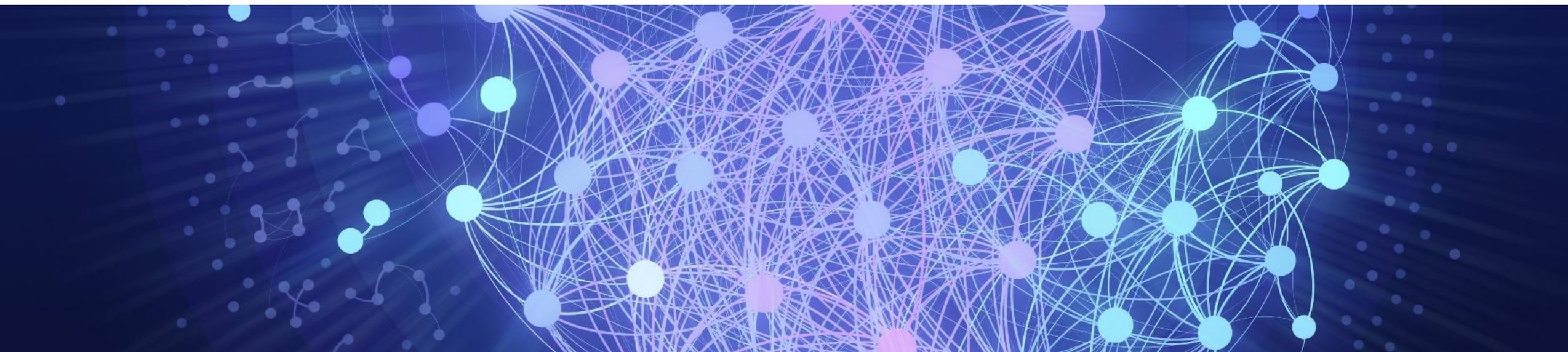




Hartree Centre  
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# AI and New Frontiers: the Hartree Centre Perspective

Alison Kennedy  
Director | STFC Hartree Centre | UK



# What is STFC?

A UK Research Council which funds, designs, builds and operates world-class science infrastructure

Providing government, academia and industry with:

- **unique scientific insight**
- **innovative technology**



# Who are we?

STFC's high performance computing, data analytics and cognitive technology centre

Provides businesses and researchers with access to powerful technologies, facilities and scientific computing expertise

Based at Daresbury in Cheshire



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# E-infrastructure

- Hartree Centre builds on STFC's long heritage and expertise in high performance computing
- 2011 Tildesley Report proposed to increase economic impact through software & modelling (High Performance Computing)
- 2015 major investment in collaborative research
  - Additional focus on data centric and cognitive computing (AI)
  - Embedded IBM Research Centre
  - Extended industrial & scientific reach



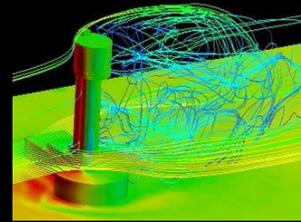
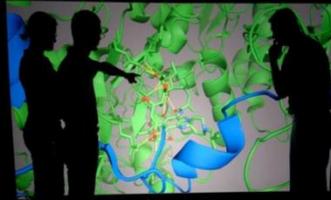
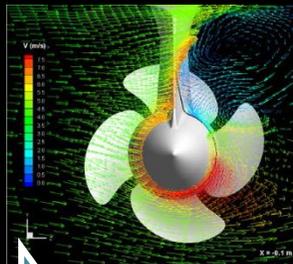
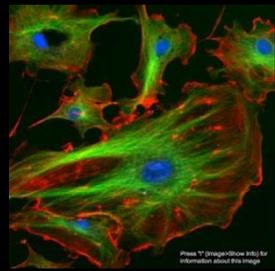
# Our purpose

- To lead UK research into the (industrial) application of high performance computing, data & cognitive technologies
- To drive the economic development of UK industry through the use of leading edge scientific knowledge and applications
- To exploit the combined research capability of STFC, IBM and other partners and make scientific solutions available for commercial use
- To transfer capability to clients to enable them to be self sufficient
- To maximise the Hartree investment in people, systems and IBM IP
- To support Daresbury as the regional centre for scientific and economic development



# Our mission

To transform UK competitiveness by facilitating and accelerating the adoption of high performance computing, data-centric computing and cognitive technologies.

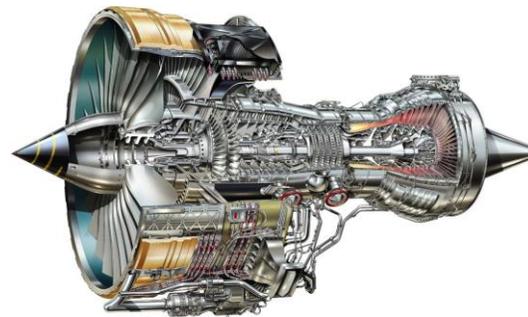


Research & innovation  
through collaboration

Development &  
prototyping

Deployment

Better products & services  
delivered faster & cheaper



Better products,  
developed faster and cheaper





“In fact, the business plans of the next 10,000 startups are easy to forecast: Take X and add AI. This is a big deal, and now it’s here”



**The Inevitable: Understanding the 12  
Technological Forces That Will Shape Our Future**

Kevin Kelly 2016 (USA)

# Growing the Artificial Intelligence Industry in the UK

## A BEIS commissioned report has just been published

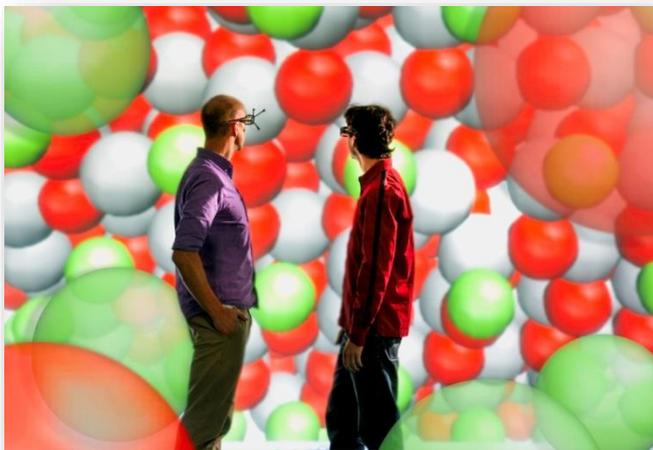
“It has been estimated that AI could add an additional USD \$814 billion (£630bn) to the UK economy by 2035, increasing the annual growth rate of GVA from 2.5 to 3.9%.”

“The recent upturn in performance has been driven by:

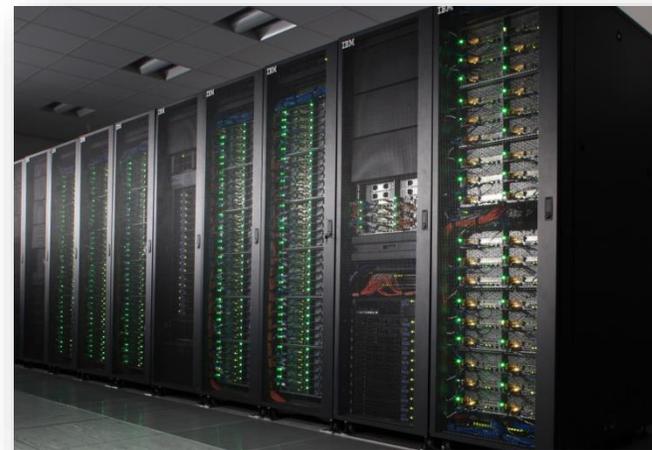
- Increasingly powerful and affordable computing capacity
- New and larger volumes of data
- Novel algorithms and applications developed by experts with very specific skills.”



# Hartree ambition



Highly skilled workforce



Utilise the power of computation!

*Economic impact through data,  
software and modelling*



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**Less than 1% of all data that is produced every day is mined for valuable information†**

† <http://research.ibm.com/articles/datacentricdesign/>

# Growing the Artificial Intelligence Industry in the UK

## Survey of 160 business on AI-readiness, for CBI and IBM, May 2017

“Nearly half of firms believe the current wave of Artificial Intelligence will be transformational and widespread; fundamentally transforming the industry and markets they work in. However, only a third feel their business has the skills to adopt data-driven technologies, so the UK must act quickly to bridge the knowledge gap as international competition heats up.

- Artificial Intelligence (AI) investment is gaining momentum with 42% of companies planning to invest over the next five years (Internet of Things – 42% / Advanced Analytics – 51%). That’s on top of the one in five companies (21%) who already invested in AI during the past 12 months
- The AI wave will be transformational and widespread, half (49%) of business believe it will fundamentally transform their industry/ market.
- Firms believe AI can lead to greater efficiency (78%) and profits (68%). Benefits to consumers (71%) are big leading theme but also collaboration (70%).
- Yet many businesses risk being left behind, 52% of pioneers have already invested in AI while 47% of ‘followers’ do not plan to invest in AI at all.



# Knowing the questions?

## **HPC-driven problems:**

Start with questions

Collect or generate data in the hope that the answer can be discovered

## **Big data-driven problems:**

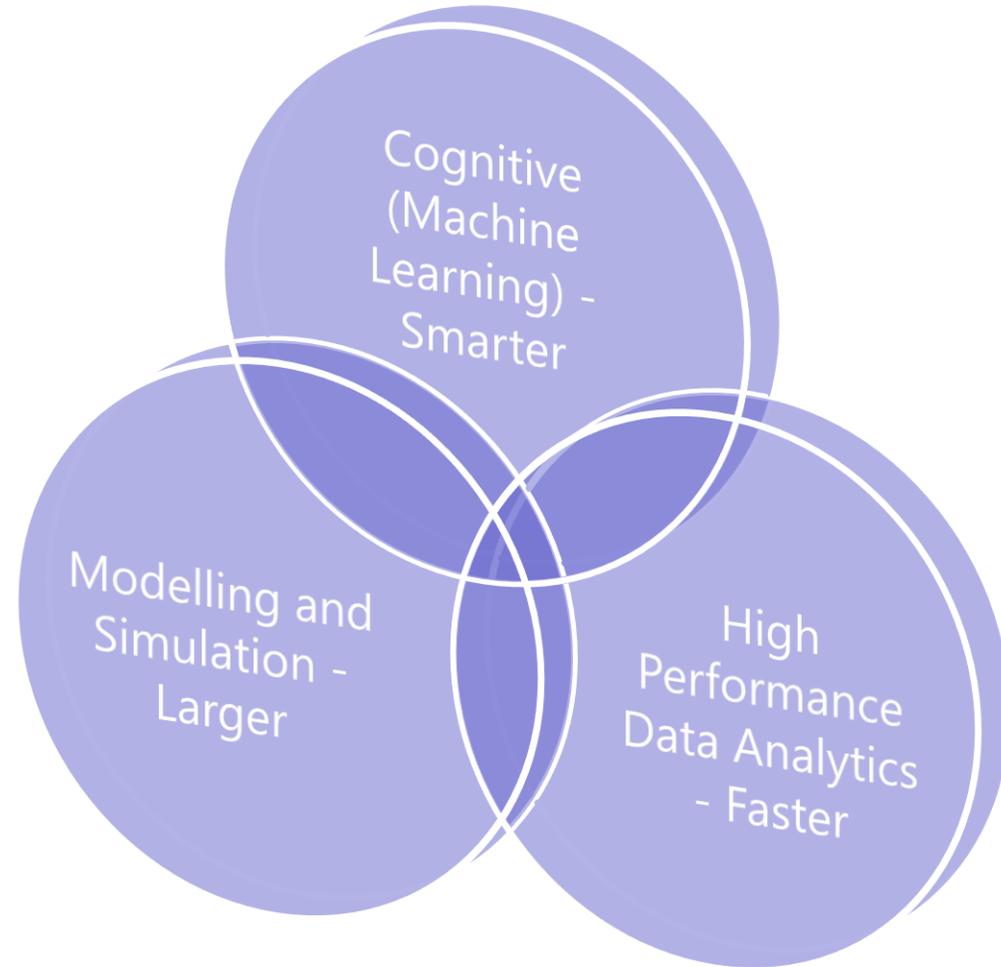
Combine and explore (multiple) datasets to see what interesting information is revealed

Limitation tends to be “imagination and human resources”



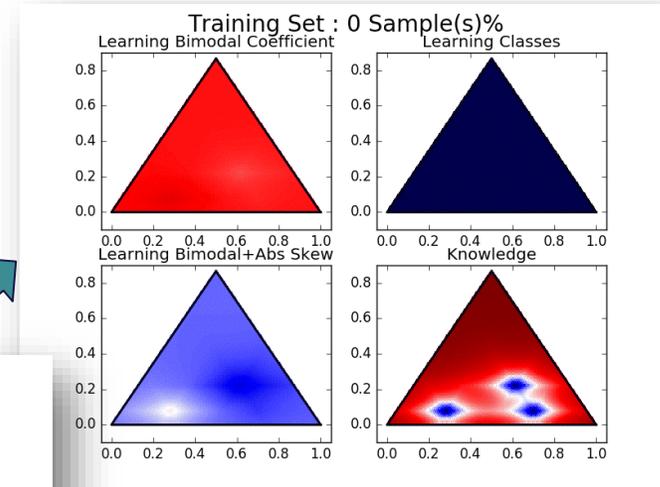
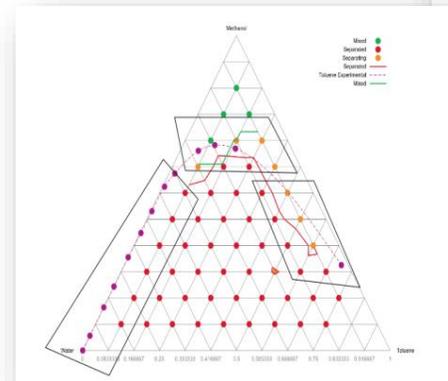
# What is our Unique Selling Proposition?

The Innovation Return On Research (IROR) programme gives us the opportunity to bring these three key technologies together.



# Getting HPC to “work smart, not hard”

- Typically HPC development is focused on increased speed.
  - The fastest calculation is the one which you don't run!
- Can we use machine learning to make better decisions on **which simulations give the most value?**
- Can we use machine learning to improve resolution of information?



**‘Cognitive’ workflow uses 1/3 of the calculations to achieve 4 orders of magnitude resolution increase**

# Spotlight on formulation

## Impact Study: Transport

UK lorries travel ~10,502 million miles pa

A large company travels ~100 million miles pa

Typical fuel consumption is 8 mpg

Improved lubricants could provide 8.5 mpg

Saving 700,000 gallons (~5% of profits)

Reduced environment impact.



- Formulation industry is worth **\$1000 billion per annum** and growing
- Formulated products are everywhere; toothpaste, shampoo, vehicle oils, foods
- **Complex process** balancing ingredients for performance
- Small improvements have big benefits

# Consumable HPC



# Case study: Improving the patient experience



- Transform patient experience for children and their parents/ carers
- Enhance Alder Hey patient interactions from first referral to the completion of their care journey
- Engaging dialogue to familiarise, reward and educate
- Providing actionable insights for clinicians based on patient and parent tone and sentiment





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Thanks to Hartree staff and IBM Research staff who allowed me to reuse their slides.

Thank you for listening



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