
Turing Fellows Workshop

10 January 2019

Professor Sir Adrian Smith FRS

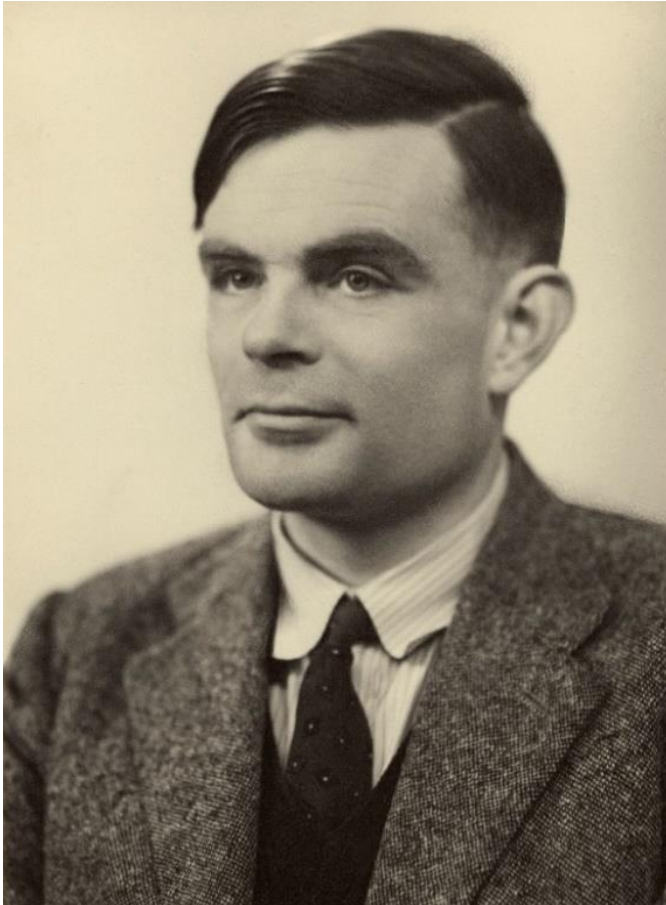
Institute Director and Chief Executive

The background of the slide is a blurred photograph of a lecture hall. In the foreground, a large whiteboard is visible with handwritten mathematical formulas in white chalk. The formulas include $L(\theta) = -\frac{1}{M} \sum_{m=1}^M \log p(y_m | x_m; \theta)$ and $\eta(\theta)$. Several people are visible in the background, some standing and some sitting, appearing to be in a lecture or discussion. A thick black horizontal line is positioned above the title text.

Background

The Turing's aims and structure

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.

Founding the Institute

“We will found The Alan Turing Institute to ensure Britain leads the way again in the use of big data and algorithm research”

Chancellor of the Exchequer

Budget Speech, March 2014

**The
Alan Turing
Institute**

EPSRC

Engineering and Physical Sciences
Research Council

Network of industry,
charity, government
partners

Network of
university
members

Strategic
government
investment

The goals of the Institute

Innovate and develop world-class research in data science and artificial intelligence

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 and artificial intelligence leaders

Advising policy-makers and shaping the public conversation around data

Our university network



The Institute's partners and collaborators



The convening power of the Institute

Leading collaborative research

A £48 million funding investment from UKRI to convene two new major research programmes in data science and AI, delivered through our university partners:

- AI and Data Science for Engineering, Health, Science and Government
- Living with Machines

In collaboration with:



AI Fellowships

A £50 million investment to develop AI Fellowships to bring the best global AI researchers to the UK, in collaboration with the Government Office for AI and UKRI.

The details of the programme are in the process of being finalised, aiming to have the first fellows in place by Autumn 2019.

In collaboration with:



The Turing community

300+ Turing Fellows

10+ Turing Research Fellows

45+ PhD students (plus 20+ on a short-term enrichment placement)

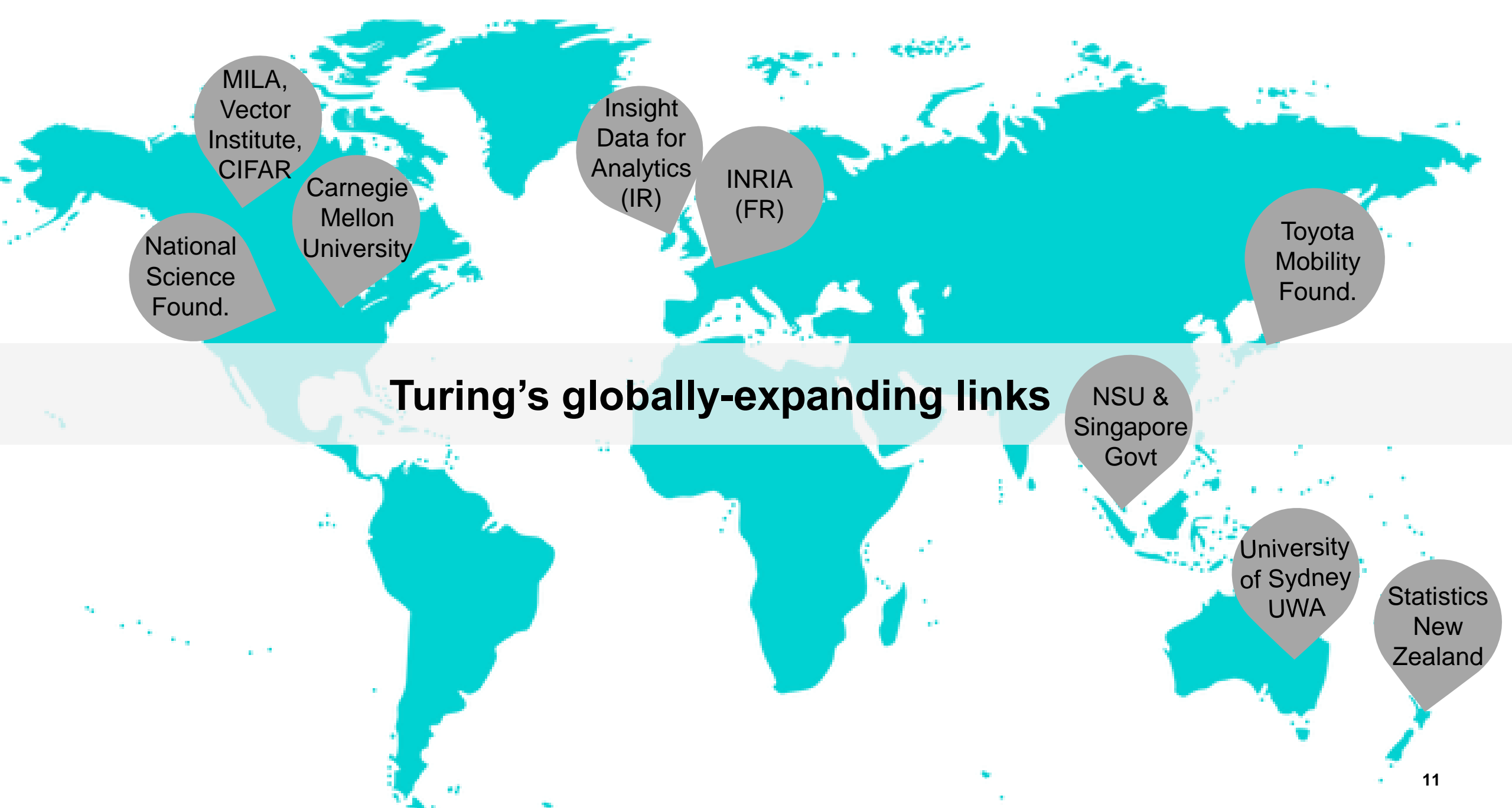
30 Interns (12 week programme)

100+ Visiting Researchers from academia, industry, govt

15+ Research Engineers/Data Scientists

(Figures as of 9 January 2019)





Turing's globally-expanding links

MILA,
Vector
Institute,
CIFAR

National
Science
Found.

Carnegie
Mellon
University

Insight
Data for
Analytics
(IR)

INRIA
(FR)

Toyota
Mobility
Found.

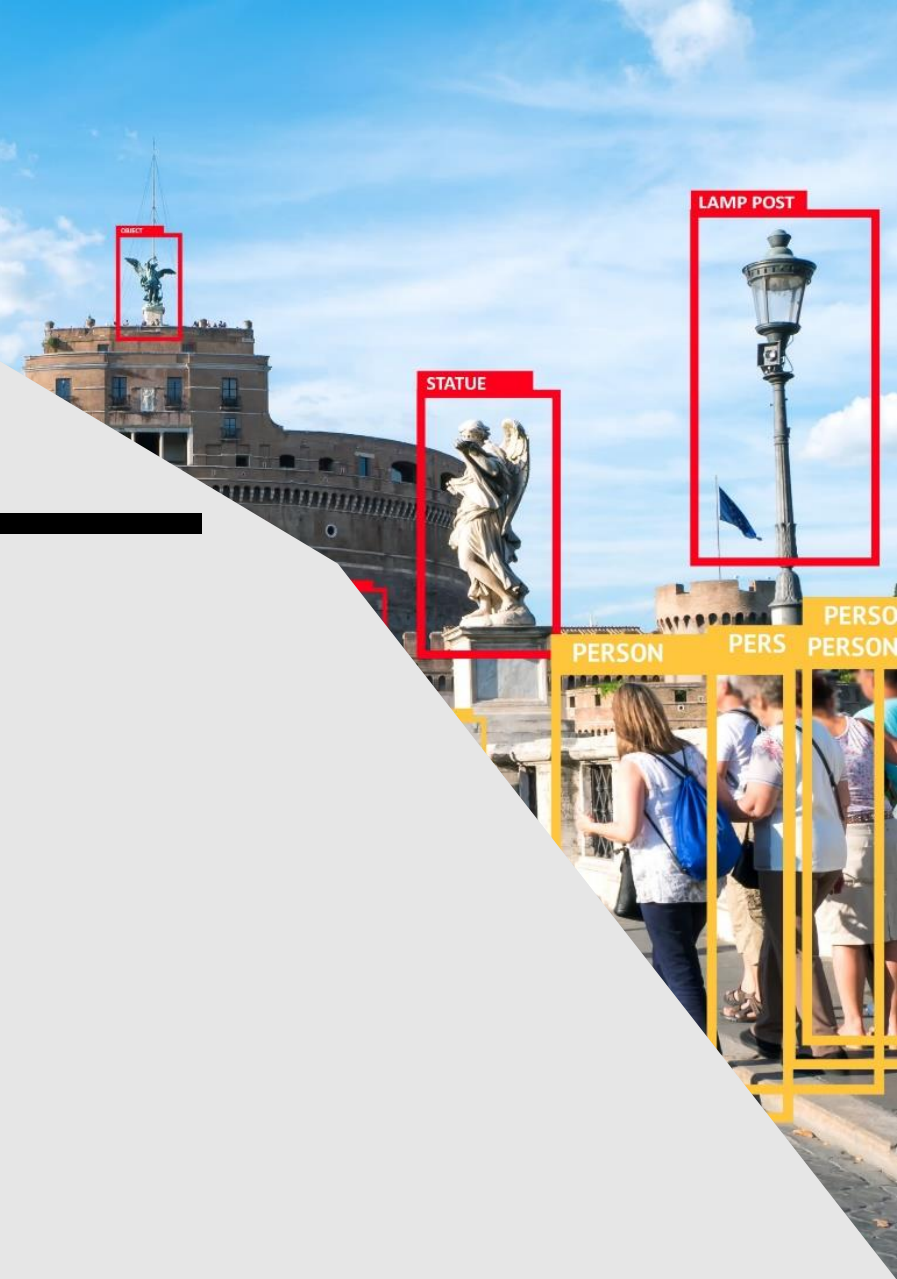
NSU &
Singapore
Govt

University
of Sydney
UWA

Statistics
New
Zealand

Resource

The Turing's science areas



Research interest groups

- Privacy-preserving data analysis
- Data science and digital humanities
- Logics for data science
- Urban analytics
- Sports and well-being
- Online machine learning
- Fairness, transparency, privacy
- Data Ethics Group
- Topology and geometry
- Low-dimensional structure in data
- Protocol governance: Blockchain & beyond
- Sampling algorithms for data analytics
- Social data science
- Natural language processing
- Mental health
- Data and inequality
- High dimensional statistics

Data Study Groups

Week-long data science sprints

Day 1: Problems are presented by partners

Researchers branch into groups for each problem and discuss different approaches

Day 2-4: Brainstorming, modelling and problem solving

Collaboration and discussion with industrial representative

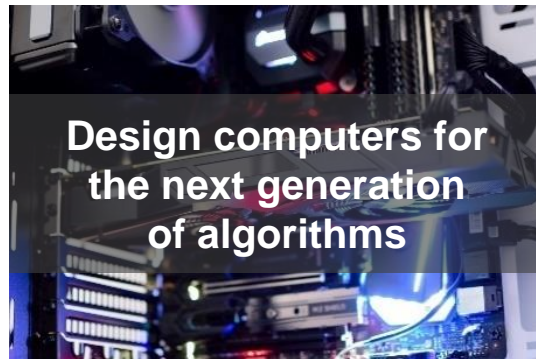
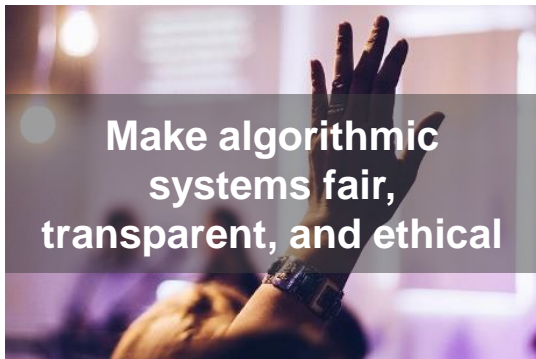
Day 5: Progress and recommended routes forward are presented.

Output: Report and possible extension of collaboration

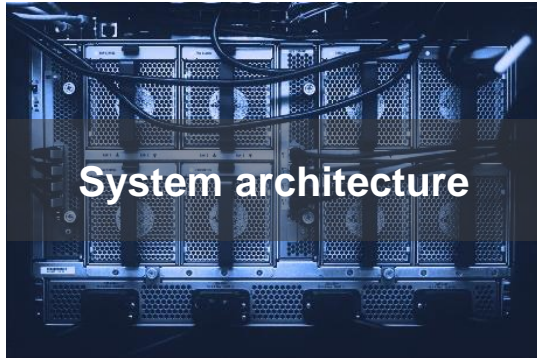


Challenges

Advance data science and artificial intelligence to...



Core capabilities



Impact stories



The
Alan Turing
Institute

Impact stories



Making simulations simpler

“We bring research code out of the academy and onto the desktop”

James Hetherington,
Director of Research Engineering,
The Alan Turing Institute

Imperial College
London



Fairer algorithm-led decisions

“This work is the first to show us how we might use causality to uncover injustices in algorithms”

Simon DeDeo,
Assistant Professor,
Social and Decision Sciences,
Carnegie Mellon University



A right to explanation

“Engaging and explaining what is going on with algorithmic decisions may help avoid repercussions for the UK economy.”

Sofia Olhede,
Director of Centre for Data Science
UCL

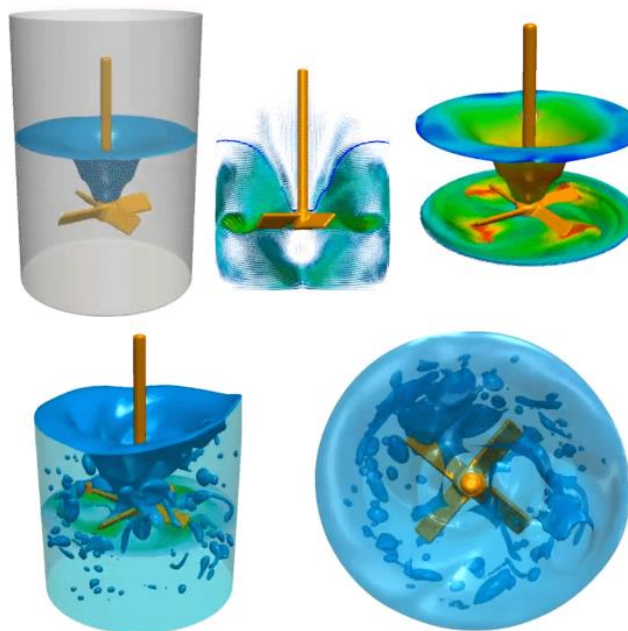
Making simulations simpler



Software engineers at the Turing, in collaboration with partners at Imperial College and UCL, have developed a user interface which aims to make the simulation process more user-friendly, for both academic and industrial communities.

“We bring research code out of the academy and onto the desktop”

James Hetherington, Director of Research Engineering at the Turing



Impact

- Lowering barrier to entry
- Increasing innovation opportunities
- Reproducibility of results
- Tackling key challenge of the Turing's data-centric engineering programme
- Core code of the app open source

Fairer algorithm-led decisions



Turing researchers from diverse fields have produced a new way of approaching fairness in algorithm-led decisions, by looking at the causes of certain factors that can sometimes result in biased decision-making.

“This work is the first to show us how we might use causality to uncover injustices in algorithms”

Simon DeDeo, Assistant Professor, Social and Decision Sciences, Carnegie Mellon University



Impact

- Set of technical guidelines for practitioners
- Influenced many leading researchers to use causal methods
- Identifying racial biases in automated US parole procedures
- Potential to have wide-reaching, meaningful effect on everyday life

A right to explanation



Advice from Turing researchers, urging the need for individuals to have a legally-binding right to have automated decisions made about them explained, is helping shape how the new EU general data protection regulations (GDPR) will be implemented.

“Engaging and explaining what is going on with algorithmic decisions may help avoid repercussions for the UK economy.”

Sofia Olhede, Director, UCL Centre for Data Science



Impact

- Helped trigger House of Commons inquiry
- Invited to provide evidence to parliament
- Cited in official EU guidance on automated individual decision-making and profiling in GDPR
- Influenced amendments to UK Data Protection Bill



Appendix

The Turing's science challenges and examples of related research projects

Revolutionise healthcare

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



Using machine learning techniques to help improve treatment plans for people living with the challenging symptoms of **cystic fibrosis**



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

Deliver safer, smarter engineering

Through spearheading new skills, standards, and education, we will deliver a safer, smarter era of data-centric engineering



Digital twin of world's largest 3D printed structure to inform design, track performance, and feed into future 3D structures



Developing machine learning algorithms and data science platforms to understand and **improve air quality** over London

Manage security in an insecure world

Developing new analytic technology and tools that can help us to manage security in an insecure world, at the cutting edge of data science and AI research



Understanding the **mechanics that cause conflict** and identifying multi-scale population areas that are at risk of conflict



Drawing on advances in **AI and machine learning** to address **data wrangling** issues, to help automate the data analytics process

Shine a light on our economy

Applying data science and AI techniques to understand the economy and monitor the real-world impact of business and policy decisions



Investigating the impact new technology has on **employment and output**



Understanding how **economic outcomes** in different regions are linked and how **shocks spread**

Make algorithmic systems fair, transparent, & ethical

Delivering fair, transparent, and ethical algorithms through bringing together cutting edge technical skills with expertise in data ethics, privacy, and policy



Data Ethics Group in partnership with Nuffield Foundation and ICO, understanding the ethical and societal implications of data



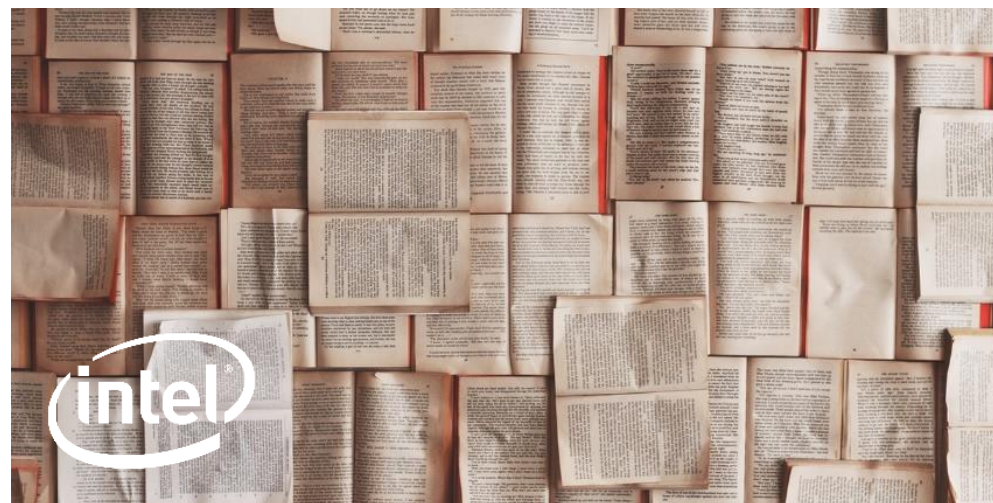
A new approach to **fairness in algorithm-led decisions**, by looking at the causes of factors that can result in biased decisions

Design computers for the next generation of algorithms

Adapt and refine computer hardware in order to meet the needs of the next generation of algorithms and data scientists



Computer scientists, clinicians, and scientists working to improve the ability of **computers to recognise tumour and cancerous cells**



Training neural networks, and developing related hardware, to be better at **translating millions of words** of online text

Supercharge research in the sciences and humanities

Research organisations are creating enormous sources of data and there are opportunities for data science and AI to assist management and processing



The **British Library** has digitised millions of pages from its collections, facing processing and analysis challenges



Automating processing of **Diamond Light Source's** synchrotron and electron microscope data using **machine learning**

Foster government innovation

Data science and AI can improve the design and provision of public services and inform policy-making across all levels of government



Turing researchers made recommendations to the National Infrastructure Commission for a national '**digital twin**' of **UK infrastructure**

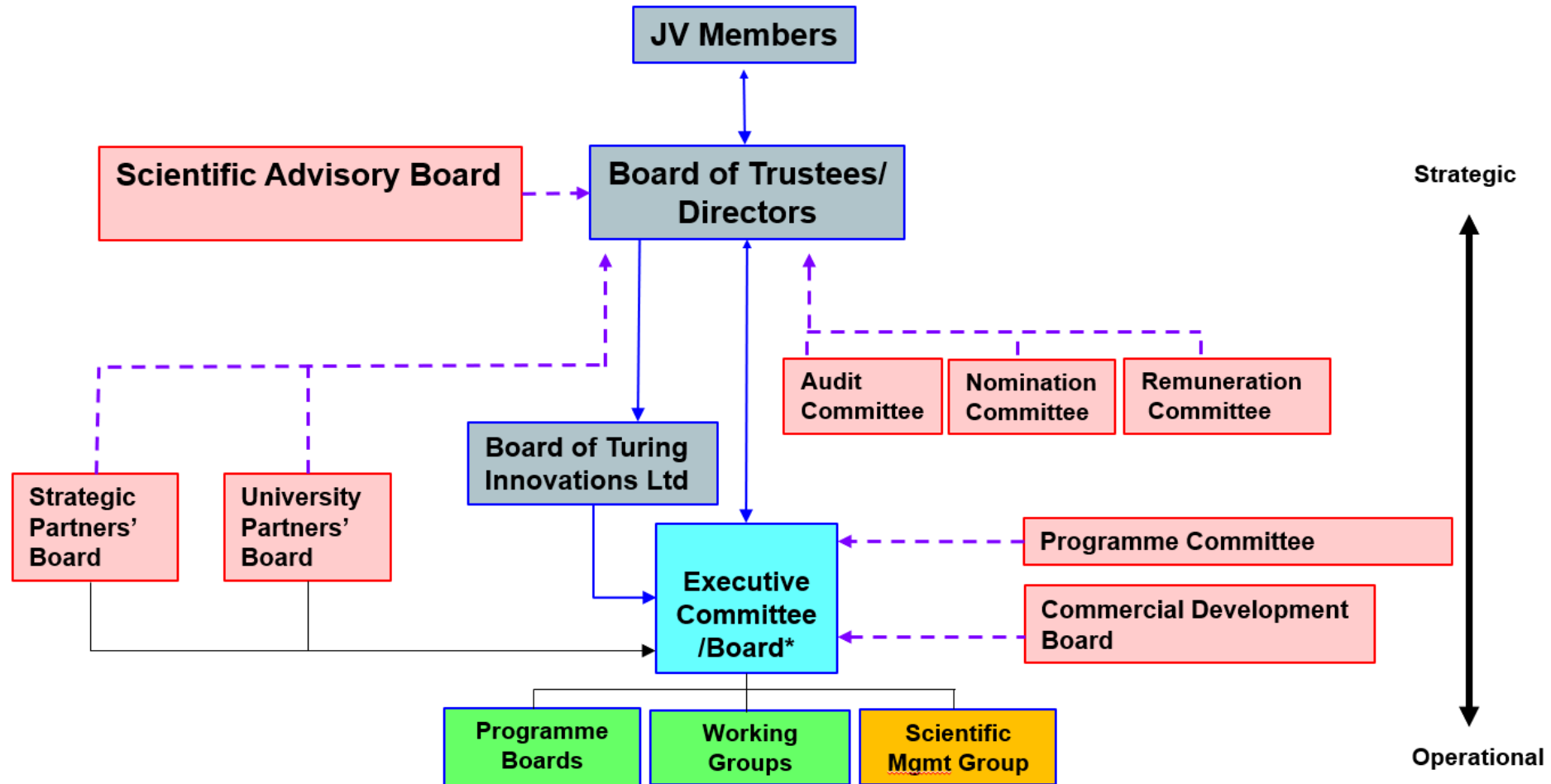


Turing researchers **submitted evidence** to the Science and Technology Committee's inquiry into **algorithms in decision-making**

Donna Brown

Director of Academic Engagement

Our Governance



Business Team

- Research Management and Facilitation
- Research Engineering
- Partnerships
- Training and Development
- Communications
- Events and Engagement
- HR
- Finance
- IT



Elena Simperl
Southampton
Susan Davies



Kate Robson Brown
Bristol
Patty Holly



Magnus Rattray
Manchester
Gwern Hywel



Richard Everson
Exeter
Katie Finch



Michael Farber
QMUL
Colin Rainey



Jared Tanner
Oxford
Kelly Ryan



Programme Directors

Mark Birkin
Urban Analytics



Mark Briers
Defence & Security



Mark Girolami
Data-centric Engineering



Chris Holmes
Health



Anthony Lee
Data Science and AI at
Scale



Helen Margetts
Public Policy



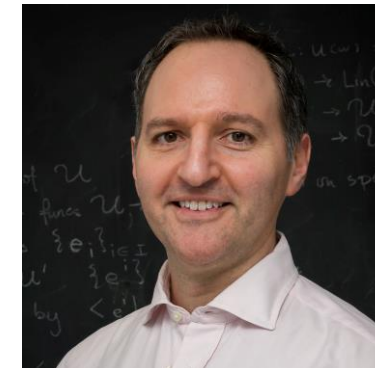
Jon Rowe
Data Science for
Science & Humanities



Lukasz Szpruch
Finance & Economic
Data Science



Adrian Weller
Artificial
Intelligence



Our researchers

Turing Fellows

- part time senior academics
- project and non-project focussed

Turing Research Fellows

- full time early career researchers (3+2 years)

Research Associates

- programme funded

Visiting Researchers

- under a number of schemes including Rutherford

PhD Programme

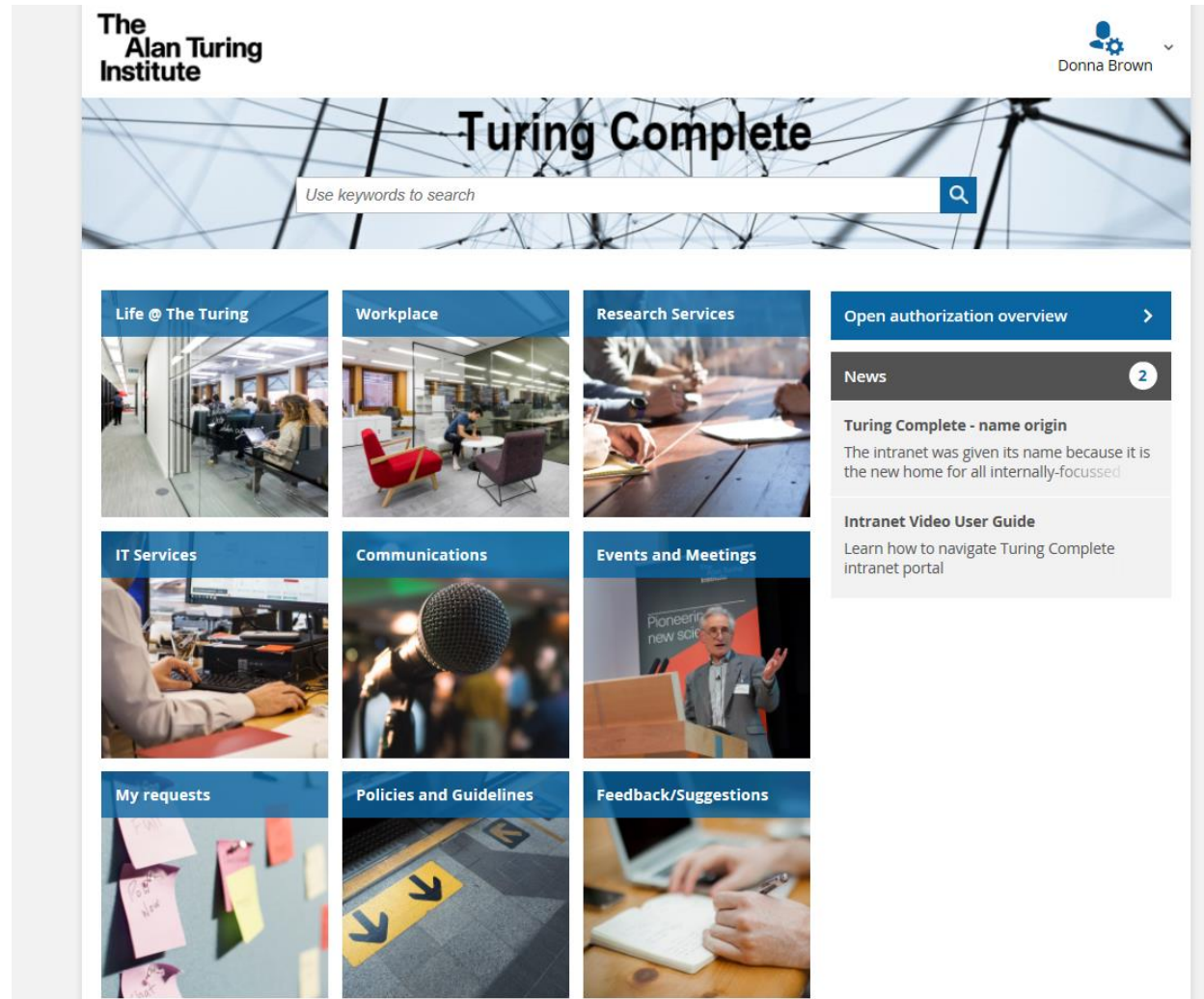
- Enrichment year
- 3.5 year straight through PhD
- Internships

Research Engineering team

Emma Cook & Julie Alland

Head of Finance & HR Consultant

https://turingcomplete.topdesk.net/



https://www.gdg.travel/login/

Call Us [08448 553 700](tel:08448 553 700) | info@gdg.travel



GrayDawesGroup
#makingsenseoftravel

[Business Travel](#) ▾ [Corporate Events](#) ▾ [Pro Sport](#) [Holidays](#) ▾ [News](#) [About](#) ▾ [Con](#)

Online Booking Tool Login

Online Log In

Username

Password

Submit

YourTrip Log In

Are you one of our clients who has recently moved onto our new
YourTrip online booking tool?

Log In using the button below.

Log In

[Download the YourTrip Flight user guide by clicking here.](#)

[Download the YourTrip Hotel user guide by clicking here.](#)

[Download the YourTrip Rail booking user guide by clicking here.](#)

[Download the YourTrip YourProfile and Trips user guide by clicking here.](#)

Franz Kiraly

Turing Fellow & University College London

2 years of being a Turing Fellow

... is there more than just free coffee?

My personal Turing story

mid-2016: initial round of inaugural Turing fellows (5 universities)

Organized ***scoping workshop*** on data science/geoscience (with M Girolami)

participated in workshop on data science/sports science

end-2016: participated in first ***data study group*** (director: S Vollmer)

joined one of 3 initial ***strategic programmes***, „data-centric engineering“

early 2017: helped coordinate sports prediction challenge

later became data science/sports/activity ***SIG*** with regular events

mid-2017: joined ***DSG*** executive team, left DCE, focus on DSG

contributed as ***principal scientist*** to health DSG & NHS projects

now multiple ongoing health collaborations within ***health SP***

(collaborating teams span 7 universities and multiple health organisations!)

Advertisement feature: UK Data Study Groups

**The
Alan Turing
Institute**

**Data
Study
Groups**



We are looking for YOU!

academic-led data challenges!

*participation fully funded,
follow-on grant eligibility*

Local organizing teams!

*free t-shirts & coffee mugs
Turing secondment buy-out!*

Stop by at DSG team 3-4pm for more info!



The Turing as a nexus of data science

Discipline nexus: data scientists, computer scientists, social scientists, domain experts

Community nexus: 13 partner universities, partner organisations, UK data science

Translation nexus: academics, research engineers, business team

Embrace the collaborative vision!

Talk to someone you don't already know!

...e.g., at the coffee machine, at a social event

or, go to a random event on an unfamiliar topic!

join a SIG and/or form a new one you'd enjoy!

*(do you know
the person
next to you?)*



Make use of Turing opportunities which reward collaboration & openness

collaborative grants, translation/enterprise support, data study groups, event support

Don't be shy, also talk to non-academics: analysts/REG & business team

they're people too, and nice, and key to the Turing's ongoing success story

21st century data science – a collaborative vision

Data science is changing the world – and we need to change with it

Someone in the 17th century:

*Surely, physicists, metalworkers, traders, and coachmen
have nothing useful to say to each other.*

(we all know that person was right)



Someone in the 20th century:

ah, these stupid Bayesians programmers
social scientists machine learners theorists
mathematicians data analysts engineers
admin people frequentists industry people

... the next industrial revolution
is just a tiny bit outside your comfort zone.

Widening your horizon is good for you...

... and it's probably good for the REF/KEF.

How to get most out of your time at Turing

Don't just keep doing what you always have been doing

talking with people you always have been talking with
researching what you always have been researching

... follow visions and explore new areas!

Value the immaterial benefits! *serendipity* *interdisciplinarity* *collaboration* *free coffee*

The Turing is so much more than a grant money printing agency. *collegiality*

Don't wait for the to Turing spoonfeed you opportunities.

... help create the opportunities you would like to be part of!

Look outside the box!

Be curious and open!

Create the world of tomorrow!

Embrace motivational platitudes if (and only if) they are well-founded by empirical evidence!

Allaine Cerwonka

Director of Academic Research Programmes

Oonagh McGee

**Head of Research Management and
Facilitation**

Research Management and Facilitation



-
- Responsible for the delivery of internal and external grant funding
 - Identifying external funding opportunities and providing support
 - Working across partners to develop collaborative funding applications
 - Development of international engagement principles
 - Responsible for the collation and delivery of research impact

Research Management and Facilitation

Oonagh McGee
Head of Research
Management and
Facilitation



Emily Neilson
Research Manager



Jessica Rowley
Evaluation and Impact
Officer



Charlie Thomas
Research
Administrator



**Research Grant
Development Officer**



Collaborative Research at The Turing

Ways to do this:

- Seed funding, visiting researchers
- Infrastructure resource – Azure credits
- We encourage collaboration across institutions
- Proposals should align with our programmes or challenge areas
- We will work with your university offices

Reporting

- Fellow reporting – Research Fish dates are 4 February to 14 March 2019.
- Get in touch – Research@turing.ac.uk

Martin O'Reilly

Principal Research Software Engineer

Nico Guernion

Director of Partnerships

The Institute's strategic partners and collaborators

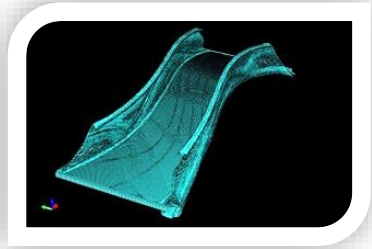


Partnerships approach – means of engagement for industry



Strategic partners

- Deep commitment (funding, people, equipment and time) to our core aims
- Key consumers of data science research



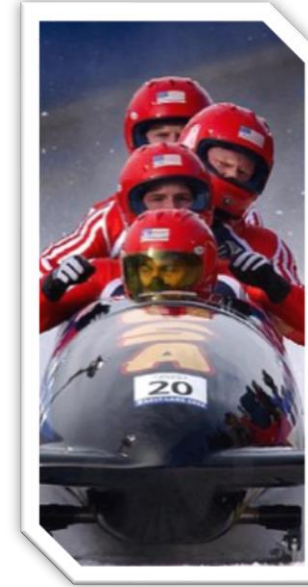
Programme and/or Project partners

- Engage with us on a specific collaboration, around a particular problem or problems of mutual interest



Members (NOT YET LAUNCHED)

- Typically SMEs
- Part of knowledge network
- Learn about the latest developments in data science



Delivery partners

- Qualified talent, complimentary tools and services
- Organisations who deliver data science / AI services beyond collaborative research



Data Study Groups

- 1-week hackathon
- 6-8 industry challenge owners
- Follow-on project(s)

Turing Partnerships – Benefits for Partners

Network and brokering

Talented people

Expertise and know-how

Resources and infrastructure

Branding and influence

Education and Events

Turing Partnerships – Benefits for Researchers

Resources

Challenges

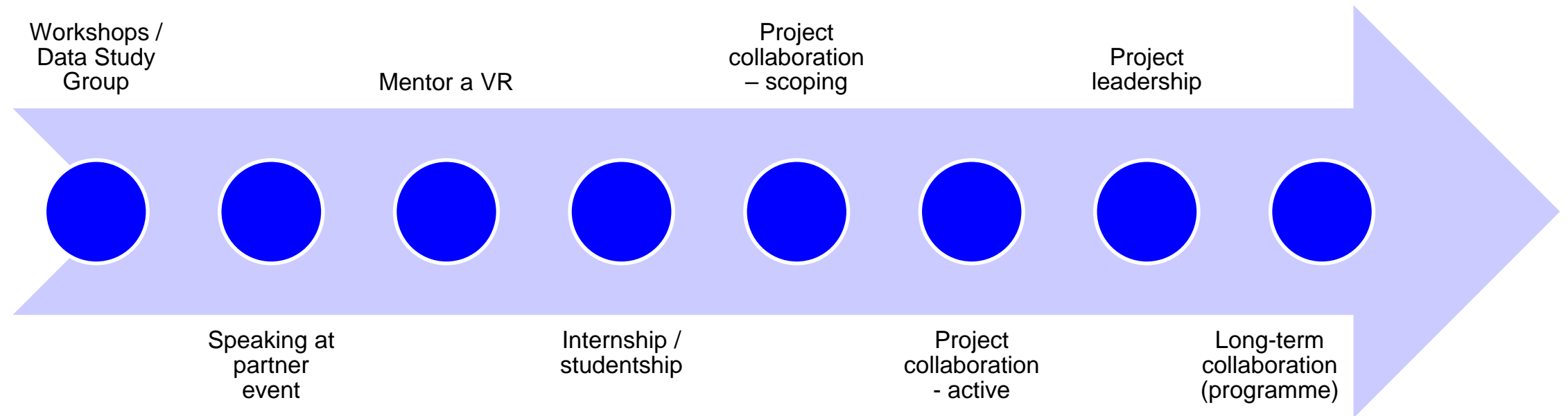
Data

infrastructure

Impact

Mentoring

Varied opportunities to engage with partners



Turing-HSBC-ONS Economic Data Science Awards 2018

- Competitive funding call for projects of 6-24 months duration, beginning by 1st October 2018, led by a researcher from one of the Turing's partner universities. The call invited applications with high potential for impact and results within 6-9 months.
- ONS are contributing data and staff resource. Turing are contributing Research Engineer expertise.
- 27 applications were received from around Britain, involving international collaborators from 5 other countries (Germany, Italy, Belgium, Singapore, USA).

**The
Alan Turing
Institute**



Collaborative projects - examples

Optimising mobility (AI)



- Toyota Mobility Foundation
- Development of traffic flow visualisation platform for traffic controllers
- 18 months to develop initial prototype
- Focus on fleet behaviour and traffic lighting

Air traffic control (Data Centric Engineering)



- National Air Traffic Services (NATS)
- Initial scoping phase - 14 months collaboration
- Research opportunities to automate air traffic control decisions

Data Study Group Apr 18

- Fairness in algorithmic decision making
- Online violence
- Predicting and mitigating operational risk
- Speech and language recovery post-stroke
- Smart gym equipment data

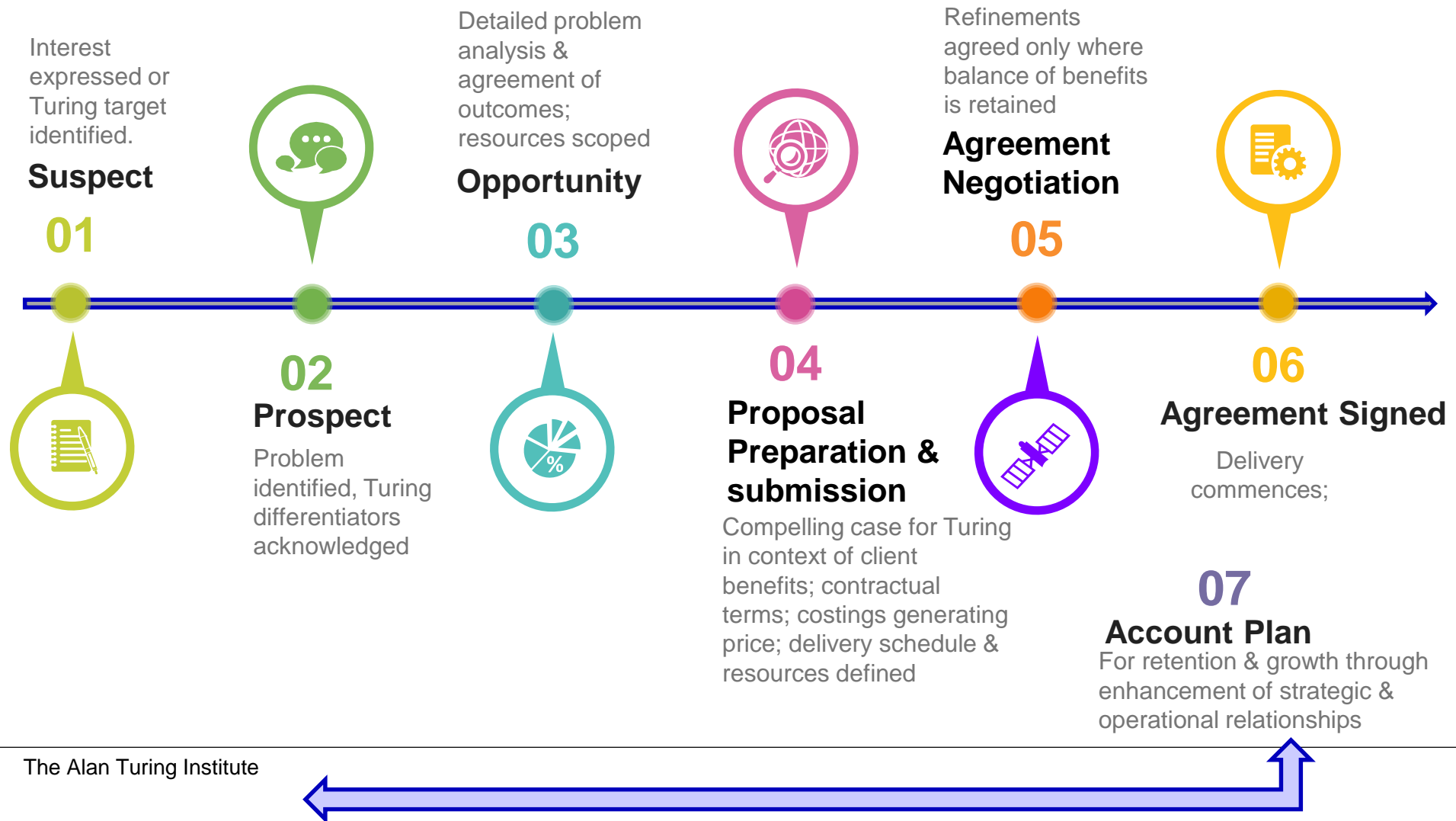
Other collaborations

- NHS Scotland on public health strategy in Scotland
- Shell engagement on Data Science at Scale

Turing criteria for partnerships (7 principles)

1. **Strategic** – how aligned are a potential partner's challenges with Turing priorities
2. **Impact** – to what extent will a partnership yield transformational impact
3. **Additionality** – to what extent a partnership with the Turing adds value
4. **Absorptive capacity** – to what extent is the partner able to take the research outputs/outcomes and use them effectively to transform their business
5. **Capabilities** – how available are research leaders and researchers
6. **Commitment** – to make it work on both sides
7. **Data** – availability of data and suitable access models are key

Turing Opportunity Development Process



Next steps?

We are keen to work with Partner Universities:

- To help us access a great range of capabilities
- To bring the research frontline to tackle real-world problems
- To work across disciplines to deliver solutions for partners
- To assist us in forming programme/project teams
- To bring about mutual benefit (e.g. use cases, ROI, etc.)

Turing Partnerships Team – who is who?



Christine Foster
MD - Innovation



Darren Grey
Programme Manager
Data Centric Engineering



Katrina Payne
Partnerships Development Lead



Aida Mehonic
Programme Manager
AI



Mahlet Zimeta
Programme Manager
Finance & Economics
Health



Nico Guernion
Director of Partnerships



Catherine Lawrence
Programme Manager
Data Science at Scale
Data-driven Security



Jules Manser
Partnerships
Coordinator



Hushpreet Dhaliwal
Partnerships Development Lead



Catrin Evans
Partnerships Project
Administrator

Ben Murton

Head of Researcher Development

Training and Doctoral Supervision

Doctoral level programmes

- **3.5 year fully-funded doctoral programme**
 - 15 students / year (5 overseas)
 - Coordinated by UPs
 - 50% time at the Institute
- **Enrichment programme**
 - 6, 9, or 12-month placements at the Institute
 - 180 months in 2018 cohort
 - UK wide recruitment opening in February

Doctoral supervision arrangements

- **Turing students and supervisors encouraged to meet up**
- **Time split between UP and the Institute**
- **Other students welcome to visit**
 - A short term (1-week) placement to collaborate
 - Access to Institute by signing in
- **Can investigate longer placements as visiting researchers**

Academic Mentors

- **Providing guidance for Turing students**
 - Identify specific areas / general guidance
 - Students will be encouraged to reach out
 - Complement the UP systems
- **Breaking down boundaries...**

Doctoral training

- **Turing Data Science Classes**
 - Broad range of topics with focus on deeper learning and application of theory to research
 - How can we be different from UP training?
- **Supporting DS Classes / Training**
 - Opportunities to teach in 2019 for Turing programme
 - Contribution to CDT Masterclasses /national training
- **Membership of the Training Steering Group**

Hotdesking

- Wooden tables (L1 / L4)
- Desks with green “Hotdesk” signs (L1/L2/L4)
- Communal areas for short meetings
- Booths for private calls etc
- Meeting rooms for meeting with others
- British Library (requires reader membership)
- Booking system soon to launch for longer visits
- Sign visitors in at the reception / Gate 8 if needed

Joanna Stacey

Head of Events and Engagement



What we do

- Coordinate the Institute's academic, industry and third sector collaborative events and sponsorships
- Support Research Programmes to plan, deliver and report on events
- Design and delivers public engagement events, activities and materials
- Support the Turing community to deliver best practice events

Holding an event



- Calls – Events, Sponsorships, Public Engagement (turing.ac.uk)
- Research Programmes (via Programme Directors/Managers)
- Seminars (via reception)
- Advice, questions or suggestions (events@turing.ac.uk)

Things to note

- Applications via website – next call opening 7 November
- Suggest at least 4 months lead time
- Applications help us to input, find connections and develop value add
- Average fund £4,000

Events and Engagement



Anneca York
Events Administrator



Jade Thompson
Events Manager



Jessie Wand
Senior Events and Engagement
Coordinator



Joanna Stacey
Head of Events and
Engagement



Kate Wicks
Events Coordinator



The Turing community

- Town Halls – next one 25 October
- Social events – slack channel
- University events – materials, funds
- University Liaison Managers (ULMs) and Turing University Leads (TULs)
- Institute spaces