The Alan Turing Institute

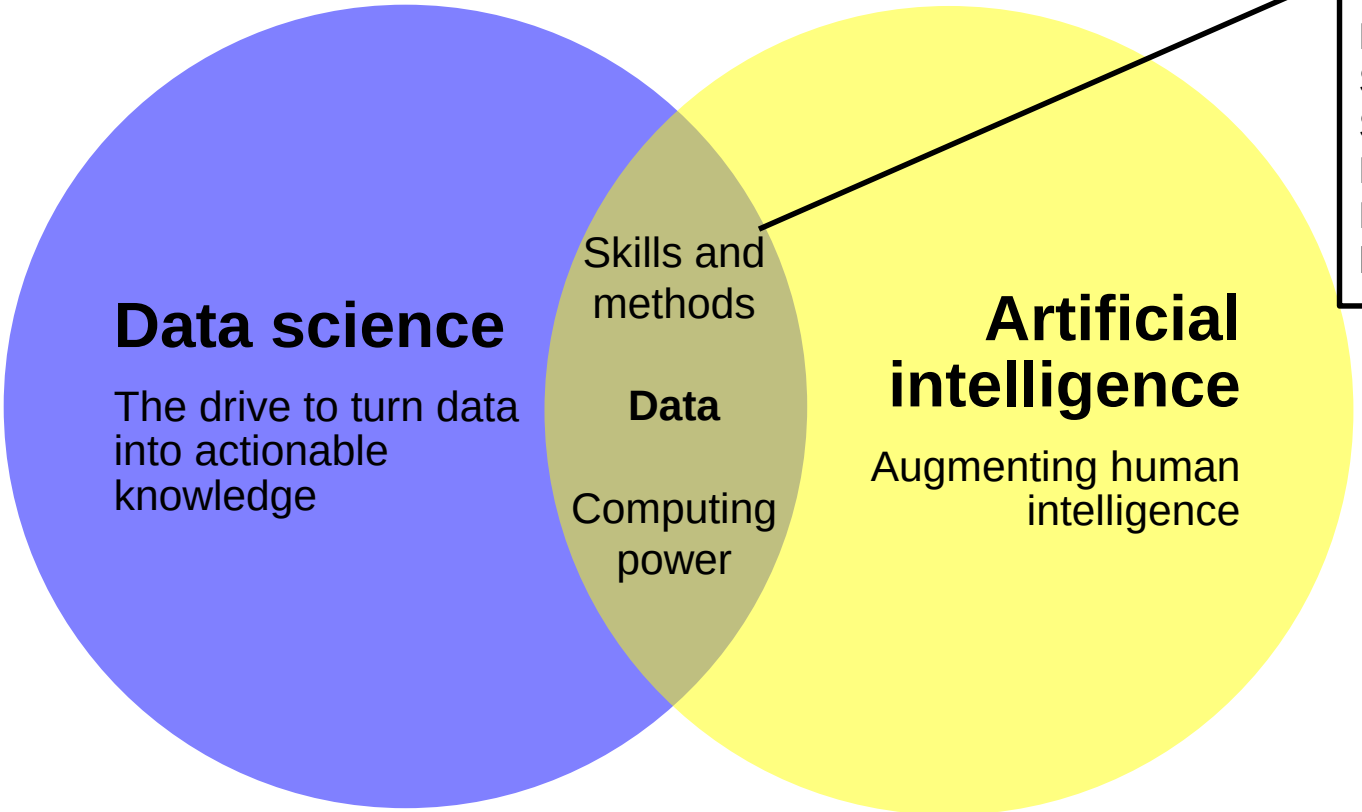
Introducing The Alan Turing Institute

The national institute for data science and artificial intelligence

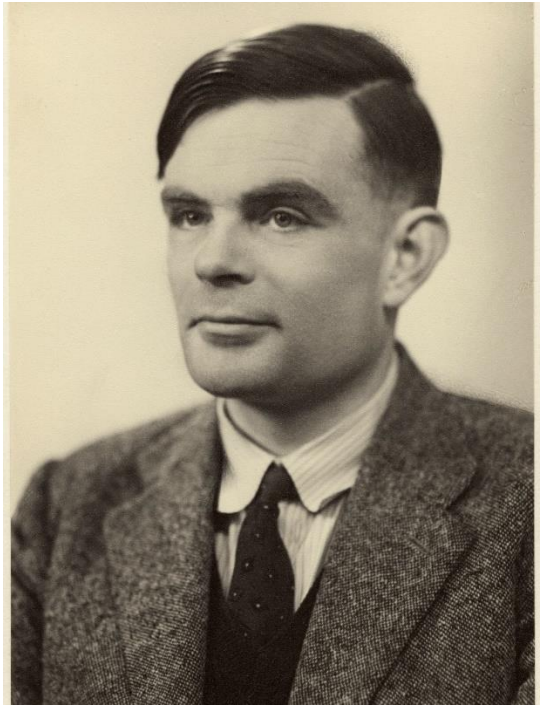
Alan Wilson

CEO

What is data science/AI?



Building on a strong scientific legacy….



- Alan Turing's pioneering work in **theoretical and applied mathematics**, **engineering** and **computing** are considered to be the key disciplines comprising the field of **data science**.

- *"I propose to consider the question,* ***"Can machines think?"****…"*

  In 1950 Turing published his seminal paper, *Computing Machinery and Intelligence*, which is credited with laying the foundations for the development and philosophy of artificial intelligence.

Since Turing's time….

Major advances in **computer power**

Colossal increases in the **volume of data** being produced everyday through mobile devices, online transactions, born-digital systems

A **global economy** waking up to the value of data analytics and its impact on our everyday lives

'90% of the data in the world today has been created in the last two years alone.'

IBM

The goals of the Institute :

Innovate and develop world-class research in data science

Apply our data science research to real-world problems, supporting the creation of new products, services and jobs

Train the next generation of data science leaders

Advising policy-makers and shaping the public conversation around data

Universities' network

Partners' network: industry, government and third sector

accenturedigital

British Heart Foundation

CRAY

Microsoft

Office for National Statistics

Scottish Enterprise

Cystic Fibrosis Trust

RESEARCH

nationalgrid

SIEMENS

The Turing community – a snapshot

145 **Turing Fellows**

19 **Research Fellows**

64 **PhD students** (17 on a short-term enrichment placement)

19 **Interns** (12 week programme)

50+ **Visiting Researchers** from academia, industry, govt

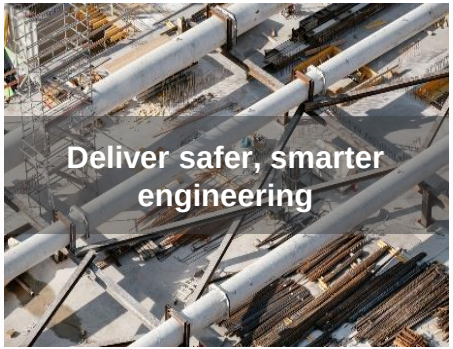
13 **Software Engineers/Data Scientists**

50 members of the **business team**

Challenges

Challenges


Revolutionise healthcare


Deliver safer, smarter engineering


Manage security in an insecure world


Shine a light on the economy

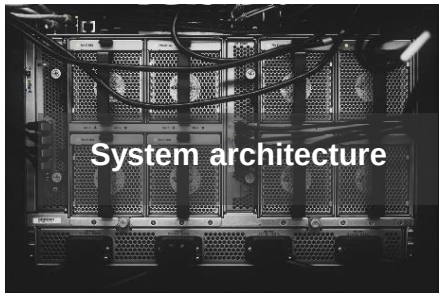

Make machine decisions fair, transparent, and ethical

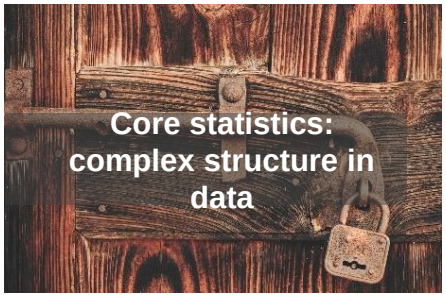

Design computers for the next generation of algorithms

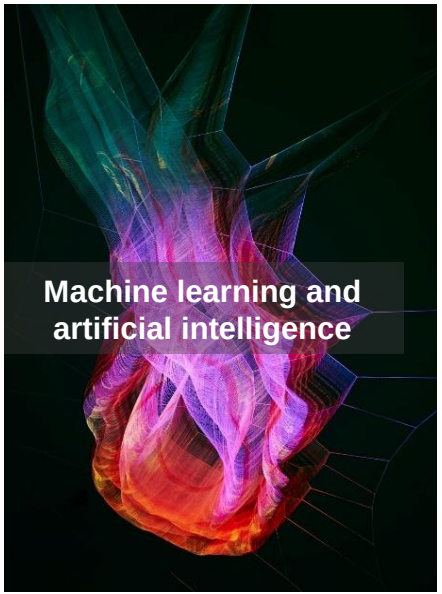

Supercharge research in science and humanities

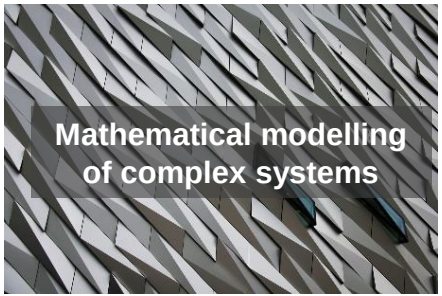

Foster government innovation

Methods and cross-cutting themes









Challenge 1: Revolutionise healthcare

Mihaela van der Schaar, Turing Fellow

A vision for personalised medicine through machine learning-driven diagnosis and treatment plans, clinicians operating with augmented intelligence

Current projects

Funding research bringing data science into new treatment options for **cardiovascular disease** with the **British Heart Foundation**

British Heart Foundation

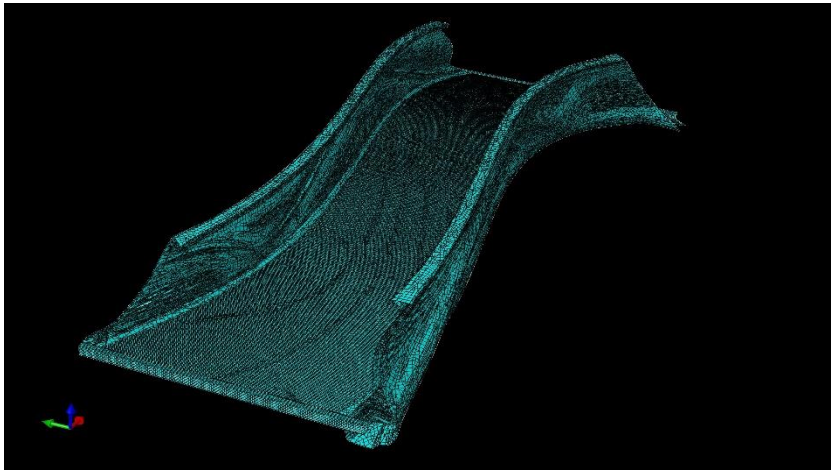
Investigating how data science can help **cystic fibrosis sufferers** with the **Cystic Fibrosis Trust** through analysis of registry data

Cystic Fibrosis Trust

Challenge 2: Deliver safer, smarter engineering

- researchers in the **data-centric engineering programme** are turning the world's largest 3D printed structure into a living laboratory for research
- digital twin technology used to inform design, track performance and feed into future 3D structures

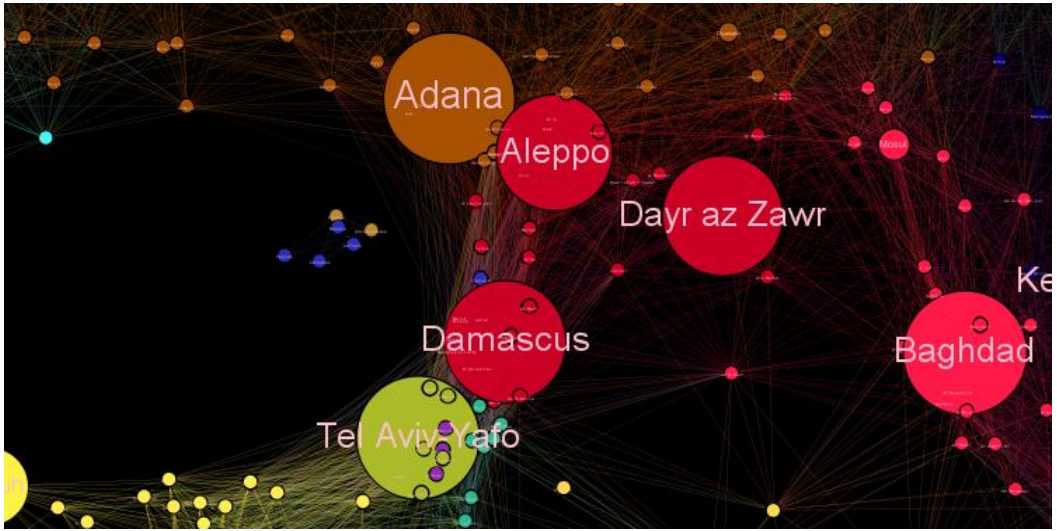
3D printed bridge to be installed over a canal in Amsterdam in 2018



Digital twin model

Challenge 3: Manage security in an insecure world

- can algorithms help us to predict and manage conflict?
- a project funded by the **defence and security programme** to understand and anticipate population areas that are at risk of conflict



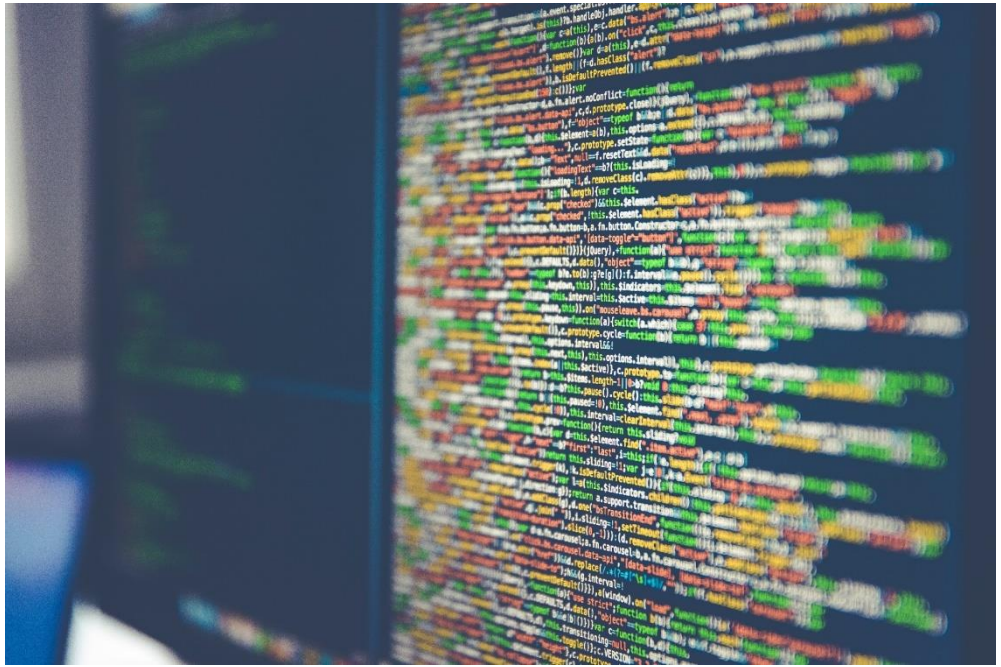
Complex interaction network between communities of cities leads to high centrality locations that correspond to conflict

Weisi Guo
University of Warwick

Alan Wilson
The Alan Turing Institute

Challenge 4: Shine a light on the economy

- identifying patterns or problems in huge amounts of information



- measuring flows of goods and services between and within countries

With access to more granular data, we can…

- inform policies for fiscal stimulus
- improve inflationary forecasting
- help to understand monetary policy transmission mechanisms

Challenge 5: Make machine decisions fair, transparent and ethical

Capability in data ethics and technical expertise

- cross-university Data Ethics Group
- partnerships with Nuffield Foundation on a Convention for Data Ethics and the ICO on a framework for AI decision-making

Luciano Floridi Oxford and Turing (Chair)

Jonathan Cave Warwick

Jennifer S Davies Cambridge

Burkhard Schafer Edinburgh

Phyllis Illari UCL

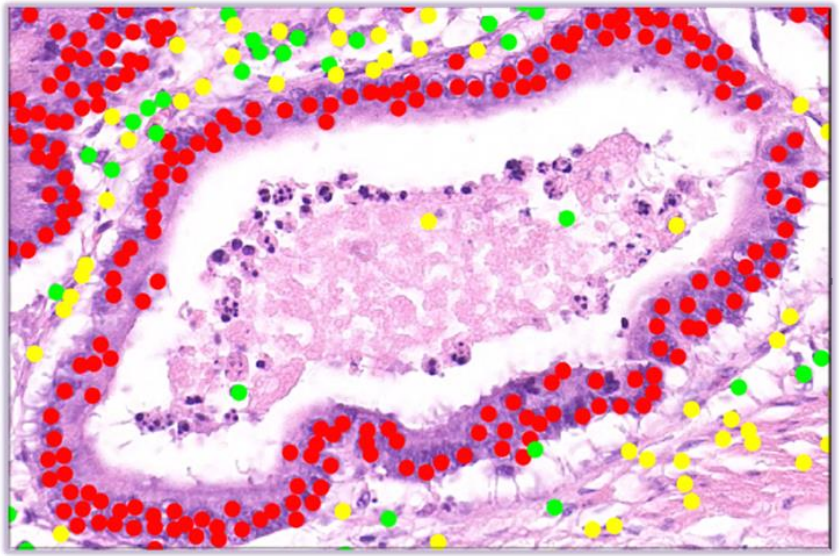
Charles Raab Edinburgh

Josh Cowls Turing

- Fairness, Transparency, Privacy interest group
- new methods for identifying algorithmic bias (counter-factual fairness) presented at NIPS 2017 (below)
- ‘right to explanation’ of algorithms in GDPR

Challenge 6: Design computers for the next generation of algorithms

- cancer pre-diagnostic analytics with AI
- Intel, the Turing and University of Warwick working together to improve the ability of computers to recognise tumour and cancerous cells



- project combines world-class computer science expertise from Intel, with clinicians and scientists from Warwick's Tissue Image Analytics laboratory

Nasir Rajpoot
University of Warwick

Microscopic landscape of various types of cells – including tumour cells (in red).

Challenge 7: Supercharge research in the sciences and humanities

Research organisations are creating enormous sources of data and there are opportunities for data science and AI inputs. Examples:

- The Francis Crick Institute
- The British Library
- UK Biobank
- Genomics England
- Health Data Research UK
- Diamond Light Source
- Rosalind Franklin Institute
- Hartree Centre
- Square Kilometre Array
- Centre for Environment, Fisheries and Aquaculture Science

The British Library has digitised millions of pages from its collections.

Collaboration with Diamond Light Source

- Diamond Light Source generates vast amounts of data from both its synchrotron and electron microscope facilities

- managing and processing this data is typically performed manually or with time-consuming methods

- how can machine learning speed up this process through automation, and increase accuracy?

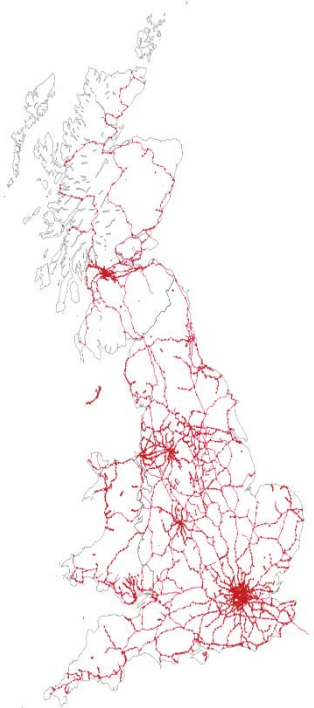
An aerial view of the Diamond Light Source HQ, Harwell Science and Innovation Campus.

Challenge 8: Foster government innovation

National Infrastructure Commission (digital twin) and the future of cities

Road, v=3.5M, e=8.4M

Bus, Ferry, v=0.29M, e=0.42M



Rail, v=3165, e=10,269

Modelling the UK: Quant

Being a researcher at the Turing

Why it works: collaboration

“The Institute is a place where I am guaranteed to meet interesting researchers I wouldn't readily encounter at my own university. It's a real opportunity to make new connections.”

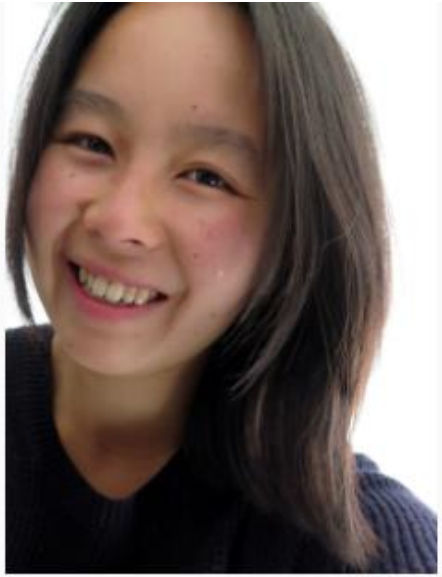
Jon Crowcroft, Turing Fellow, University of Cambridge

Why it works: interdisciplinarity

“The Turing is one of the few places in the world that enables early career researchers to carry out independent research.

The interdisciplinary nature of the Institute makes it the perfect place to carry out my research agenda, in which I have a basis in computer science but work closely with social scientist and linguists.”

Dong Nguyen, Research Fellow

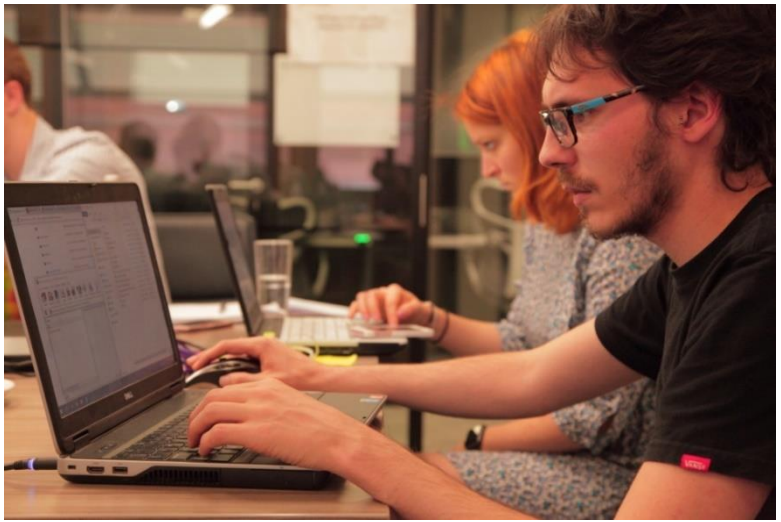


Why it works: impact

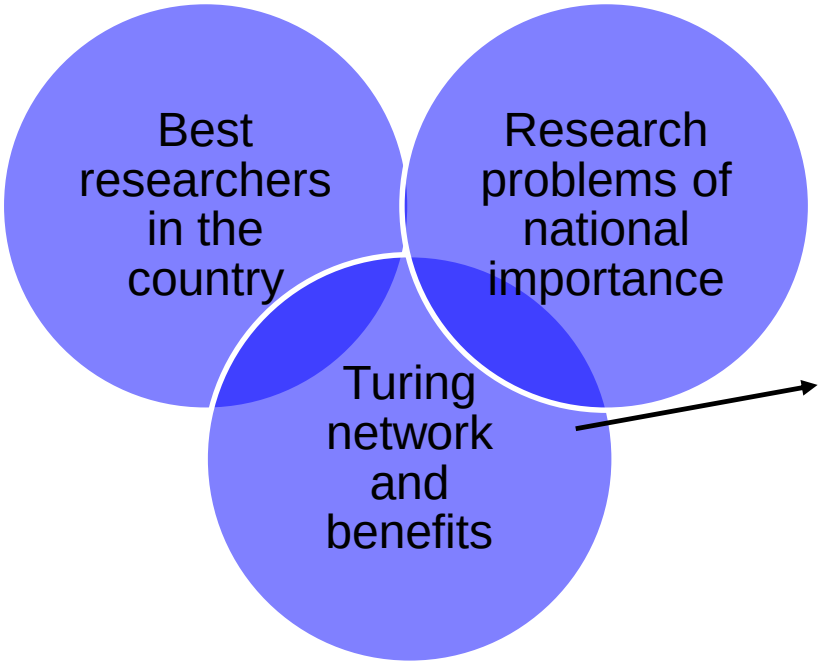
“The Data Study Group week was one of the best experiences I’ve had working with external suppliers of any kind in my 8 years in the MOD.”

Matthew,
Defence Science and Technology Laboratory (DSTL)

Data Study Group, 22-26 May 2017



The Turing as a catalyst for **collaborative, interdisciplinary partnerships**



Ability to attract funds through Independent Research Organisation status, UKRI, industry and third sector partners, public sector, Industrial Strategy

Researchers benefit from:

- a team of **Software Engineers/Data Scientists**

- access to **cloud credits, Intel cluster, HPC**

- access to **seed-funding** and **workshop funding**

- an opportunity to **collaborate** with researchers they wouldn't typically encounter, in a **physical space** with **no disciplinary boundaries**

- opportunity to engage with **industry partners** and **government**, benefiting from Turing's position as a national institute

Exeter and the Turing

opportunities for collaboration

- Turing challenges and toolkits
- combined with Exeter research centres
- collaborating with other partner universities
- the whole greater than the sum of the parts

Exeter centres – a sample

- Exeter Institute for Data Science & Artificial Intelligence
- Impact Lab
- Global Systems Institute
- Digital Humanities Lab
- Environment and Sustainability Institute
- European Centre for Environment and Human Health
- Land, Environment, Economics and Policy Institute
- Centre for Water Systems
- Wellcome Wolfson Medical Research Centre
- Wellcome Biomedical Informatics Hub
- EPSRC Centre for Biomedical Modelling and Analysis
- EPSRC Network Models to Decisions

Opportunities to be explored – sampling again

- Data science for global environmental risk assessment
  - **using data science to help address global environmental challenges**

- Modern data and evidence based decision making

- Uncertainty Quantification

- Data Gravity and Data Lakes

What next?

What next for the Institute?

Building and developing our research

- launching our game-changing challenges in data science and AI

Growing the Institute networks

- expanding the university network
- new ways to work with industry, third sector, public sector

Training and skills

- addressing the critical data science skills gap
- executive education

Advancing our national leadership

- convening the UK data science community
- policy
- agenda-setting research

What next for the collaboration?

- meetings to define collaborative programmes and projects
- appointment of first round of Turing Fellows to lead these
- identify seed-corn funding to support new initiatives
- exploration of external funding sources
- contribute to the UK training programmes in data science and AI
- help lead the national conversation
- preliminary work from now on, significant take-off in the new academic year

Get involved now

Sign up to the newsletter at turing.ac.uk to keep in touch with news and opportunities

Funding call for research proposals in economic data science is open.

Apply before 9 April 2018.

Livestream or attend a **Turing event**, seminar or lecture.

Turing.ac.uk
Turing YouTube.

Keep in touch

Follow us @turinginst on Twitter

Speak to a member of Turing staff after the lecture:

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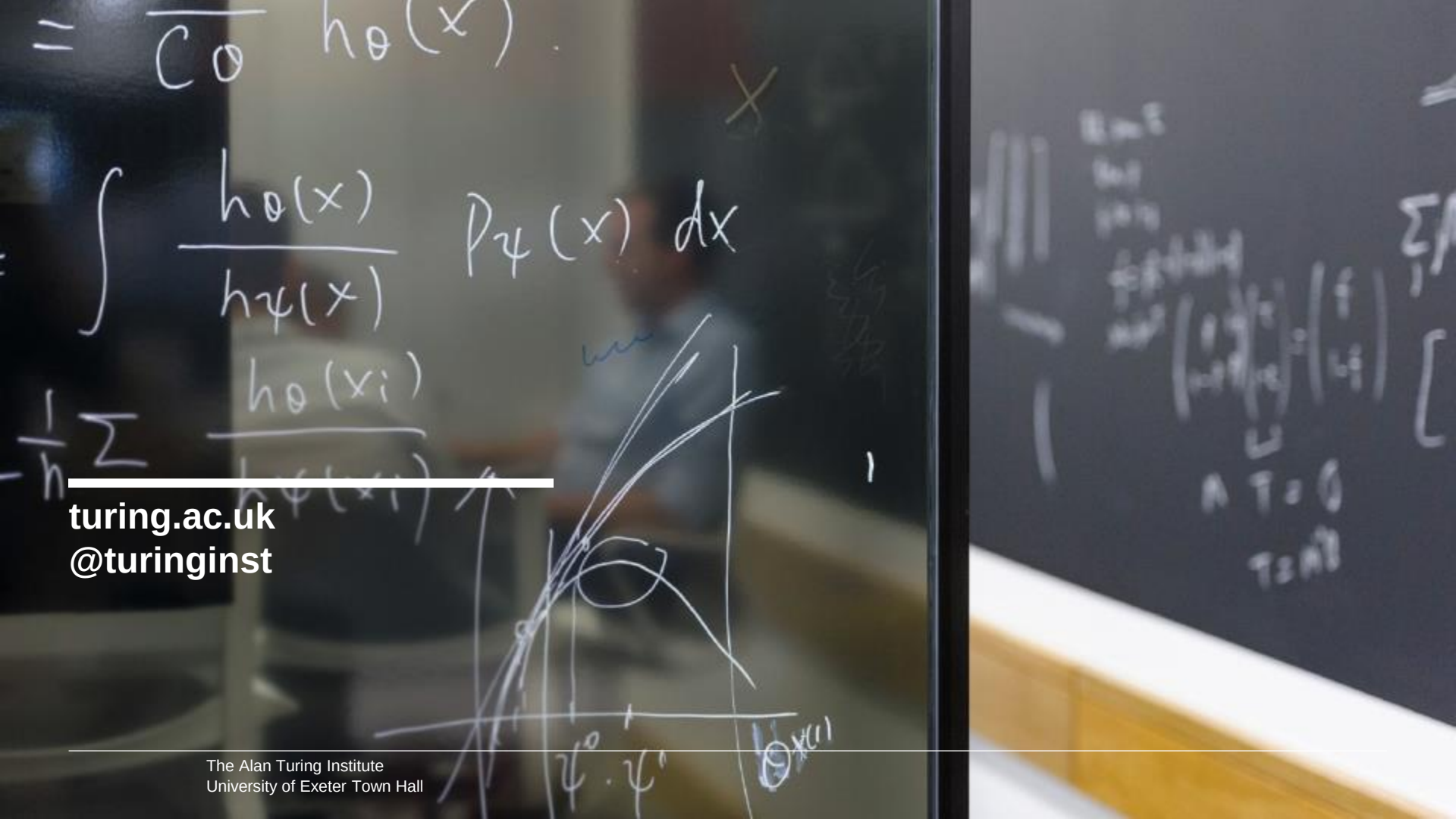
Director of Academic Engagement

Oonagh McGee
Senior Research Facilitator

Ben Murton
Head of Researcher Development and Training

Christine Foster
Managing Director for Innovation

Beth Wood
Press and Communications Manager



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