Position Paper

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The use of artificial intelligence in research

Unlocking its full potential

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The Guild
of European Research-Intensive Universities

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The use of artificial intelligence in research: Unlocking its full potential

Introduction

Artificial Intelligence (AI) is rapidly being developed and becoming pervasive in human activities, creating momentum for policies to harness its benefits and address the challenges of its increasing adoption. At the same time, with the reaffirmation of its strategic importance by the Commission President's Political Guidelines in July 2024 and the adoption of the European Union AI Act shortly after, there is a strong push for Europe to become a global leader in AI innovation while ensuring AI's human-centric and trustworthy nature[1]. This balance is vital for safeguarding societies and economies while leveraging AI's benefits for Europe's long-term competitiveness and resilience.

The pervasiveness also reached universities, where AI is used by teachers, students, researchers, and administrative and technical staff, leading to discussions about its positive and negative impact. The Guild emphasises that while concerns about potential misuse and adverse effects are valid, they should not significantly overshadow AI's potential to enhance research productivity and quality. The OECD[2], the Commission[3] and its Scientific Advice Mechanism[4] have underscored that if used responsibly, AI could assist researchers with various research activities, including literature review, hypothesis formulation, data analysis and visualisation, experiments, and results dissemination. By accelerating the productivity of research, AI could help push the boundaries of knowledge and make breakthrough discoveries, potentially contributing to solving complex scientific and societal challenges.

We welcome the Commission's commitment to promoting and boosting the responsible use of AI in science. To this end, The Guild created a task force to showcase institutional strategies and initiatives for using AI in all research activities, as presented in this paper. The document formulates recommendations, emphasising the need for more research on AI, especially in universities, to use AI more responsibly in research and to contribute to ongoing policy discussions on relevant EU policies.

In particular, we recommend the need for universities, national funders and the European Union to:

- Advance research on AI to enable AI in research. This requires strengthening fundamental research on AI (recommendation 1) and strengthening the use of AI in cross-disciplinary research (recommendation 2).
- Develop and strengthen skills for using AI in research and foster talent (recommendation 3) and

- Optimise the creation and use of computing infrastructure and data (recommendation 4), as data availability is vital for understanding the opportunities for sharing data. Equally, the availability of and access to sustainable computing infrastructures is essential, and the benefits and challenges of centralised and decentralised access need to be weighed.

Challenges posed by AI may differ across research areas. The recommendations comprehensively address research, noting that discipline-specific recommendations could complement them. Finally, the recommendations support the use of responsible AI in research. While this paper does not aim to define this concept, The Guild re-asserts its commitment to further engaging with the Commission for this exercise and identifying appropriate enforcement mechanisms.

Advance research on AI to enable AI in research

Significant investments are needed to develop AI for research because existing AI tools potentially have limitations that could hamper their responsible use in research. The following sections elaborate on these limitations.

Lack of off-the-shelf AI systems appropriate for research purposes

Researchers engage in varying degrees in adopting or developing AI tools for research, ranging from modifying off-the-shelf tools to developing new methods and tools for training or applying them. Researchers adapt existing AI tools to their needs in between these two approaches.

When none of the existing AI tools fit the specific needs of researchers, new tools must be developed. Existing algorithms may need to be adapted for research and other research-related activities and for responsible use. The EU's objective of human-centric and trustworthy AI requires a better understanding of the implications of AI in terms of safety, trust, efficiency, and explainability, as well as improving the performance of existing and future AI tools.

While Europe needs to catch up with other global players in AI development, it should spearhead research on the development of trustworthy, explainable, and sustainable AI systems to strengthen its leadership and competitiveness. In line with such a European approach to AI, universities and researchers in Europe must also be enabled to transparently review and test the existing AI algorithms, thereby ensuring that these can be used in research.

Predominant commercial interests

Technology companies outside Europe have developed many existing AI tools, potentially resulting in drawbacks for researchers, particularly in Europe. The OECD highlighted that industrial players' predominant role in AI's most recent developments has been narrowing down diversity in AI research and shifting the focus away from the development of applications which could have higher societal impacts. Similarly, the Commission's Group of Chief Scientific Advisors warned that the AI tools developed for commercial purposes may not be appropriate for research. Also, because these tools were developed or are hosted outside Europe, they do not systematically comply with the EU legal framework, preventing their responsible use in Europe.

Lower representation of European language data

Most existing large language models (LLMs) have been predominantly developed and trained using English, which limits their relevance and performance in non-English contexts. Because Europe is a place of many languages, it needs LLMs working on more, if not all, languages for their application in research projects, especially in social sciences, arts, and humanities. The recently launched EU initiative, the Alliance for Language Technologies (ALT-EDIC), attempts to address this challenge, by increasing the availability of Large Language Models of European language, improving European competitiveness while upholding Europe's linguistic diversity and cultural richness[5]. Contrary to similar initiatives, such as the Language Data Space (LDS)[6], which the Commission coordinates, the ALT-EDIC is coordinated by the French Ministries of Culture and Economy and receives financial and in-kind contributions from participating Member States[i]. While EU initiatives of similar scope and aims are welcome, ensuring the appropriate use of financial and human resources is important, particularly as both initiatives are publicly funded.

To this end, significant investments in AI research, including fundamental AI research, are essential to advance AI and enable its responsible use. By prioritising investments in the abovementioned fields, Europe can enhance its leadership in AI, driving innovation and maintaining competitiveness on the global stage.

Promote and facilitate cross-disciplinary research collaboration

Research-performing organisations, including universities, should facilitate and promote cross-disciplinary collaboration to use AI tools in research to strengthen the following points:

Collaboration for developing AI tools for research

Developing new AI tools often needs to be cross-disciplinary and cut across areas such as machine learning, statistics, mathematics, computer science, language technologies, logic and computer vision. Social sciences, arts and humanities also have a significant role in improving our understanding of the impacts of AI tools: these disciplines, among others, reflect on the responsible use of AI and ensure that it complies with Europe's legal framework and principles of human-centrism, human rights, and trustworthiness. They can also bring the necessary expertise to promote multilingualism and multiculturalism in LLMs. Therefore, we call for increased investments in mono-, inter-, and trans-disciplinary research on AI.

The openness of AI models, the code (in the sense of open source), and the data used is crucial for their verification, uptake in the academic communities, and acceptance. It also holds producers accountable. This implies the availability of clear documentation

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i - Coordinated by France, the ALT-EDIC counts sixteen Members States: Bulgaria, Croatia, Czechia, Denmark, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Slovenia and Spain; and seven observing Member States: Austria, Belgium, Estonia, Malta, Portugal, Romania and Slovakia

(model cards) that describes the training process, the data used, and the limitations of the models.

Cross-disciplinary collaboration to support the use of AI in research

AI researchers should not be seen as merely supporting other researchers in using AI. Their involvement in defining research questions, developing methodologies, and analysing data, among other research tasks, is determinant in leveraging the potential of AI tools to make discoveries. In view of making Europe more attractive to AI talents (including in research), it is crucial to recognise and value their contributions to research projects and related publications.

Collaboration between AI researchers and researchers from other disciplines, such as natural sciences, physics, chemistry and biology, is important as AI is fundamental to all these fields. AI research must, therefore, be strengthened in these areas. Some research projects require support from AI experts but offer few opportunities to advance research on AI. To support AI researchers assisting other researchers, their contribution to research excellence, even outside their expertise area, should be recognised appropriately in their evaluation. Research assessment systems should provide incentives for cross-disciplinary collaboration and research support activities (such as AI consultancy) while focusing on research quality and impact first and foremost.

In addition to AI researchers, engineers and other research assistants may provide support for using AI tools in research. They bring crucial technical expertise in developing, training, and running algorithms for specific research projects. Recognising and valuing the contributions of engineers and research assistants is vital to promote cross-disciplinary collaboration.

That said, there are a growing number of excellent examples from members of The Guild from which the wider sector and policymakers can take inspiration on how to foster interdisciplinarity in AI:

Examples of The Guild members - Interdisciplinarity in AI

- Researchers could access AI tools and AI expertise to apply in specific research projects, for which they may also get dedicated funding: Data Science Lab at the University of Bern.
- Creating research centres with the precise objective of exploring the use of AI in specific research domains, among others, the Pioneer Centre for Artificial Intelligence, co-led among others by Aarhus University, the Jagiellonian Human-Centred Artificial Intelligence Lab, the Estonian Centre of Excellence in Artificial Intelligence, and Centre of Excellence for Personalised Medicine led and co-led by the University of Tartu, and the Excellence Cluster Machine Learning: New Perspective for Sciences at the University of Tübingen.

- Creating cross-disciplinary AI research teams: The Alma Mater Research Institute for Human-Centred Artificial Intelligence at the University of Bologna, the Centre for Data Science & AI at the University of Glasgow, the upcoming Centre of Excellence in Artificial Intelligence for Digital Humanities at the University of Ljubljana[ii], the Paris Artificial Intelligence Research Institute (PRAIRIE) jointly run by Université Paris Cité and Université PSL plus other French research institutes, the Centre for Studies in Artificial and Natural Intelligence (CeSANI) at Pompeu Fabra University, AI4Research at Uppsala University, and the University of Warwick's Centre for Applications of Mathematical & Computing Sciences (CAMaCS), which aims to identify ways to increase impact of AI in real-world applications.
- Democratisation of AI, machine learning, and data science through open, visual, and easy-to-use tools, such as Orange Data Mining at the University of Ljubljana.

Incentives for collaboration

Institutional incentives for cross-disciplinary collaboration and the use of AI tools for research should also include financial support for one-off initiatives to increase awareness about and understand AI's potential for research and facilitate the collaboration between AI researchers and non-AI researchers. Such support could consist of seed funding for research collaboration, funding for research projects, and financial support for the organisation of, as well as participation in workshops, seminars, summer schools, and the like. Therefore, we call on the Commission to strengthen existing and future funding structures to target cross-disciplinary projects and financial support for educational events to enhance knowledge sharing and skills development.

ii - The initiative is supported by the EU ERA Chair Programme and officially starts on 01 February 2025.

Develop and strengthen skills for using AI in research and foster talent

The cross-disciplinary dimension of research projects using AI tools also requires researchers on both sides to have the right skills and mindset to collaborate. Other required skills are more specific to the use of AI in research. Domain researchers need a basic understanding of AI tools and their potential for their respective research projects to choose research questions and adequately design their methodologies. It is crucial that these researchers also acquire minimum mathematical and statistical abilities, as well as data science and data analytic skills, to assess the models underpinning AI applications for research and accurately and critically interpret their outcomes. Finally, researchers need to be aware of the ethical and epistemological implications of using AI in the very context of their research.

The more researchers contribute to developing or adapting AI tools for research, the more computational thinking, problem-solving, and high-performance computing skills they need. These skills are sometimes required to use certain AI tools, adapt existing tools to the specific needs of research projects, or even perform related tasks, such as developing open (source) libraries.

Developing these skills among students and researchers requires the provision of dedicated training programmes by universities and other education providers. This offer can be embedded in existing degree or stand-alone training programmes (possibly with micro-credentials):

Examples of The Guild members - Training programmes

- The Erasmus Mundus joint Master in AI is run by the Universities of Ljubljana, Pompeu Fabra University, Radboud University, and Sapienza University in Rome. It provides a comprehensive framework of theory and practice in AI and gives students the foundational knowledge to explore key contextual areas and complex technical applications of AI systems.
- The African Institute for Mathematical Sciences runs a master's degree programme on AI for Science, targeting students who already have a strong computational and mathematical background. The challenge is, nevertheless, to provide a minimum level of programming skills and understanding of AI technologies and their underpinning algorithms to ensure that all researchers – regardless of their background – make responsible use of AI tools.

- The Research Institute on Artificial Intelligence, Virtual Reality, and Robotics at Babeș-Bolyai University has developed two master's programmes in AI: Applied Computational Intelligence and Data Science for Industry and Society. Additionally, a bachelor's programme in AI has been established that integrates scientific and professional training within the "scientist-practitioner" paradigm, equipping students for advanced studies at the master's and doctoral levels and entry into the workforce. Collaboration between the Faculty of Computer Science and other faculties makes the programme interdisciplinary. It also receives support from industrial partners, who provide educational guidance and access to necessary resources.
- The Africa Europe Cluster of Research Excellence on AI (CoRE-AI) is experimenting with online masterclasses on AI and computational thinking. These masterclasses intend to provide participants (PhD and Master's students) with a better understanding of the latest developments in AI, their underpinning mathematical theories, their ethical implications, and conditions for responsible use. These masterclasses have the added value of forging more equitable, long-term partnerships for a broader scope of cutting-edge AI-related research, intending to address challenges facing societies on both continents.

Europe needs to attract and retain more talent to develop and adapt AI tools and use them for research. These talents include researchers and AI-capable digital specialists such as data engineers, data scientists, software engineers, cybersecurity experts, and system administrators. At the same time, Europe must develop new collaborative partnerships with the Global South, including Africa, where increased research capacity comes through brain circulation and mutual capacity-building.

The Guild highlights that higher and more stable investments in (digital) research will significantly make research careers more attractive. This also requires consideration of the need to offer competitive remuneration compared to the private sector. It is also important to stress that an added value of academic careers compared to research careers in industry is the freedom to define research questions, choose and develop theories, and employ methods critically. Hence, it is crucial to safeguard academic freedom to keep attracting AI talents to universities.

Increase access to computing and data

The uptake of AI in research requires new digital infrastructures and higher computing capacities to develop, train, and run AI tools. While acknowledging the potential benefit of a large and centralised AI infrastructure for research, as highlighted by Commission President Ursula von der Leyen's proposal for a European AI Research Council inspired by CERN, we underline the need to make computing facilities more accessible to researchers across Europe. This is crucial not only to accelerate the uptake of AI techniques in research across disciplines, institutions, and countries but also to train a maximum number of researchers and ensure they acquire the skills they need to

encourage responsible use of AI, which is also vital. The Guild urges that the Commission and the EU Member States provide universities with increased support to acquire and/or secure access to computing power to both train and run AI algorithms for research.

Furthermore, all hardware and other infrastructures researchers use to train and use AI for research must demonstrate high cybersecurity and energy efficiency while remaining accessible to a maximum number of researchers. Universities investing in computing facilities must also ensure they have the necessary organisational and administrative capacities to provide and operate the infrastructure for AI technologies and their operations. This decentralised approach should not prevent the bundling of computing capacities where relevant, including for training new LLMs. Therefore, we regard as relevant the proposal of the Commission's Group of Chief Scientific Advisors to set up a state-of-the-art distributed facility for research with AI "that complements, coordinates or liaises with existing bodies and develops new nodes depending on the changing needs".

To address this concern, the Commission President prioritised to ensure access to new, tailored supercomputing capacity within the first 100 days as part of the AI Factories initiative. This initiative aims to provide additional financial support to Member States if they acquire new or upgrade existing supercomputer structures with AI capabilities. The Guild insists this new initiative is also targeted at the wider research community, as with the European High-Performance Computing Joint Undertaking.

Furthermore, existing rules on data access at the EU or national level may also hamper the uptake of AI in research. While we fully endorse the need to protect privacy to ensure the highest standard of research ethics, we call for better access to data – including personal data, such as socioeconomic or health data and data held by for-profit private entities – for research purposes[7, 8, 9]. The Commission must provide a consistent and balanced regulatory framework that balances copyright requirements and the ability to access and re-use data for research purposes. We welcome its proposal for data spaces, such as the European Open Science Cloud and the European Health Data Space and insist that researchers' needs drive them.

While digital infrastructures can support the EU's carbon neutrality goals outlined in the European Green Deal, their maintenance is costly. This is partly due to rising energy prices, high energy consumption, and the private sector's demand for specific hardware, particularly graphic processing units. These factors directly affect the affordability and availability of computing resources for researchers across Europe. Investments should focus on developing energy-efficient algorithms and digital infrastructures to align the green and digital transitions. Additionally, data collection, storage, and analysis solutions are needed to help researchers minimise the environmental impact of the AI tools they use[10].

Conclusion

The rapid development and integration of AI across various sectors, including academia, presents opportunities and challenges. The Guild supports the responsible use of AI to enhance research productivity and quality, recognising its potential to drive significant scientific and societal progress. By fostering fundamental AI research, investing in energy-efficient technologies, and addressing the unique challenges across different research disciplines, including the training and retention of talent, AI can contribute positively to Europe's long-term competitiveness and resilience. We remain dedicated to collaborating with the Commission to promote responsible AI in research use and develop effective enforcement mechanisms.

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