

## Quick Reference

# Artificial Intelligence - UKRI CDTs

**Call type: Invitation for outlines**

**Closing date: 16:00 28 March 2018**

**Overview:** Funding to support 10-20 Centres for Doctoral Training focussed on areas relevant to Artificial Intelligence (AI) across the UKRI remit. The process is being delivered by EPSRC on behalf of UKRI partners and as such high quality outline proposals are welcomed from applicants working in areas across the remit of all seven Research Councils (AHRC, BBSRC, EPSRC, ESRC, NERC, MRC and STFC) addressing UK training needs in the development, applications and implications of novel and existing artificial intelligence technologies.

**How to apply:** This call will be a two-stage submission. The application and assessment process has been integrated into the EPSRC CDT 2018 call but is a distinct strand.

**Assessment Process:** Outlines will be considered by expert panels. Invited full proposals will be sent to external reviewers followed by interview panels. The assessment of individual applications and the balance of the training landscape across the AI area will be taken into account when making decisions at both the outline and final stage.

### Key Dates:

Activity	Date
Deadline for Outlines	28 March 2018
Outline Panels	Week beginning 14 May 2018
Deadline for Full Proposals	No earlier than 31 July 2018*
Interview Panels	w/b 05 November 2018
Funding decision	December 2018
New CDT cohort starts	2019/20 Academic Year

\*This date is dependent on the communication date of the outcomes of the outline stage. Where possible, ten weeks will be given between outline decisions and the full proposal deadline.

**Additional information:** The EPSRC CDT 2018 call has an institutional limit on outline submissions. Applications submitted as part of the Artificial Intelligence strand will not count towards this limit.

Applications made against the AI strand must meet the conditions laid out in the EPSRC call document [<https://www.epsrc.ac.uk/funding/calls/epsrc-2018-cdts-outline/>]. There is a single exception to this - proposals primarily addressing the 'Applications and Implications of Artificial Intelligence' priority will not be

required to meet a minimum EPSRC remit. Please note that all applications must meet a minimum cash leverage requirement.

**Contacts:** EPSRC CDT mailbox; Email: [cdt@epsrc.ac.uk](mailto:cdt@epsrc.ac.uk)

EPSRC will coordinate responses with/between UKRI partners.

## Artificial Intelligence - UKRI CDTs

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All Research Councils

### 1. Summary

On behalf of the UKRI partners, EPSRC is pleased to confirm that additional investment in Centres for Doctoral Training will be made to support research training of relevance to Artificial Intelligence (AI). This is expected to support 10-20 CDTs. While EPSRC has been asked to deliver this investment, utilising the timescales of the existing CDT call [<https://www.epsrc.ac.uk/funding/calls/epsrc-2018-cdts-outline/>], this is a cross-UKRI activity in which the Research Councils and Innovate UK have come together to jointly develop the scope. Therefore, bids are welcomed and encouraged from eligible institutions that address training needs in AI challenges across the breadth of AHRC, BBSRC, EPSRC, ESRC, MRC, NERC, and STFC remits. As with the EPSRC CDT call, there is also a strong emphasis on engagement with users of research, both in terms of commitment to and support for the training environment and consideration of context and potential impact in the development of research training programmes. Innovate UK have also been closely involved in the development of this initiative. This additional investment represents an exciting opportunity for highly multidisciplinary doctoral research training in an area of key importance to the UK.

The additional investment is complementary to the EPSRC CDT call. For institutions already preparing submissions to the EPSRC CDT call please note that this is additional funding that will support both CDT applications submitted predominantly against the existing 'Enabling Intelligence' CDT priority area [<https://www.epsrc.ac.uk/files/funding/calls/2018/2018-cdts-call-priority-areas/>] and a new priority area (see [Annex 1](#)) called 'Applications and Implications of Artificial Intelligence'. CDT bids submitted against the new AIAI priority will **not** be required to include research training in EPSRC's remit.

AI proposals must meet all the conditions laid out in the EPSRC CDT call [<https://www.epsrc.ac.uk/files/funding/calls/2018/2018cdtsoutlinescall/>]. The single exception is that applications submitted predominantly against the 'Applications and Implications of Artificial Intelligence' priority area do not need to meet the EPSRC remit requirement (as stated above, these applications are not required to contain EPSRC remit research training). All other call conditions such as the minimum number of students to be supported and a need to provide additional support from non-Research Council sources do apply.

The proposed CDTs must focus primarily on the vision and training needs described within the 'Applications and Implications of Artificial Intelligence' and/or 'Enabling Intelligence' priority areas. Where it is considered that less than

50% of the training being offered by a CDT bid is relevant to 'Applications and Implications of Artificial Intelligence' and/or 'Enabling Intelligence' areas, they will not be considered to fit to this additional investment.

For ease of understanding in the remainder of this document the EPSRC CDT call is referred to as the 'EPSRC CDT call' and the additional UKRI investment in AI as the 'additional AI investment'.

## 2. Background

As part of the UK Industrial Strategy, funding for talent and skills related to artificial intelligence has been made available. UKRI wishes to invest in Centres of Doctoral Training to support the development of skills in 1) those with a background in AI and related disciplines, to apply their skills to a wide range of disciplines and challenges and 2) those from different disciplinary backgrounds, where AI could make a transformational contribution to that discipline or where that discipline could be brought to bear on the development of AI technology and approaches. Further details of the full range of areas of interest can be found within the following priority area descriptions:

- Enabling Intelligence  
[<https://www.epsrc.ac.uk/files/funding/calls/2018/2018-cdts-call-priority-areas/>]
- 'Applications and Implications of Artificial Intelligence'  
[[Annex 1](#)]

## 3. Eligibility

Under the additional AI investment, applications will be accepted from eligible institutions looking to support Centres for Doctoral Training whose primary focus is relevant to artificial intelligence and which fit the vision and training needs described within the 'Applications and Implications of Artificial Intelligence' and/or the 'Enabling Intelligence' priority areas. CDT bids submitted primarily under the 'Applications and Implications of Artificial Intelligence' priority will not be required to include research training in EPSRC's remit.

For other eligibility information please see the EPSRC CDT call document [<https://www.epsrc.ac.uk/files/funding/calls/2018/2018cdtsoutlinescall/>].

## 4. Demand management

The EPSRC CDT call is subject to demand management with the number of applications that an institution can make as the lead institution restricted. To aid delivery of the additional AI investment, proposals submitted against the additional Artificial Intelligence investment (i.e. against the 'Applications and Implications of Artificial Intelligence' and/or 'Enabling Intelligence' priority areas) may be submitted as additional bids i.e. they will not count towards the institutional quota.

## 5. Training clinicians in Artificial Intelligence

The additional AI investment provides the opportunity to train clinicians as well non-clinical researchers in the understanding and development of AI approaches. MRC would like to encourage innovative CDTs which embed clinicians into the centre's training. This will foster a shared understanding between individuals

developing and applying AI approaches and those using the technology to enable earliest diagnosis and precision treatments. Bids focussing on digital pathology, radiology or diagnostics are particularly encouraged.

To overcome the barrier of costs, MRC will consider providing 'top up' funding to cover the additional costs associated with a clinical PhD compared to non-clinical doctorates. This opportunity is restricted to bids submitted against the Applications and Implications of Artificial Intelligence priority area of the UKRI CDT call in AI and will be limited to £150k per individual. MRC anticipates supporting clinicians in up to three successful CDTs, each supporting a small cohort of (up to six) clinical trainees as part of their wider CDT.

Proposals wishing to include clinical trainees in their bid should briefly indicate this at the outline stage. Costings should include the additional clinical PhD costs, however, these additional costs for clinical PhDs do not need to meet the call's co-funding requirements. The call requirement for 20-40% studentship costs to be contributed from non-RCUK sources should therefore be based on the total studentship costs of the CDT costed as non-clinical doctorates.

To ensure high quality CDT applications can proceed to the next stage while managing demand and costs for clinical PhDs, it is possible that some applicants will be invited to proceed to full proposal but asked to remove clinical PhDs. Further guidance on including clinical PhDs as part of a full proposal will be provided after the outline stage where relevant.

## **6. How to apply**

### **6.1 Submitting an outline application**

A single outline application should be submitted on behalf of all the partnering eligible institutions.

You should prepare and submit your proposal using the Research Councils' Joint electronic Submission (Je-S) System [<https://je-s.rcuk.ac.uk/>].

When adding a new proposal, you should select:

- Council 'EPSRC'
- Document type 'Outline Proposal'
- Scheme 'Outlines'
- On the Project Details page you should select the 'EPSRC 2018 CDTs Outline' call
- The names of Centres should be prefixed by "UKRI Centre for Doctoral Training in ..."
- Please use the 'Computer Science' routing classification (this is for administrative purposes only).

Note that clicking 'submit document' on your proposal form in Je-S initially submits the proposal to your host organisation's administration, not to EPSRC. Please allow sufficient time for your organisation's submission process between

submitting your proposal to them and the call closing date. **EPSRC must receive your application by 16:00 on 28 March 2018.**

## **7. Assessment**

The assessment of proposals submitted under the additional AI investment will be the same as the EPSRC CDT call except that outline panel meetings dedicated to AI will be held. All CDT outline panels will have appropriate membership to consider the proposals tabled and in particular, membership of the additional AI panels will look to represent the breadth of UKRI partners' remits. The AI outline panel meetings are scheduled for the week beginning 14 May 2018. The later submission deadline and separate meeting date is to allow applicants the same amount of time between the announcement of the investment opportunity and the submission deadline as those applying against the EPSRC CDT call.

Please note that all proposals considered to primarily contribute to AI (i.e. primarily 'Applications and Implications of Artificial Intelligence' and/or 'Enabling Intelligence') will be sent to the AI outline panel meetings even if they are submitted by the EPSRC CDT call deadline (13 March 2018).

The assessment criteria are as described in the EPSRC CDT call - applicants should consult the call document for this information

[<https://www.epsrc.ac.uk/files/funding/calls/2018/2018cdtsoutlinescall/>].

As with the EPSRC CDT call, when deciding which applications should progress, UKRI partners will consider the balance of applications across the breadth of the AI area in addition to the assessment of an individual proposal.

### **Full proposal process**

The results of all outline panel meetings (both for the EPSRC CDT call and the additional AI investment) will be announced at the end of May. The deadline for the submission of full proposals (for successful outline applications) is expected to be 31 July 2018. It is expected that interviews for applications receiving sufficiently supportive reviews will take place during the week commencing 5 November 2018.

As with the EPSRC CDT call, following interviews, applications will be tensioned across the various meeting lists to ensure that those ranked towards the top of each list represent equivalent quality. UKRI partners will seek to ensure a balanced portfolio of AI CDTs and where possible that complementary investments across the broad remit of AI are made. If there are large numbers of high quality proposals in one area it is possible that some will be unfunded in order to maintain a balanced portfolio.

## **8. Guidance for host organisations**

### **Outline stage**

Unlike the EPSRC CDT call, institutions will not be required to provide information about applications submitted to the 28 March 2018 deadline. These may be submitted as additional bids i.e. they will not count towards the institutional quota.

For proposals submitted to the EPSRC CDT call against the 13 March 2018 deadline, institutions (with a submission allocation greater than one) will need to

complete a SmartSurvey to provide information about these submissions and describe the use of their allocation. The deadline for this remains the 14 March 2018.

## Full proposal stage

Please see the EPSRC CDT call document for this information

[<https://www.epsrc.ac.uk/files/funding/calls/2018/2018cdtsoutlinescall/>].

## 9. Key dates

Activity	Date*
Deadline for Outlines	28 March 2018
AI Outline Panels	Week beginning 14 May 2018
Deadline for Full Proposals	No earlier than 31 July 2018 <sup>+</sup>
Interview Panels	w/b 05 November 2018
Funding decision	December 2018
New CDT cohort starts	2019/20 Academic Year

\*EPSRC aims to adhere to the key dates as published, however there may be exceptions where the deadline, meeting, or interview dates may have to change due to panel member availability.

<sup>+</sup>This date is dependent on the communication date of the outcomes of the outline stage. Where possible, ten weeks will be given between outline decisions and the full proposal deadline.

## 10. FAQs

Answers to some anticipated questions are provided below. If you have further questions please consult the FAQ page on the EPSRC website which has been set up for the CDT call [<https://www.epsrc.ac.uk/skills/students/centres/2018-cdt-exercise/2018-cdt-faqs/>] and will be regularly updated. If your query is not covered please email the EPSRC CDT mailbox [[cdt@epsrc.ac.uk](mailto:cdt@epsrc.ac.uk)].

- a) I was going to submit a proposal under the 'Enabling Intelligence' priority anyway, what should I do?

If you are not making changes to your proposal as a result of this announcement we would ask you to submit your application by 13 March 2018 if possible. However the final deadline for AI CDT outlines is 28 March 2018. Regardless of the deadline used, all AI focussed CDT applications will be assigned to the outline panel meetings in May.

- b) My application straddles 'Enabling Intelligence' and another published CDT priority area (e.g. 'Robotics and Autonomous Systems' or 'Towards a Data-driven Future') what does this mean for me?

The EPSRC CDT call deadline remains the 13 March. You must still submit your application by this date. EPSRC will decide whether the proposal is best considered at the April or May outline panels.

Applications submitted between 13 and 28 March 2018 with insufficient relevance to 'Applications and Implications of Artificial Intelligence' and/or 'Enabling Intelligence' will be rejected. Even if an application is mainly within EPSRC's remit there will be no option to be considered at the EPSRC CDT outline meetings in April if it falls predominantly in another priority area or in the Open stream.

- c) I have an idea for a CDT which is outside of EPSRC's remit and straddles AI and another area?

Proposals containing research training <50% EPSRC remit will only be accepted where the research training falls at least 50% in the areas covered by the two AI priority areas. Any application with insufficient focus on AI will be rejected.

- d) While the main priority area I am applying against is not one of the AI areas, I would like to modify my application as a result of this announcement, what should I do?

You are welcome to amend your application but, if the application is predominantly outside AI you will still need to submit your proposal by 13 March 2018.

## 11. Contacts

For any queries on the process, Email: [cdt@epsrc.ac.uk](mailto:cdt@epsrc.ac.uk)

EPSRC will coordinate responses with/between UKRI partners.

For questions relating to using Je-S, Email: [JeSHelp@rcuk.ac.uk](mailto:JeSHelp@rcuk.ac.uk); Phone: +44 (0) 1793 44 4164.

## 12. Change log

Name	Date	Version	Change
Christina Turner	02/02/2018	1.0	N/A
Karen Muncey	14/02/2018	2.0	Amended the closing date under FAQs a) and b) to reflect the correct date of 28 March 2018
Christina Turner	20/02/2018	3.0	Additional section highlighting funding opportunity relating to Clinical PhDs



## Annex 1. Priority area description for 'Applications and Implications of Artificial Intelligence'

Applications for Centres of Doctoral Training are open across the seven Research Councils (AHRC, BBSRC, EPSRC, ESRC, MRC, NERC and STFC), which address research into the Applications and Implications of Artificial Intelligence (AIAI). UKRI expects that AI will transform every sector of industry over the coming years and we want to ensure the UK is best placed to benefit. Innovate UK is also involved in this activity; co-creation between different disciplines and engagement with industry and users are strongly encouraged. Whilst high-quality proposals in any relevant area of the Councils' remits are welcome, interdisciplinary proposals reaching across the remits of two or more Councils are particularly welcome.

Investing in CDTs in this area will train people across a spectrum from those with a background in AI wishing to apply their skills to a wide range of disciplines and challenges, to those who are from different disciplinary backgrounds, where AI could make a transformational contribution to that discipline or where that discipline could be brought to bear on the development of AI technology and approaches. CDTs should also consider the implications of applying their development and application of AI into the intended domains, examining the legal, ethical and socio-economic consequences of potentially disruptive intelligent technologies before they are deployed. Proposals for CDTs focused primarily on the legal, ethical or socio-economic implications of applying AI are also welcome.

In the recent Industrial Strategy White Paper [<https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future>] the Government laid out a Grand Challenge in 'Growing the AI and Data-Driven Economy', building on the groundwork laid by the Royal Society's 2017 report 'Machine Learning: the power and promise of computers that learn by example' [<https://royalsociety.org/news/2017/04/machine-learning-requires-careful-stewardship-says-royal-society/>] and the independent review 'Growing the artificial intelligence industry in the UK' [<https://www.gov.uk/government/publications/growing-the-artificial-intelligence-industry-in-the-uk>] carried out by Professor Dame Wendy Hall and Jérôme Pesenti published in October 2017. AI represents a new industry in its own right but it will also transform businesses across multiple sectors and affect how humans interact with each other and their environment. The UK already has globally recognised capability in the research that underpins AI. However, meeting this Grand Challenge means maximising the opportunities created by AI, as well as defining and responding to the possible implications on society this technology could cause.

Each application domain of AI will have its own challenges to deployment. For example, the barriers to adoption of AI in the health sector will be different to those for the automotive sector, will be different to those making decisions on supply chain risk. Therefore it is essential that bids to this priority consider the unique and specific implications for their domain.

Examples of the **applications of AI** include, but are not limited to:

### **Biological, health and clinical sciences**

The biological, health and clinical sciences provide a wealth of opportunities and challenges that are potentially tractable through innovative use of AI and related approaches. Across the life sciences, data from high-throughput DNA sequencing and other 'omics technologies, bio- and medical imaging across a range of different scales, automated phenotyping and sensor platforms, healthcare records, population level data and other sources of 'big data' present an unprecedented resource for data-driven research. Within the biosciences, AI will provide new ways to explore the fundamental properties and dynamics of biological systems, such as cell and physiological systems, as well as to address key challenges in the bioeconomy; for example, enabling laboratories of the future in synthetic biology and other bio-based industries, and delivering a step change in the agri-food sector by supporting automated decision making in precision agriculture, creating insight into animal and plant health issues, and identifying new ways to enhance sustainability. AI will enable automation, quantitation and enhanced reproducibility of analyses extracting information from ambiguous, noisy datasets, such as imaging, with greater sensitivity, potentially marker-free, and with higher throughput enabling the understanding of dynamic biological systems. In the health sciences, AI applications include digital pathology and radiology, acceleration of drug discovery research and development, systems medicine, biomedical informatics, improvements to diagnosis and support for clinical decision making or improving organisation of complex public health services and systems.

### **Natural environmental sciences**

AI technologies have significant potential application across the breadth of environmental science remit. The skills of the environmental science community to effectively use AI approaches in managing, manipulating and interrogating big data for complex analysis and decision-making at increased spatial resolution and in real-time represents a step-change in potential understanding of the anthropogenic impact on the environment, as well as the impact of the environment on operating context of the human population and economy. The next generation of environmental scientists will require a broad skill base that combines both development and implementation of innovative environmental monitoring techniques with the necessary mathematical, computational and data management skills to apply AI techniques to environmental challenges. Examples of thematic challenge and application areas could include climate and weather modelling and visualisation, real-time analysis of complex natural systems, environmental genomics, water, supply chain risk and impacts, risk and hazard management, resilience and earth observation.

### **Data from large science facilities**

Advanced data handling techniques employing AI will be crucial for dealing with the high complexity, rate and volume of data produced by the current and forthcoming generation of large science facilities. These include the UK's large national facilities such as the Hartree Centre for the HPC and big data needs of UK industry; the Diamond Light Source, ISIS Neutron and Muon Source, and the Central Laser Facility for the physical and life sciences; and international ground and space facilities such as CERN, DUNE, ESO, SKA, LIGO, Planck, Gaia and LSST which produce experimental data on an unprecedented scale in areas including astronomy, particle physics and nuclear physics. AI techniques will be both developed and used to transform

how these huge data sets, from national and international facilities, are analysed and understood, with enormous implications ranging from pattern recognition and front-end data reduction to novel data-driven reconstruction, analysis and discovery.

### **Creative industries**

The creative industries are a key part of the UK economy, estimated to be the fastest growing sector within the UK. Intelligent tools, platforms and technologies are increasingly being used to create, disseminate, redistribute, link and consume content and innovative ways to benefit society, enhance user experiences and support inclusion.

When addressing challenges in this area bids could look to providing meaningful new experiences within the creative industries using AI – for example, in popular entertainment, considering audiences of the future, community engagement, augmented reality, and within the heritage and cultural sectors. More broadly, a focus on how AI can enhance the creative arts as well as understand the impact of AI on those practices would be beneficial.

### **Service Delivery**

AI offers the potential to transform the delivery of a wide range of services, from health and social care to financial services and other administrative functions.

Bids contributing to this area may wish to focus on the use of AI to assist: the improvement and personalisation of assessable public services; the provision of health and social care including the mental health implications and ethics of artificial intelligence-based systems as carers; civic engagement and participation; financial services and management; environmental and urban planning, as well as other administrative functions.

CDTs contributing to all the application areas described above must, where appropriate, demonstrate feasible access to relevant datasets at scale, required for the application of AI. They will involve the development and application of advanced AI methods to turn vast data streams into knowledge, understanding and physical action. Bids could also consider intelligent front-end data reduction, interpretation of information from smaller datasets, the validation of new AI methods and tools to help decision makers assess risk and uncertainty. CDTs funded through this priority could focus on one specific domain or develop generalised AI methods applicable to a variety of sectors.

Examples of the **implications of AI** include, but are not limited to:

#### **Law, regulation and intellectual property**

With the significant advances in AI and other technologies there is a clear and associated need for further research on the human impact of entering an age of AI and the consequent implications for law and justice.

Bids contributing to this area should consider industry standards, regulation and legislation in AI, both for those writing AI algorithms and for those using them.

### **Impact of AI on workers, the economy and governance**

When looking at the potential broader socio-economic implications and consequences of AI, those undertaking the research need a clear understanding of what is possible and realistic in terms of technological advancement.

Bids contributing to this area should address the impact of AI on economic productivity, work patterns, monopolies and potential changes in business models. They should also consider the broader societal impacts and governance issues, such as the effects of changes in employment patterns and implications for security and the management of risk.

### **Applied ethics**

It is necessary that AI systems are developed to relate to the needs of the people who use them; ensuring such systems are safe, secure, reliable, trustworthy, legally compliant and ethically sound.

Bids contributing to this area should address issues of trust, transparency, privacy, fairness and bias in the development and adoption of AI.

### **Human-human and human-machine interactions**

To ensure that technology is useful and will work effectively in the real-world environment, researchers working in AI need to have a clear understanding of how humans will interact with the technology.

Bids contributing to this area should consider how AI technologies affect human-human interactions, such as bias outcomes and the identification and challenge of negative social attitudes. They should also consider how humans interact with AI machines, understanding how diverse communities interact with AI and the accessibility of products and services delivered through digital technologies. Research should also examine how users are able to interpret results, how trust in the outcomes from intelligent technologies is facilitated, and the impact on user training requirements.

All CDTs in the Applications and Implications of Artificial Intelligence priority area:

- Must specifically address and action Responsible Research and Innovation [<https://www.epsrc.ac.uk/research/framework/>] in the context of this area as part of the research and training agenda.
- Will have awareness and provision of training in cross-cutting issues which have relevance to a variety of domains (e.g. ethics of data science, healthcare regulation, accountability, bias)
- If required, should embed students in an environment with relevant domain expertise and/or an industrial sector to facilitate the rapid adoption and appropriate development of new AI technologies by engaging with the user base. This will help students to build up a picture of how research in different domains can have an impact beyond the academic community, and then to integrate this understanding into their own research.
- Bids should link to existing relevant national resources, infrastructure and investments; for example, the Hartree Centre and the Alan Turing Institute.

Applications are not expected to cover the full breadth of this priority as described. We expect to make multiple complementary investments in this area, subject to quality.