* Health – revolutionising health services through precision medicine
* Criminal Justice System – laying foundations for AI in government departments and agencies
* AI for Science – delivering AI into national labs
* Tools, Practices and Systems – bringing best practice into domain areas.

EPSRC is the UKRI delivery partner of the investment, and is represented on its governance structures, including the Management Board, and the External Advisory Board.

In consultation with the programme’s External Advisory Board, the ASG Management Board agreed in July 2020 to fund several new and strategic research initiatives to build on research outcomes from the first two years of the ASG programme and address important issues for the UK government and public sector made more urgent since the onset of the COVID-19 pandemic. These are:

* shocks and resilience
* ecosystems of digital twins
* environment and sustainability.

[Find out more about ASG on the Alan Turing Institute website](https://www.turing.ac.uk/research/asg).

### Trustworthy autonomous systems (TAS)

The UKRI Trustworthy Autonomous Systems (TAS) programme is a £33.7 million investment funded through the [Strategic Priorities Fund](https://www.ukri.org/our-work/our-main-funds/strategic-priorities-fund/). It was developed from a community-led submission to the EPSRC [Big Ideas](https://www.ukri.org/about-us/epsrc/who-we-are/big-ideas/) process and is led by EPSRC, working across UKRI with AHRC, ESRC, Innovate UK and STFC.

This activity aims to bring together research communities and key stakeholders from across all sectors and disciplines, to drive forward multi-disciplinary fundamental research to ensure that autonomous systems are safe, reliable, resilient, ethical and trusted.

The TAS programme consists of two discrete and interdependent parts: a central hub, with a key leadership and coordination role for the programme and the broader community, and six research nodes that undertake fundamental, multidisciplinary research into a particular topic, and support the hub in delivering the objectives of the investment.

The hub and the six nodes were funded in 2020. These are the:

* [TAS Hub](https://www.tas.ac.uk/)
* [UKRI TAS Node in Functionality](https://tasfunctionality.bristol.ac.uk/)
* [UKRI TAS Governance and Regulation Node](https://www.law.ed.ac.uk/research/research-projects/trustworthy-autonomous-systems)
* [UKRI TAS Node in Resilience](https://resilience.tas.ac.uk/)
* [UKRI TAS Node in Security](https://tas-security.lancs.ac.uk/)
* [UKRI TAS Node on Trust](https://trust.tas.ac.uk/)
* [UKRI TAS Verifiability Node](https://verifiability.org/).

The TAS Hub has a key role in connecting the autonomous systems landscape and fostering collaborations. It undertakes community building activities to facilitate engagement across disciplines and drive culture change around the design of autonomous systems. In addition, the Hub delivers funds to pump-prime new research ideas and opportunities across the community. Stakeholders with an interest in autonomous systems and wishing to engage with the programme are encouraged to [contact the TAS Hub through their website](https://www.tas.ac.uk/contact/).

### Turing AI fellowships

The [Turing AI Fellowships](https://www.gov.uk/government/publications/turing-artificial-intelligence-fellowships/turing-artificial-intelligence-fellowships) are a £46 million investment by the UK government in the retention, attraction and development of world-leading academic talent in AI. EPSRC is delivering these fellowships on behalf of UKRI, in partnership with the [Office for AI](https://www.gov.uk/government/organisations/office-for-artificial-intelligence) and the [Alan Turing Institute](https://www.turing.ac.uk/people/researchers/ai-fellows).

The aims of the investment in Turing AI Fellowships are:

* to accelerate and support the careers of a diverse cadre of the best and brightest AI international researchers, retaining them in and attracting them to UK academia
* to enable enhanced connectivity between AI academia and industry across sectors, and facilitate career mobility for leading AI researchers and thinkers between academia and industry or the third sector, accelerating the pathway to impact of AI technologies
* to enable leading researchers to undertake world leading creative and innovative AI research in the UK, with a broad range of potential impacts across sectors and timescales
* to boost the UK’s global reputation as a great place to study, invest or work in AI.

The investment supports 25 fellows through three components:

* [Phase 1 announced in 2019](https://www.turing.ac.uk/people/researchers/ai-fellows)
* [Turing AI Acceleration Fellowships announced in 2020](https://www.ukri.org/news/new-turing-ai-fellows-to-deliver-world-class-ai-research/)
* [Turing AI World-Leading Researcher Fellowships announced in July 2021](https://www.ukri.org/news/global-leaders-named-as-turing-ai-world-leading-researcher-fellows/).

### UKRI AI centres for doctoral training

The UKRI Artificial Intelligence Centres for Doctoral Training (CDTs) are training a new generation of PhD students who will develop and use AI technology in areas such as improving healthcare, tackling climate change and creating new commercial opportunities.

The PhD students are being trained at 16 centres based at 14 universities with over 300 partners, including AstraZeneca, Google, Rolls-Royce and the NHS.

The UKRI AI CDTs are funded by £100m from the government, along with additional leveraged funding to bring the total investment to over £200 million. This leveraged funding comes from project partners investing £78 million and the universities committing a further £23 million. Around 1,000 students will be funded over eight years.

### UKRI Challenge Fund robotics and AI in extreme environments

The Robotics and AI in Extreme Environments Hubs are part of the UKRI Challenge Fund investment in [Robotics for a Safer World Challenge](https://www.ukri.org/our-work/our-main-funds/industrial-strategy-challenge-fund/future-of-mobility/robots-for-a-safer-world-challenge/). The four academic-led, user-inspired hubs have received a £44.5 million investment from UKRI, £1 million from the UK Space Agency and £52 million leveraged from industry. The hubs undertake collaborative research and development to accelerate the deployment of robotics in AI technologies in industrial settings where operators may be exposed to hazardous environments, such as in the offshore energy, nuclear energy and space sectors. This research contributes to improving the performance of UK industries, reducing costs of operation and reducing the health and safety risks to the workforce.

The four hubs are:

* [National Centre for Nuclear Robotics](https://www.birmingham.ac.uk/research/activity/metallurgy-materials/robotics/national-centre-nuclear-robotics.aspx), a consortium of eight universities developing cutting-edge technology to solve the problem of nuclear waste
* Future AI and Robotics for Space Hub, advancing the capabilities needed to enable space robots to perform complex tasks on long-duration missions with little or no human intervention
* [Robotics and AI in Nuclear Hub](https://rainhub.org.uk/), which is developing the advanced robotics and artificial intelligence that will be essential for future nuclear operations
* Offshore Robotics for the Certification of Assets Hub, developing robotic systems and artificial intelligence solutions to assist Asset Integrity Management for the offshore energy sector.

### Impact in the real world

Funding into AI and Robotics has enabled the development of core capabilities which are taken forward into a wide range of applications, some of which have profound economic and societal benefits. Below are some examples of the impacts resulting from EPSRC funding research.

#### Harnessing a sea of data

Major multinational AkzoNobel operates in a range of markets, including decorative paints, performance coatings and speciality chemicals.

To explore how the huge data mountains generated by the company could be exploited to support its activities in the ship paint sector, AkzoNobel approached the EPSRC [Centre for Doctoral Training (CDT) in Cloud Computing for Big Data](https://www.ncl.ac.uk/bigdata/). The aim was to assess the feasibility of extracting value from data on the position of every ship worldwide (information collected every 15 minutes) and on which ships were coated with AkzoNobel paints.

A team of four CDT students undertook the project, analysing the data in the ‘cloud’ over an eight-week period. This produced valuable findings that the company could harness to inform its commercial strategies and help shape its decision-making as it sought to expand its share of the ship paint market. As well as producing insights into vessel movements over time, the students developed a clear understanding of the skills needed to tackle data cleansing and data modelling and of different challenges and priorities relating to the utilisation of data resources in future.

### Self-driving vehicles

In 2016 self-driving vehicles equipped with autonomy software Selenium were tested successfully in public for the first time in the UK on pedestrianised streets at the heart of Milton Keynes. Selenium was integrated onto an electric vehicle developed by Oxford University spin-out Oxbotica.

The long term EPSRC-funded research team behind the LUTZ Pathfinder pod demonstrated how the vehicle can navigate autonomously while avoiding unpredictable obstacles or hazards, such as children running into the road, by using the software to build 3D models of its surroundings.

[Find out more on the Oxbotica website](https://www.oxbotica.com/).

### Unlocking applications using next generation computing and artificial intelligence

The Visual Geometry Group at the University of Oxford, led by Professor Andrew Zisserman and Professor Andrea Vedaldi and supported by EPSRC, are developing next generation computer vision algorithms that can analyse, describe and search image and video content with human-like capabilities.

Artificial Neural Networks developed by the group have had a transformative impact on the field of computer vision, because they enable large image datasets and video content to be searched with ever greater degrees of accuracy. VGG 16 and two-stream architectures (two types of neural network models developed by the Group) have been used in wide ranging real-world applications.

The Visual Geometry Group has contributed to many high-impact projects in natural sciences, material science bibliography, zoology, conservation and beyond. An example is chimpanzee face recognition, where software can analyse decades’ worth of video recordings of wildlife in its natural habitat automatically, identifying individuals and social structures with ease.