A European Vision for AI

Call for the Establishment of a Confederation of Laboratories for Artificial Intelligence Research in Europe (CLAIRE)

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Find additional information about this initiative at claire-ai.org.

1. The Need for a European AI Strategy

Artificial intelligence (AI) methods and technologies are posed to bring transformative change to societies and industries world-wide. The game-changing nature of AI and its role as a major driver of innovation, future growth, and competitiveness are internationally recognised. As a result, AI is at the top of national and international policy agendas around the globe.

In the United States of America, huge investments in AI are made by the private sector, and a substantial governmental plan was launched in 2016, which includes significant long-term investments in AI research [1]. Similarly, in 2017, the Canadian government has started making major investments in AI research, focusing mostly on existing strength in deep learning [2]. In 2017, China released its Next Generation AI Development Plan, with the explicit goal of attaining AI supremacy by 2030 [3].

However, in terms of investment in talent, research, technology and innovation in AI, Europe lags far behind its competitors. As a result, the EU and associated countries are increasingly losing talent to academia and industry elsewhere [4]. Europe needs to play a key role in shaping how AI changes the world, and, of course, benefit from the results of AI research. The reason is obvious: AI is crucial for meeting Europe's needs to address complex challenges as well as for positioning Europe and its nations in the global market.

Europe has started to react: In April 2018, 25 countries pledged to increase national research funding for AI as part of a common "European approach" [5]. In parallel, the European Commission laid out a preliminary plan for strengthening AI across Europe [6], realising that more focussed instruments are needed beyond those planned in H2020 to turn the tide and *achieve the research and innovations we need, and on the scale we need*. This urgent sense of need for action was also clearly expressed in a recent open letter by a number of AI researchers, who proposed a European research centre in machine learning and related areas of AI [7].

In the following, we outline a proposal that builds on and expands on these initiatives, and, we believe, is necessary to meet their objectives. In particular, we strongly support the ambition and vision

articulated in the recent EC Communication [6], and we endeavour to present a specific approach to realising it.

2. All of AI, all of Europe, with a Human-Centred Focus

There is a pressing need for increasing Europe's strength and position in the area of AI research. Based on extensive discussions within the community of European AI researchers, following the recent EC Communication on AI [6], a strong consensus has emerged on key aspects of a coordinated European research effort.

In particular, a broad and ambitious vision is needed for European AI research to thrive and for Europe to stay competitive with other major players. The research and innovation efforts required in this context should encompass all of AI, and include all of Europe. Furthermore, by building on our existing strength in AI and commitment to European values, Europe should take a human-centred approach to AI.

> We call for a vision that aims to **(1)** have **European research and innovation in artificial intelligence be amongst the best in the world**, that **(2)** encompasses **all of AI and all of Europe**, and that **(3)** has a **strong focus on human-centred AI**.

The best in the world. In order to meet Europe's challenges and to secure markets, European research and innovation needs to be among the best in the world. The good news is that Europe is very well positioned: We have a strong tradition of excellence in all areas of AI, and many of the top European researchers are recognised as leading figures within the AI community and related fields of research and technology.

All of AI. Artificial intelligence comprises a broad spectrum of methods and techniques, each with their own important applications. While recently, advances in machine learning techniques have enabled rapid progress across many areas of AI, future applications of AI will increasingly leverage combinations of AI techniques. It is therefore crucial that Europe builds on its existing strengths across the full spectrum of AI, covering all of machine learning, knowledge representation and reasoning, search and optimisation, planning & scheduling, multi-agent systems, natural language processing, robotics, computer vision, and other areas.

A broad view of AI that includes all areas within the field is essential to meet the challenges that lie ahead of us, especially in human-centred, ethical AI, where explanations and deep understanding (of natural language, images, etc.) are essential to achieve trust between humans and machines, and to thus obtain the best solutions to the problems we face as individuals and societies. Moreover, AI researchers need to adopt a multi-disciplinary approach and work with experts from other areas, not only from mathematics, engineering and the natural sciences, but also with social scientists.

All of Europe. Human talent is already a limiting factor in AI research and development in Europe. For a European initiative to succeed, it needs to attract, educate, and harness talent, and drive innovation

across the continent, leveraging the strength in AI currently found in many European countries, and ensuring diversity and inclusion across languages, cultures and gender. It is therefore of key importance to foster AI excellence across Europe.

Human-centred AI. Artificial intelligence increasingly enables new forms of production, services, and medical treatments, but may also lead to increased bias, inequity, manipulation, invasion of privacy, and job loss [8]. We believe that responsible AI research and deployment should be strategically focussed on augmenting human capabilities, rather than replacing them, on compensating for human bias and limitations, and on serving and protecting the human and ethical values that are of core importance to European societies [9]. Research on AI in Europe thus needs to understand, anticipate, and address ethical, legal and social aspects (also known as, and in EU's Framework Programmes usually referred to as, Responsible Research and Innovation, or RRI).

As AI scientists, we are keenly aware that AI is a disruptive set of technologies. Consequently, we need to act at the European level and issue a set of principles and guidelines regarding the responsible use of AI - similar to what physicists did in 1955 with the "Russell-Einstein manifesto". This **"AI manifesto" should stipulate limits of responsible use and anticipate the consequences of deploying specialised AI systems as well as of creating general, human-level AI**. It should also define how to quantitatively and qualitatively assess whether AI systems or agents comply with those limits. We believe that European AI researchers are in an ideal position to play a leading role in an ambitious, global effort to address these issues and have a responsibility to exercise leadership in this area.

3. A Confederation of Laboratories for Artificial Intelligence Research in Europe (CLAIRE)

The discussions within the community of European AI researchers have also led to a clear understanding that Europe needs not only to increase its research activity level, but also to coordinate better and collaborate more closely. This requires investment in both outstanding AI research and in structures that allow effective collaboration and transfer of results. In particular, major actions are required to develop and retain key talent and expertise in AI, and existing strength needs to be leveraged and expanded.

Specifically, we call for the establishment of a **Confederation of Laboratories for Artificial Intelligence Research in Europe (CLAIRE)**, comprising a network of centres of excellence, strategically located throughout Europe, and a new, central facility that serves as a hub, providing state-of-the-art infrastructure, and fostering the exchange of ideas and expertise.

To be effective in meeting the above vision, CLAIRE should consist of the following key elements:

- A collaborative network of relevant existing and new research labs and organisations across Europe. Under the leadership of some of the top researchers in the field, this network should

jointly identify fundamental research questions, discuss the most promising approaches, and help organise collaborative efforts to address them.

- A selection of some of these research labs, located strategically throughout the European Economic Area and EFTA, to be designated “Centres of Excellence in AI”, should play strong regional or national roles as hubs for the members of the collaborative network in their region.
- A new facility that serves as a highly visible and vibrant focal point for the collaborative network, the “CLAIRE Hub”. Here, excellent scientific personnel at all levels and from all partners would find an outstanding research environment for AI, where they can work together, face-to-face, for periods of time (e.g., an extended version of the highly successful Leibniz Centre for Informatics in Dagstuhl, Germany). This hub should provide cutting-edge infrastructure and support, but would not have permanent scientific staff.

This is a model that builds on existing strengths, brings together the still fragmented AI research activities and expertise in Europe, while at the same time creating centres of excellence and a structure that can efficiently focus research and distribute results.

Our vision for CLAIRE is in part inspired by the extremely successful model of CERN [10]. CERN’s research activities rely on distributed, collaborative efforts of many physics laboratories across Europe that jointly define the research questions, discuss how to address them, and then collaboratively develop the experiments and publish the results. This network is supported by a central facility, a joint working environment, and a distributed research infrastructure for collaboration and data sharing.

In other aspects, CLAIRE will differ from CERN: Despite the central facility, its structure will be more distributed, as there is less need for reliance on a single experimental facility. It will also have much closer collaboration with industry, to quickly and efficiently transfer new results and insights. Similar to CERN, the suggested structure will allow for the establishment of a common, well-recognised “trademark” for high-quality European AI research. As can be seen with CERN, research gets much wider exposure by being associated with a "trademark" like CERN, without diminishing the scientific reward for the individual researchers and their laboratories.

4. How CLAIRE can Ensure the Success of European AI

While deliberately refraining from defining details of the organisation and financing of the proposed Confederation of Laboratories for Artificial Intelligence Research in Europe (CLAIRE) at this early stage, we believe that the following ideas and concepts are important to ensure its success:

Wide range of applications. CLAIRE should support AI research that is expected to have major short-, medium- and long-term impact across a wide range of application areas, including efficient and safer transportation, advanced healthcare, smart industry, effective and sustainable agriculture, accelerated scientific research, and others. In order to have a significant impact on applications, funding should be targeted towards existing scientific strengths, novel research opportunities and key European interests. CLAIRE should also put in place suitable mechanisms to engage with industries and collaborate with them on defining and tackling applications in various sectors.

Social impact. CLAIRE should also conduct AI research that aims at resolving some of the open issues regarding the social impact of AI, such as fairness, transparency, explainability and value alignment, with a clear focus on building trustworthy AI that is beneficial to people and aligned to European values.

Attracting talent. Funding should be focussed on existing strengths and support attractive fellowships for Master students, PhD candidates and post-doctoral researchers, as well as exceptional junior, mid-career, and senior researchers, using efficient, light-weight but solid scientific reviewing and allocation processes. The aim should be to attract the best talent from all over the world.

The CLAIRE Hub. The CLAIRE Hub should be created to provide a visible, vibrant center for AI research in Europe. This facility should comprise a large, state-of-the-art data and computer centre, cutting edge robotics laboratories, test facilities for key application areas, such as autonomous transportation, advanced agriculture and automated scientific experimentation, usability labs, and others. It should have outstanding support staff, including programmers, usability and interface experts, and hardware technicians. The centre should also maintain a repository of datasets open for researchers across Europe. We do not envision the CLAIRE Hub including permanent research staff, but rather as hosting affiliated researchers and visitors (including researchers on sabbatical / study leave) at all levels of seniority for limited periods of time to exchange ideas, work on projects, and jointly use infrastructure only available there.

Strong infrastructure. The CLAIRE network should be supported by strong infrastructure in terms of computing, big data storage (including long-term storage and secure storage for sensitive data), and networking as well as infrastructure for maintaining joint AI platforms and services. It needs to be able to support large-scale AI research that can compete at the level of large private entities, while focusing on areas specifically relevant for Europe. Collaborations with existing initiatives, such as GÉANT or the new EuroHPC, will be essential.

Fostering talent. The central facility should run summer schools, seminars, public outreach activities and workshops at the highest scientific level and from all areas of AI. A special focus should be on identifying and supporting as early as possible the best emerging AI talent across Europe.

Centres of Excellence. The distributed Centres of Excellence in AI should become highly visible and vibrant regional environments. Excellent scientific personnel and students receive secondary appointments and spend part of their time at the central hub or in other centres of the network. The Centres of Excellence would benefit from (i) outstanding research infrastructure that encourages collaboration across many areas of AI, (ii) state-of-the-art collaboration infrastructure, such as conference and working environments, (iii) an innovation infrastructure that facilitates industry collaboration and entrepreneurship, including pre-incubators, innovation advisors, and well-developed relationships with governmental innovation support and investor organisations.

Supporting collaboration. To stop the current level of brain-drain and attract the best talent, CLAIRE should provide considerable support for exchange and interaction of researchers at all levels of seniority, across all areas of AI. The CLAIRE Hub should provide a focal point for such exchange and interaction. There should be considerable incentives to establish joint research projects among

researchers in the network, under the lead of top researchers in the field. CLAIRE should provide support for developing and running high-quality study programmes focussed on AI.

Because top researchers produce excellent results with high consistency, a substantial part of the funding should be allocated based on track record (e.g., similar to the Reinhart Koselleck funding[1] in Germany for excellent researchers, which is based on 5-page proposals for up to 1.25 M€) rather than the need for extensive research proposals. Of course, substantial funding opportunities also need to be provided for talented junior researchers without a long-standing track record.

While the individual researcher needs to enjoy full academic freedom, the community as a whole would greatly benefit from a more coordinated approach to guiding European AI research. Other disciplines, e.g., physics, have long provided excellent examples for this. To that end, CLAIRE would establish a scientific process through which fundamental research questions, the most promising approaches to their solution, and key steps to implement them would be identified and regularly updated. The process would combine top-down and bottom-up mechanisms, leveraging guidance from top European scientists that are highly trusted by the community, as well as new ideas from outstanding members of the community, including rising stars.

The scientific discussions that form the basis of this process will offer a unique opportunity to strengthen, focus and coordinate European AI research, while offering a solid basis for developing guidelines for industry, politics and the general public. In parallel, CLAIRE would organise and drive similar discussions regarding both the requirements of European industries as well as the benefits, social consequences, and key European values that should define and drive a European approach to AI. The open and well-founded discussion between science, industry, and society will be a key element of CLAIRE.

5. Realising the Vision

Obviously, many details of our vision for CLAIRE remain to be specified, and we strongly believe that this should be done based on further discussions with members of the European AI community and other stakeholders. Yet, given the global competition, CLAIRE (the distributed "CERN for AI") should be created as quickly as possible, to maximise retention of critical AI talent in Europe and to start defining and focusing a joint European AI agenda.

A number of activities in that direction have already been started: The "Humane AI" proposal for an EU Flagship project on AI has just progressed to the second phase, together with two other proposals in the AI context: robotics and language technology. Several proposals for a European AI-on-demand platform are currently under review (ICT-26), with the goal of starting work on a software platform supporting AI research and development throughout Europe later this year. The EC Joint Research Centre has also started to devote significant attention to AI. In addition, many member states have ramped up their AI

[1] http://www.dfg.de/en/research_funding/programmes/individual/reinhart_koselleck_projects/index.html

research programmes and platforms, including large cross-national AI initiatives, such as the planned French-German collaboration on AI. Again, most of them highlight the need for human-centred AI and share the core vision of CLAIRE.

Finally, we note that the previously mentioned open letter [5] calling for substantial investment in machine learning research in Europe, with a focus on excellence in fundamental research, is well-aligned with our vision. All these initiatives form a strong basis for the larger vision of CLAIRE, which unites and strengthens AI across Europe.

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