By email: DigitalEconomy@industry.gov.au

26 July 2023

Australian Academy of Science submission on
Supporting responsible AI: discussion paper

Use of AI and AI tools in science is an opportunity to accelerate discoveries and boost economic growth. However, it is crucial for Australia to prepare itself, as waiting to observe the impact of AI on science is not a viable option.

Investment in AI is not optional; it is essential to safeguard the future of Australian research and sovereign capability. Government investment should focus on fundamental AI research and the means to build collaboration – between the disciplines, scientists, users – including business and government. It means supporting the development of a suitably skilled workforce.

The Academy makes the following recommendations:

- The government must take leadership by developing a national strategy and guidelines for the responsible use of AI in research and development.
- Sovereign high-performance computing facilities must be supported with planning and investment to enable an AI-driven scientific endeavour.
- The government should establish an open science strategy to prepare Australia for uptake of AI.

Government leadership

Australia is in a productivity slump. AI could boost economic productivity significantly - generative AI tools are estimated by the Technology Council of Australia to deliver between $45 and $115 billion of value to the Australian economy annually by 2030. Currently, AI is the only technology poised to contribute so significantly to productivity.

The risk of failing to act is loss of sovereign research and development capacity. The government needs to take leadership in preparing our science sector.

The areas where Australia excels – including ecology, medicine and agriculture – will be disrupted by AI. These fields encompass critical research about Australia for Australians. If we fall behind global capability because we have not developed the fundamental AI research to drive these areas forward, the health and wealth of Australia's existing research effort will suffer.

Without guidance on how researchers should use AI tools, such as generative AI tool ChatGPT, there is a risk of misuse. An incident involving peer reviewers for Australian Research Council grants using ChatGPT to evaluate research proposals resulted in the prohibition of generative AI in the ARC's grants programs. This highlights the critical necessity for clear guidelines for researchers that may look to AI tools to assist with administrative tasks.

These guidelines will also be required as researchers increasingly begin to collaborate and use AI in their research.

Australian researchers need to be engaged in the development of guidelines that outline how they can use these tools to maximise the benefits without compromising the role of expertise, human judgement and the peer review process.

Misinformation and trust in science

The ease of access to generative AI tools has risen sharply in the past year. Generative AI tools can produce outputs that are incorrect or misleading – known as 'hallucination'. There are limitations in how these tools can cite genuine sources to provide sufficient reasoning for their results. Currently, these tools can invent references when asked, with potential problematic impacts on democratic discourse and research integrity.

Artificially generated content could also be misused in democratic processes. Generative AI tools can generate high-quality, cheap and personalised content, including for harmful purposes. Tools built on these models are already in use to generate deep fakes (high-quality artificial images, video and speech for disinformation, including by state actors) that is in many cases, indistinguishable, without special training or technical expertise, from human-generated content. Existing challenges related to the spread of misinformation may be amplified as AI-generated content circulates alongside other information.

While they provide ample opportunities for misuse, the capability of generative AI can also be used to detect harmful or misleading content or as a tool to detect fake research or verify research reproducibility.

Responsible and appropriate use of AI tools will depend on government leadership, and requires a national strategy guided by evidence and research.

Changing infrastructure needs

The amount of computing power used to train AI systems has been doubling every six months over the past decade. Computing infrastructure is a critical enabler for the development and adoption of AI tools.

It is important to ensure access to high-performance computing (HPC) and software for advances in AI and science. The provision of computing resources by large tech companies is helpful, but this has important gaps. For example, it is usually unrealistically expensive for academics to use state-of-the-art HPC and AI computing resources from commercial cloud providers.

Without computing power on our own shores, Australia's AI capability relies on other nations. **The increasing need for sovereign computing power to enable scientific progress is an urgent matter. Australia's future HPC facilities need to be planned for and built now.**

Research productivity

The use of AI also has the potential to accelerate research productivity. Tasks that have previously taken researchers years to complete, such as searching for drug targets or analysing patterns in neural signals, could be performed using AI tools in a matter of hours. Administrative tasks such as writing may be completed twice as fast and made more productive.

Among G20 countries it is recognised that AI can integrate multidisciplinary knowledge can help improve our understanding of human and environmental health and thereby enabling better predictive, diagnostic and management solutions.

CSIRO's Artificial Intelligence for Science report showed that AI is increasingly moving beyond the field of computer science and into other research disciplines. Whether it's discovering new materials or predicting the structure of proteins, researchers in fundamental AI science are in high demand to collaborate with researchers from other disciplines to expand the frontiers of their research.

Researchers in training, Australia's higher degree by research (HDR) students, will need to be prepared for this shift. This does not mean every HDR student needs to learn how to code or become a part-time fundamental AI researcher – but every HDR student will benefit from understanding the fundamentals of AI research. This will allow them to imagine how AI could benefit their research in the future and prepare them for future collaborations.

Multidisciplinary research collaborations are a feature of contemporary AI approaches. Knowledge brokering between organisations, industries and research will need to be encouraged to promote engagement pathways. Successful models such as Interface in Scotland can provide a model for an independent organisation that specialises in brokering relationships between businesses and academics. Barriers to partnerships can be addressed by, for example, harmonising national and international IP arrangements and providing early-stage investment options. The Australian Government's Industry Growth Program could be used to fulfil this opportunity.

Investment in AI should be used as a tool to drive diversification in the Australian economy and to drive economic growth and productivity.

Open Science to promote AI uptake

Australia and the world are producing unprecedented amounts of data, which has the potential to be used by AI tools. However, much of this data is not accessible. Ensuring datasets adhere to the FAIR principles (Findable, Accessible, Interoperable, Reusable) would benefit research and innovation, as well as governance and economic growth. It would also enhance transparency and accountability.

Australia needs an open science strategy and to evaluate how to meet the UNESCO recommendation on Open Science. If data is not available as FAIR and open data, it will limit the progress that could be made across research disciplines because of using AI tools, and the full benefit may not be realised. One example is the application of AI to molecular informatics which is constrained because most of the data used for training and testing deep learning models is not available as FAIR and open data.

Definitions

The definition of machine learning in the discussion paper requires revision. An alternative, derived from the CSIRO definition of machine learning, is:

> *"Machine learning (ML) is a subset of AI where intelligent algorithms are designed to automatically extract important and valuable patterns from data. ML is inherently data-driven, requiring a model (typically a neural network) to be trained on a dataset using a learning process."*

For further information on this submission, please contact Mr Chris Anderson, Director Science Policy (chris.anderson@science.org.au).