

Navigating the Uneasy Interdependence of AI and Open Science

A COAR Statement

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Artificial intelligence (AI) is proving highly disruptive to open science as it becomes both widely used in the analysis and production of scholarly literature and deeply embedded in the public information commons. On the one hand, researchers across all domains are harnessing the power of AI and machine learning to do things previously unimaginable - such as rapidly processing massive datasets or synthesising large corpora in many different languages - greatly accelerating scientific progress and leading to new discoveries. On the other hand, AI is seriously challenging some of the fundamental assumptions on which open science rests, putting the open science ecosystem at risk in ways that demand urgent attention.

Open Science and AI aren't merely complementary, they are structurally interdependent. Open resources are the raw materials for training AI models and for their application; while well-functioning AI tools are increasingly critical for conducting groundbreaking research. Yet AI, as a major consumer of open science outputs, also brings with it attribution problems, the potential for information contamination, and aggressive automated traffic that strains the very infrastructure on which it depends. Left unaddressed, these pressures threaten to reverse much of what the open science movement has achieved.

Three areas of particular concern

Lack of Attribution

Large language models (LLMs), which are now starting to dominate most discovery systems, introduce an intrinsic attribution problem that breaks the chain of scholarly credit and verification. When you ask an LLM a question, it generates an answer by synthesizing patterns from the millions of documents it was trained on. But an LLM does not track which specific sources contributed to which parts of its response. Because of this, authors and institutions are increasingly pushing back on their work being used without consent or attribution for AI training, and this tension seems to be growing.

Misinformation

LLMs do not retrieve facts, they generate statistically plausible text. This means they can produce convincing claims, references, and summaries that have no basis in reality, but that can easily be mistaken for legitimate scholarship. This, along with a steady rise in paper mills augmented by AI-generated fake papers, has the potential to pollute the scholarly information space. And because LLMs are retrained continuously on new

驾驭人工智能与开放科学间的微妙相互依存关系

Coar声明

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人工智能（AI）正对开放科学产生深远影响，其应用范围不仅涵盖学术文献分析与创作领域，更深度融入公共信息共享体系。一方面，各领域研究人员正借助AI与机器学习技术实现突破性进展——例如快速处理海量数据集、跨语言构建大型语料库等，这些创新极大推动了科学进步并催生新发现。另一方面，AI技术也对开放科学核心理念构成严峻挑战，其对开放科学生态系统的潜在威胁亟待引起高度重视。

开放科学与人工智能并非简单的互补关系，二者在结构上具有高度依存性。开放资源是训练AI模型和实际应用的基础素材，而功能完善的AI工具对开展突破性研究愈发不可或缺。但作为开放科学成果的主要使用者，人工智能也带来了署名权争议、信息污染风险以及过度自动化流量等问题，这些因素正对依赖其发展的基础设施造成压力。若不及时应对，这些挑战恐将逆转开放科学运动迄今取得的诸多成果。

三个特别令人关注的领域

归因缺失

大型语言模型（LLMs）如今已开始主导大多数学术发现系统，但其引入的固有归因问题却打破了学术成果的溯源与验证链条。当用户向LLM提问时，系统会通过整合训练数据中的海量文档模式生成答案，但无法追踪具体哪些文献对回答内容的哪些部分作出了贡献。正因如此，越来越多的学者和机构开始强烈反对未经许可或未标注来源就将研究成果用于人工智能训练的行为，这种矛盾冲突似乎正持续加剧。

错误信息

大语言模型（LLMs）并非用于事实检索，而是生成具有统计学合理性的文本。这意味着它们能够产出看似可信的论断、参考文献和摘要，这些内容虽缺乏现实依据，却极易被误认为是严谨的学术成果。加之论文工厂的持续扩张与人工智能生成的虚假论文交织，极有可能污染学术信息空间。由于LLMs需要不断通过新数据进行再训练，这种现象愈演愈烈。

content, errors and fabrications can be absorbed, laundered, and amplified with each successive training cycle, making the problem self-reinforcing over time.

Aggressive Bots

Beyond the integrity concerns, repositories and other data providers are being inundated with aggressive bot traffic, placing serious strain on open science infrastructures. COAR's community resources for “Dealing with Bots” represents a constructive first step in helping repositories navigate this challenge. However, there are currently no ideal solutions, and the problem is already producing a troubling response: a growing number of repositories are erecting barriers to machine access in order to protect their systems - blocking all machine access so that friendly indexing and AI systems can no longer access those resources.

How can repositories respond?

Open science was designed to make the scholarly record more trustworthy, accessible, and impactful. However, the pressures described above threaten to invert that mission, turning openness into a vulnerability rather than a strength. We must work together to develop solutions that maintain the integrity of the scholarly commons, while also remaining as open as possible to ensure that research continues to drive scientific advancements. **The open science ecosystem was hard-won and will not sustain itself without effort. As such, COAR is committed to working with our community and other stakeholders on the steps needed to advance the vision of open science.** As a first step, we recommend the repository community take the following concrete actions:

- **Remain open.** Do not block access to well-behaved machines. Researchers (and others) need access to content in repositories and rely on machines to access that content. Adopt only the measures needed to maintain full operations.
- **Improve trust markers.** Undertake metadata curation, adopt PIDs, link records with related content elsewhere, and encourage your communities to participate in open peer review initiatives that link open peer reviews to repository resources (e.g. publish, review, curate)
- **Keep humans-in-the-loop.** Validate the items being deposited into the repository to ensure they are legitimate contributions
- **Engage with research communities.** Inform the research community about the negative impacts of not sharing their work
- **Contribute content to open source AI models.** Participate in the development of AI systems that are transparent, scholar-led, and that provide clear attribution to original source materials
- **Develop community norms.** Work with partners (scholarly-led or industry partners) to develop the appropriate governance, norms, and practices that ensure the integrity of the scholarly record

内容、错误及捏造信息可在每次连续训练周期中被吸收、洗白并放大，从而使该问题随时间推移呈现自我强化特性。

攻击性机器人

除了数据完整性问题外，存储库和其他数据提供商正面临机器人流量的突如其来的冲击，给开放科学基础设施带来巨大压力。Coar社区发布的《应对机器人入侵指南》为存储库应对这一挑战提供了有益的初步方案。然而目前尚无理想解决方案，问题已引发令人担忧的连锁反应：越来越多的存储库为保护系统安全，开始设置机器访问屏障——通过全面封锁机器访问权限，使得友好型索引系统和人工智能工具无法获取这些资源。

资料库应如何应对？

开放科学的初衷是提升学术记录的可信度、可获取性与影响力。然而，上述压力正威胁着这一使命的实现，使开放性从优势沦为隐患。我们必须携手合作，制定既能维护学术公共资源完整性、又尽可能保持开放性的解决方案，确保科研持续推动科学进步。**开放科学生态系统来之不易，若无持续努力将难以维系。因此，Coar致力于与学术界及利益相关方通力合作，共同推进开放科学愿景的实现。**作为第一步，我们建议知识库社区采取以下具体行动：

- **保持开放。**不要阻止对行为良好的机器的访问。研究人员（和其他人）需要访问存储库中的内容，并依赖机器来访问这些内容。只采取所需的措施来维持全面运作。
- **提高信任标记。**开展元数据管理，采用PIDs，将记录与其他相关内容链接起来，并鼓励您的社区参与开放同行评审倡议，将开放同行评审与存储库资源（例如发布、评审、管理）链接起来。
- **保持人参与决策过程。**对存入存储库的项目进行验证，以确保其为合法贡献
- **与研究界互动交流。**向研究界通报不分享其研究成果所带来的负面影响
- **为开源人工智能模型贡献内容。**参与开发透明、由学者主导且能明确标注原始来源材料的人工智能系统
- **建立社区规范。**与合作伙伴（学术界主导或行业合作伙伴）合作，制定适当的治理、规范和实践，以确保学术记录的完整性