

European collaboration in machine learning and AI

Note of discussions at a Royal Society and Leopoldina event

3 April 2019, Neues Schloss, Stuttgart

The Royal Society and Leopoldina

The Royal Society is the UK's national academy of sciences. The Society's fundamental purpose, reflected in its founding Charters of the 1660s, is to recognise, promote, and support excellence in science and to encourage the development and use of science for the benefit of humanity.

The Deutsche Akademie der Naturforscher Leopoldina has been the German National Academy of Sciences since 2008. Since its foundation in the 1600s, it has been committed to the advancement of free science, to benefit humankind and to shape a common future.

In April 2017, the Royal Society published the results of a major policy study on machine learning. This report considered the potential of machine learning in the next 5 – 10 years, and the actions required to build an environment of careful stewardship that can help realise its potential. Its publication set the direction for a wider programme of Royal Society policy and public engagement on artificial intelligence (AI), which seeks to create the conditions in which the benefits of these technologies can be brought into being safely and rapidly¹.

As part of this programme, in April 2019 the Society and Leopoldina convened a workshop on European collaboration in machine learning and AI. In the context of new initiatives to support AI research in Europe, such as the European Lab for Learning and Intelligent Systems (ELLIS), this workshop brought together leading researchers to explore opportunities and challenges for European scientific collaboration in AI. This note summarises discussions at the workshop. It is not intended as a verbatim record, and does not reflect an agreed position by workshop participants or the Royal Society and Leopoldina.

Advancing AI research and development: a European approach

AI technologies are advancing at pace. Algorithmic advances, increasing data availability, and growing compute power have contributed to significant research achievements in recent years, with many of these achievements coming from successes in machine learning, an approach to AI in which computer systems learn to carry out complex processes by learning from data. As a result, AI is moving from a research discipline to one that is applied at scale. The economic and social benefits that follow are potentially significant, with new applications promising benefits across healthcare, transport, education, and more.

Europe has tremendous strengths in AI: its universities are home to leading researchers², the world's largest technology companies have set up significant bases throughout Europe, and many countries support a vibrant start-up environment.

Across Europe, national governments are seeking to capitalise on the opportunities presented by these technologies by developing national strategies aimed at boosting economic growth and improving societal wellbeing. Common themes emerging from these national strategies include policies to: advance research; develop talent; support industrial strategy; access data and govern its use; and explore the social and ethical implications of widespread AI adoption.

As policy approaches in each of these areas develop, there are new opportunities for collaborations – across nations, and between industry and academia – to translate the potential of AI into benefits for people across Europe.

1. Further information on this programme is available at: <https://royalsociety.org/topics-policy/data-and-ai/artificial-intelligence/>

2. The 2018 AI Index notes that "Europe has consistently been the largest publisher of AI papers", with the majority of these coming from researchers affiliated with public sector establishments. Element AI's 2019 Global AI Talent Report also points to significant clusters of research activity in Europe. Documents available at these links: <https://aiindex.org/> and <https://jfgagne.ai/talent-2019/>

Understanding different models of collaboration

A variety of organisations could offer lessons for how to support European collaboration in AI. A brief description of some such examples are given in tables one and two.

TABLE ONE

Examples of research collaborations from across scientific disciplines.

Organisation	Area of research interest	Description
European Molecular Biology Laboratory (EMBL)	Life sciences	<p>EMBL is an intergovernmental organisation comprised of more than 80 research groups operating across six locations in Europe. It works to “promote molecular biology across Europe, and to create a centre of excellence for Europe’s leading young molecular biologists” through access to research funding, infrastructure and facilities, training, and technology transfer activities. EMBL was founded in 1974 by a treaty that specifies its membership, activities, and the nature of the collaborations it can support.</p> <p>For AI research collaborations, EMBL may offer lessons in:</p> <ul style="list-style-type: none">• Enabling access to infrastructure;• Storage of datasets;• Facilitating collaborations across multiple sites; and• Offering training schemes for early career researchers.
European Atomic Energy Community (EURATOM)	Nuclear energy	<p>The European Atomic Energy Community (EURATOM) provides funding for research into nuclear energy across its Member States. In addition to funding research, EURATOM plays a role in setting safety standards for nuclear workers and members of the public, and its activities include a Research and Training Programme (ERTP) that seeks to develop skills and competencies to contribute to high standards in nuclear safety.</p> <p>For AI research collaborations, EURATOM may offer lessons in:</p> <ul style="list-style-type: none">• Coordinating research in key areas of interest; and• Offering training schemes for early career researchers.
CERN	Fundamental physics	<p>CERN, the European Organisation for Nuclear Research, provides particle accelerator facilities to support research in fundamental physics. Its core mission is to advance fundamental research in particle physics, while training future generations of scientists and providing a platform for international collaborations.</p> <p>For AI research collaborations, CERN may offer lessons in:</p> <ul style="list-style-type: none">• Coordinating access to infrastructure; and• Offering training schemes for early career researchers.

Examples of research collaborations in AI.

Mila	Mila is a partnership between the Université de Montréal, McGill University, École Polytechnique de Montréal and HEC Montréal. It seeks to advance the science of deep learning, and understanding of its socio-economic implications, while supporting technology transfer activities that foster local economic growth.
Alan Turing Institute (ATI)	The ATI is the UK's national institute for data science and AI. It is a partnership of thirteen UK universities, each of which as a lead member that acts as an interface with the Institute. It supports research, offers training in data science in AI, and contributes to public and policy debates about data science and AI. It also plays a role in international engagement in AI research.
Canadian Institute for Advanced Research (CIFAR)	CIFAR is a charitable organisation that supports interdisciplinary research collaborations, through the appointment of fellows and award of research grants. It aims to create a network of researchers from across Canada and the world, committed to producing excellent research.
Vector Institute	Vector is funded by the Government of Canada (via CIFAR), the Government of Ontario, and through support from approximately 40 companies. It works to lead AI-based innovation in Canada, by helping develop skilled researchers and to support innovation clusters, while creating a community of researchers.
Cyber Valley	Cyber Valley is a research network consisting of the Max Planck Institute for Intelligent Systems, the University of Tübingen, the University of Stuttgart, and industry partners from: Amazon, BMW Group, IAV GmbH, Daimler AG, Porsche AG, Robert Bosch GmbH and ZF Friedrichshafen AG. Supported by the State of Baden-Württemberg, Cyber Valley seeks to coordinate research activities in AI across these partners, establishing new research groups and professorships in machine learning, robotics, and computer vision, and training up to 100 doctoral students.
Examples of collaborations within or between countries	<ul style="list-style-type: none"> • The Joint European Disruptive Initiative (JEDI) is a Franco-German collaboration seeking to advance 'moonshot' research collaborations, in a manner similar to the US agency DARPA. • The Paris Artificial Intelligence Research Institute (PRAIRIE) is an industry-academia collaboration aiming to boost the contribution of Paris-based AI labs to international research.

A vision for European AI

If it is to remain at the leading edge of research in data-driven AI, Europe will need structures and initiatives to advance collaboration across its centres of excellence. These would seek to attract AI talent to Europe, support research breakthroughs, and create the conditions in which the benefits of AI can be shared across society. Such structures or initiatives could seek to drive action in the following areas:

Build a well-founded public dialogue

Across Europe, there are examples of how public debates about the place of science in society can shape the development of research. In the UK, for example, widespread public support for the development of embryology and its subsequent application in fertility treatments is generally considered to be the result long-term engagement between scientists, policymakers and publics to develop mutual understandings of the potential of embryological research and its potential social impacts.

Many people already interact with AI-enabled systems on a daily basis, but experience of other emerging science and technology issues shows that early adoption does not guarantee continued support by all or most of the public. Continued public confidence will be important to the continuing success of AI, and to realising its benefits across industry sectors. A well-founded public debate, based on continued engagement between AI researchers and the public, will be important in shaping the development of AI technologies.

Develop and retain talent

As the demand for those with advanced AI skills increases across businesses and academia, a key challenge is to develop and recruit skilled individuals, and to ensure that Europe remains an attractive place for them to build their careers.

Many national governments are providing financial support for additional PhD places. As the structures to train these students develop, there may be opportunities for collaboration across Europe, for example developing exchange programmes or summer schools that help build capacity in core areas, such as embedding ethical or rigorous research practices.

Flexible hiring practices can also be important in helping institutes attract researchers in areas of high demand. This might involve new approaches to working across industry and academia.

Interface and collaborate across the public and private sectors

European AI research has been successful in attracting interest from major global technology companies, and many countries are putting in place policies to support start up communities and existing businesses seeking to make use of AI. For those working in AI research in academia, collaborating with industry partners can offer exciting opportunities to pursue new research directions, to access data or compute power to create advanced AI systems, or to see their research have impact 'outside the lab'.

Many research institutions have already developed models of collaboration with industry. Joint appointments, for example, allow researchers to divide their time between academic and industry research settings, enabling those researchers to continue their work in developing and applying AI, while also training a new generation of researchers. In some cases, Technology Transfer Offices are also developing new approaches to managing Intellectual Property, in order to support translation of AI research and support local economic growth. Better understanding the current models of industry-academia collaboration could help support further collaborations, and spread best practice.

In addition to developing new interfaces with industry, AI research could also benefit from new collaborations with the public sector and with other academic disciplines. The application of AI in healthcare, for example, is an area of significant interest for many governments. Healthcare and bioscience research are also areas where there are high quality data stores, the value of which could be leveraged by modern AI techniques to generate new insights or research directions. There may be valuable strategic partnerships with research organisations operating in this space.

Advance research in key areas

Fundamental to the success of AI in Europe is the ability to pursue leading-edge AI research. For some areas of research, this might require access to infrastructure – namely, compute power – or data. Investment in research and collaborations across sectors can facilitate this.

As AI technologies advance, a new wave of research questions is emerging, which falls at the intersection of science and society, including:

- Research relating to the effectiveness of AI systems, for example around the robustness, fairness, and interpretability of AI;
- Research to develop applications in areas of societal interest, for example in healthcare.

Further articulating these areas as exciting research missions could help inspire a new generation of AI research. Advancing research in these areas could help ensure that high quality AI research continues to have a strong home in Europe, that AI technologies develop ethically, and that their benefits are shared across society.

Participant list

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