

Generative Artificial Intelligence

A Brief Primer for CARL Institutions

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Overview

Artificial intelligence is transforming how we access, interpret, and make use of information. Recent developments in generative AI, notably the advent of Chat-GPT in 2022, have inspired new applications and consideration within the library realm. The potential uses of generative AI cross all areas of research library mission and operation, presenting both opportunities and risks – and currently occasioning much online analysis, opinion, and hype.

Traditional forms of AI are already in use in many task-specific library applications as well as in everyday life; the affordances of generative AI have distinct implications. Traditional AI and generative AI differ in their respective capabilities and applications. Whereas traditional AI systems are primarily applied to analyze data and make predictions, generative AI uses its training data to create new content. Though generative AI is a powerful tool that will only grow in importance, both forms of AI, with their different capabilities and applications, can work in tandem and are not mutually exclusive.

This brief document provides a function-based structure to frame consideration of the various areas of library work that AI will impact. This is a selective snapshot at the moment, however, and the listings within the outlined areas will soon date. New applications of AI are emerging all the time.

Library leaders need a critical understanding of generative AI technologies and their potential uses within library functions, and must encourage all parts of the library workforce to consider critical AI knowledge as an emerging core competency that requires fostering, training, and support.

With more knowledge and informed opinion about the technologies, tools, risks and opportunities, library leaders will be able to contribute usefully to campus-wide discussions on AI applications and attendant issues.

Examples of widely used general tools

- [GPT-4](#); [Claude.ai](#); [Perplexity.ai](#); [Google Bard](#); [Bing Chat](#)
 - There are more products than the most-known ChatGPT that serve similar generative functions. Some reviewers have concluded that others in this list perform better, in fact. Most offer both free and premium versions.
- [DALL-E 3](#); [Midjourney](#); [Stable Diffusion](#)
 - Image generation tools

- [CORE-GPT](#) (coming soon)
 - A GPT-based tool trained on over 32 million full-text open access scientific articles. It provides evidence-based answers to questions, along with citations.

Research

Though numerous, the various discipline-specific AI tools that researchers make use of during the conduct of their research are beyond the scope of this overview. For example, data gathering, analysis, and management tools are not identified here.

There are existing and emerging opportunities for AI tools to save time for researchers. Tools like ChatGPT can serve as virtual research assistants, conducting literature reviews and online experiments, analyzing data, writing grant applications, abstracts, and papers, generating software code, generating citations, and more. Libraries can harness the opportunities provided by these tools to better support researchers and make use of AI-generated analytics to measure impact.

Currently, research technology companies and commercial publishing vendors are putting significant resources into developing AI-based research tools that serve researcher workflows across the research and dissemination lifecycle. For example, Scopus and Web of Science are introducing AI-based conversational interfaces to their database search functions. These products are typically not transparent and may be prone to bias. Non-profit organizations are working on open-source tools but are not as well funded as for-profit vendors. For example, the extent to which OpenAI has access to publications behind paywalls is unclear.

The added nuances and concerns around AI mean that libraries may want to further cultivate relationships with vendors, whether through their professional associations or directly. Libraries need to perform due diligence around a given vendor's claims of AI integration, as the capabilities range considerably. As with other library systems, end users may not be able to tailor the system to local needs to the extent they would like, and system development and maintenance costs are high. Libraries may need to make ethics-driven decisions when negotiating with vendors and should be aware of a given system's sources of factual data, training data, privacy settings, and other guardrails.

Examples of literature search and management tools

- [Scite](#)
 - A smart citation index that displays the context of citations and classifies their intent using deep learning. Scite.ai has access to some full text and publications behind paywalls.
- [Consensus](#)
 - A search engine that uses AI to extract, aggregate, and distill findings from research articles.
- [Elicit](#)
 - An AI tool that finds articles and summarizes article abstracts, while also mining for keywords/subject headings. Elicit can find relevant papers without perfect keyword match, summarize takeaways from the papers specific to your question, and extract key information from the papers. While Elicit does have access to some full-text and articles behind paywalls, it may draw direct answers from abstracts alone.
- [ResearchRabbit](#)
 - A citation-based literature mapping tool, showing links and relationships between authors and sources. Allows you create collections, categorize resources, and share collections.
- [ChatPDF](#) and [Docalysis](#)
 - Upload a PDF document and then ask questions about the content of the PDF.
- [Connected Papers](#)
 - Provides a visual overview of similar papers to identify trends, popular works, and the dynamics of a given field.
 - [Explainpaper](#)
 - Synthesizes uploaded passages; designed to provide clear explanations of dense academic writing.
- [Scholarcy](#)
 - Summarizes articles; useful features include directing user to Open Access version on citation and creating a personal collection of summaries.

Teaching and Learning

AI literacy will be increasingly important as students develop critical thinking skills and navigate which uses of AI are appropriate for academic work, from brainstorming through to literature searching, analyzing sources, and writing papers. The ethical implications related to academic integrity, privacy and assigning/deciphering

ownership and authorship in student work necessitate developing very clear guidelines for students.

The competencies to critically evaluate AI technologies and use them reflectively and ethically complement existing programming related to information, digital and copyright literacy. Algorithmic literacy – the understanding of one’s interaction with AI, how AI processes information online, and the use of personal data – is increasingly vital to all, and libraries are well-positioned to provide instruction. Libraries should be prepared to answer relevant questions from students and faculty, but they may also consider proactively promoting their AI expertise, especially to faculty. Libraries must grow their understanding of prompt engineering and problem formulation so as to most effectively engage with large language models (LLMs) and provide adequate instruction to students and faculty in this area.

Some of the opportunities available to libraries are to use AI to support individualized learning, to develop digital literacy skills, and to support course administrative tasks such as lesson planning, evaluation and feedback, and the analysis of student success. But recognized risks include depersonalized learning, the introduction of system-based biases derived from the AI’s training corpus and decreased critical and creative thinking skills.

One opportunity for libraries may be in OER production. Tools like ChatGPT can save writing time for authors, but they will need to (carefully) review and revise the generated output. The declaration of AI assistance is advisable if human authors are being credited. Possibly, the reduction in time dedicated to such projects will make them more attractive for faculty, leading to an increase in production of OER.

Examples of teaching tools

- [ClassPoint AI](#)
 - Creates quiz questions based on PowerPoint slides
- [PowerPoint Speaker Coach](#)
 - Helps rehearse presentations, providing feedback based on pacing, pitch, use of filler words, informal speech, euphemisms, culturally sensitive terms, etc.
- [SlidesAI.io](#)
 - Creates attractive and engaging presentation slides
- [Synthesia](#)
 - AI video generation platform that turns text into videos (can do 120+ languages)

Examples of writing tools for student learning

- [Grammarly](#)
 - Writing assistance
- [Moonbeam](#)
 - Helps to organize notes and ideas into well-written content
- [QuillBot](#)
 - Helps to correct grammar and paraphrase sentences

Library Operations

AI offers the potential to maximize efficiencies in various areas of traditional library operations. AI tools provide opportunities to extend and enhance existing user services and their accessibility, and to provide more customized support. In addition to user services, AI-generated library analytics can support management and planning.

The selection of appropriate tools, vendors, and partners should be informed by best practices as they evolve and related codes of conduct, like the Government of Canada code noted in the Policy section. Libraries may want to consider developing guidelines with respect to adopting and implementing AI within operational units.

Cataloguing, metadata, discovery and aggregation

In this rapidly evolving environment, the imperative for libraries to optimize their metadata for machine actionability and interoperability is strengthened.

Cataloguing systems have made use of automation for many years, so it is no surprise that they would incorporate AI-based tools to accelerate and streamline activity around cataloguing and metadata. These tools can be especially helpful in handling the high volume and range of digital resources libraries are now managing; indexing, generating keywords, document matching and flagging offensive content are just some examples where AI has utility. Image-based systems employ facial recognition to identify and create metadata around images.

Library vendors, such as Ex Libris, have declared they are integrating AI tools into their ILS and other products, such as conversational discovery and article summation, as part of what they are calling the Next Discovery Experience. OCLC has added [AI-generated book recommendations](#) to WorldCat.org. These new tools have the potential to streamline workflows and improve access to library collections, as searchers retrieve more personalized patron results.

Despite these efficiencies, integrating AI technologies with legacy systems can be complex and resource-intensive. Libraries should consider data sovereignty issues when choosing third party providers where processing occurs beyond the local environment.

Reference

AI tools already answer basic reference questions, freeing up staff time for other tasks. [Current findings](#) suggest that ChatGPT may not yet be adequately trained or have access to sufficiently current information to perform adequately for a large research library. However, as training data grows, and vendors develop their own customized reference chat-bots, AI-generated reference will increase in sophistication and functionality. The potential exists to offer tailored reference responses based on user data the library possesses; however, issues around privacy and retention of personal data mean this area needs to be navigated carefully.

For more complex requests, library staff can help students and researchers use research tools (such as those listed above) to dig deeper into the literature. Librarians can leverage their existing research and literacy skills to train students and researchers in prompt engineering. AI has the capacity to make the investigative stage of research more efficient and advanced reference is likely to be increasingly well-served. The expertise and authority of library staff, however, is unlikely to be replicated by these tools in the near future.

Preservation

AI tools can accelerate and streamline the digitization process, help to identify and restore damaged or degraded digital artifacts, and improve accessibility. However, rapid obsolescence and future incompatibility of AI tools for digital preservation portend future complications.

The advent of “synthetic text” created through AI invites questions for libraries in terms of what to collect and preserve. The presence of inauthentic content can both undermine trust in the library and obscure the authoritative historical record.

Workforce development

Libraries should address any “skills gap” amongst library staff to ensure a smooth integration of AI technologies. Desirable competencies to be maintained and upgraded include: competency in a wide variety of technologies; understanding of data science; facility with big data and complex searching; and information, media, and algorithmic literacies. While AI offers opportunities for library staff to reform and accelerate aspects of their work, they may feel overwhelmed by expectations around new competencies.

Examples of tools serving aspects of library operations

- [Microsoft Syntex](#)
 - Though not specific to libraries, this tool may be useful to cataloguers for document processing, “taxonomy tagging” and more
- [Microsoft’s Azure Custom Vision](#)
 - An image-recognition service for building, deploying and improving image identifier models
- [Tableau AI](#)
 - Data visualization tool
- [Anyword](#)
 - AI-based marketing tool that can be applied to social media
- [Sheeko](#)
 - Open source software to generate captions and keywords for images
- [AgentGPT](#)
 - Custom AI agent that can be trained to plan and execute goal oriented tasks, with wide potential application

Publishing

AI will have an impact on scholarly publishing in different ways, including the production of OER resources. Publishers will need to create policies around submissions that have been generated, in whole or in part, by generative AI.

At the same time, researchers and publishers will be able to streamline the publishing process by using new tools for identifying appropriate journals for submission, [screening manuscripts](#) or redirecting manuscripts to other journals, proofreading, creating abstracts, formatting manuscripts, and more. Although a topic of discussion, AI has yet to replace humans for the actual task of peer review and some funders have banned AI for the purposes of their peer review processes; but this is a space to be watched as developments are likely.

Examples of tools for editorial management and peer review

- [iThenticate](#)
 - Identifies plagiarism, including copied text and non-idiomatic translated text
- [Edanz Journal Selector](#)
 - Recommends journals by comparing abstract text
- [EndNote Manuscript Matcher](#)
 - Compares Web of Science data against title, abstract and references

- [Penelope.ai](#)
 - Verifies formatting against journal requirements

Personal work / professional competency

AI tools can improve productivity for a variety of tasks, such as drafting emails, press releases, and event posters. For example, Microsoft's AI companion, Copilot, will span across all of Microsoft's applications, including Microsoft 365, Windows 11, Edge, and Bing, so users will be able to get AI assistance across their workflow using MS products.

Examples of task-based tools

- [Grammarly](#)
 - Writing assistance
- [InterviewMe AI](#)
 - Practice interviews for software engineers
- [Rationale](#)
 - For decision making, including pros & cons analysis, SWOT analysis, multi-option analysis, and outcomes analysis
- [Taskade](#)
 - Automate workflows

AI tools can be used to automatically translate text into a variety of languages. In addition to the utility machine translation provides to operations and research, language tools may help level the playing field for researchers, students and library workers who lack competency but need to write and publish in English or French. AI is contributing to the revitalization of Indigenous languages, though existing AI platforms still fall short when it comes to recognizing Indigenous language and produce a high volume of hallucinations. Libraries should be aware of issues around [data sovereignty](#) when engaging with AI in the context of Indigenous languages and culture and copyright issues with translation activities, more broadly.

- [Reverso](#)
 - AI based text translation in over 15 languages; additional services include full document translation, integrated grammar checks and dictionaries, and conjugations tools
- [DeepL](#)
 - Online translation service that can be integrated directly into products and platforms
- [Tradooit](#)
 - AI based translation service adapted for Canadian vocabulary

- [Google Translate](#)
 - The ubiquitous translation tool is especially useful for mobile users
- [ReadAlong Studio](#)
 - Open-source software that uses elements of AI to create read-alongs in 27 Indigenous languages

Policy

As governments consider the broad, societal implications of AI as a transformational technology, our views and expertise can contribute to local, provincial, and federal policy development. Our voice needs to embrace the new technologies, while also suggesting how risks might best be mitigated.

Institutional policies to address ethical and legal considerations are emerging rapidly. They may address many of the areas mentioned here, but tend to be focused on academic integrity, disclosure and citation. Addressing these issues in a rapidly developing landscape will require ongoing research and attention.

The Government of Canada recently released a [Voluntary Code of Conduct on the Responsible Development and Management of Advanced Generative AI Systems](#), and has tabled *Bill C-27, Artificial Intelligence and Data Act (AIDA)*. Such instruments aim to address the concerns below.

Misinformation

Misinformation includes both unintentional misinformation (e.g., hallucinations) and intentional disinformation, with a range of consequences. For example, current AI tools can make up citations to works that do not exist, necessitating vigilance and vetting. Countering pernicious disinformation continues to be challenging despite the development of tools to detect it. Human intervention remains key: understanding effective prompt engineering (and training others) mitigates hallucinations, just as vigilance and digital literacy effectively counters mis- and disinformation and other harmful outputs.

Nature of inputs

Can published collections be data mined to support the production of LLMs? [CORE-GPT](#) has done this based on open access articles. Working with materials that are either behind paywalls or include all rights reserved content would expand the knowledge base significantly and perhaps mitigate hallucinations in generated content, but there could be significant legal implications.

Copyright

At this point, AI-generated works do not appear to be eligible for copyright protection in Canada and the availability of exceptions for the use of copyright-protected content by AI tools is unclear, but the matter will likely be considered by parliaments and brought repeatedly to the courts in the coming years. Libraries should reinforce their reputations as copyright leaders on campus by staying up to date on the situation and be aware of developments and decisions in other jurisdictions. CARL submitted a response to the [*Consultation on a Modern Framework for Artificial Intelligence and the Internet of Things*](#) in (2021) that lays out some of the AI copyright concerns in terms of authorship, text and data mining and TPMs and the Right to Repair.

Privacy

Many new tools make use of personal data, whether for training an AI system or to check student papers for plagiarism. Libraries should be contributing to conversations about appropriate use of student and researcher data and in what situations individuals should be able to opt out of data collection.

While institutional research and ethics boards (REBs) provide oversight in terms of the appropriate collection and storage of data acquired through research projects, as issues around AI and privacy increase in complexity, libraries should be prepared to support REBs in the ethical assessment of projects involving AI.

Bias

Current AI systems are known for being biased, since they have been trained on biased data. They can also result in reinforcing existing biases of users. Libraries should anticipate situations in which these biases could be harmful and create strategies for mitigation.

Social impacts

Costs for some generative tools (e.g. premium editions) mean that some students – and institutions – have limited access to certain AI tools, creating an equity issue. Students who make use of AI-generated information, legitimately or dishonestly, may be advantaged over those without skills, access, or inclination to do so. The increase in automation may accelerate job loss and the exploitation of precarious labour. The enormous consumption of electricity and carbon dioxide emissions associated with AI technologies create a substantial environmental impact; for example, the increasingly large datasets required to train LLMs require vast amounts of energy and create substantial emissions.

Conclusion

AI technologies offer considerable advantages to libraries, and moreover, the clock cannot be turned back. The range of technologies, their uses, and relative risks and benefits mean that they need to be considered on a case-by-case basis. Given the number of systems currently at play in the library (and university) environment, integration of new ones can be challenging, slow-paced, and resource-intensive; institutional agility and responsiveness is key to staying current with technological advances.

Aligning with institutional responses, libraries may wish to adopt local principles to guide their use of AI technologies. These principles could address:

- User privacy and data security
- Algorithmic bias
- Investment and sustainability costs
- Training for library staff
- Equity and fairness
- Transparency with respect to AI systems in place
- Understanding the limitations of AI and the need for human oversight
- Text and data mining of library resources
- Regular risk assessment, monitoring and evaluation of systems and practices to ensure safety and efficacy
- Collaborating and sharing best practices within the academic research library community
- Advocating for and promoting responsible use of AI

With effort to keep abreast of developments and to thoughtfully seek out opportunities and mitigate risks, libraries are well-positioned to deploy AI technologies effectively and responsibly and cultivate strong, appropriate literacies among their users. CARL will continue to monitor developments and consider whether more issue-specific briefings would be useful to our members and the academic and research library community.

Further reading

Policy and regulation

- [Guidance for Generative AI in Education and Research \(UNESCO\)](#)

- [Voluntary Code of Conduct on the Responsible Development and Management of Advanced Generative AI Systems](#) (Innovation, Science and Economic Development Canada)
- [Statement on Generative AI](#) (G7 Data Protection and Privacy Authorities)

How generative AI tools work

- [Generative AI and Large Language models: Background and Contexts](#)
- [Generative AI, scholarly and cultural language models, and the return of content](#)

Discussions of academic library-related applications and implications

- [Generative AI and libraries: 7 contexts](#)
- [Looking towards a brighter future: the potentiality of AI and digital transformations to library spaces](#)
- [ChatGPT: Implications for academic libraries](#)
- [Using Machine Learning for Finding Research](#)
- [Understanding AI Writing Tools and Their Uses for Teaching and Learning at UC Berkeley](#)
- [AI Tools for Libraries](#)
- [ChatGPT-like AIs are coming to major science search engines](#) (paywall)
- [AI and human interactions in scholarly publishing](#)
- [AI and Scholarly Publishing: A View from Three Experts](#)
- [Artificial intelligence to support publishing and peer review: A summary and review](#)
- [Can generative AI facilitate the research process?](#)
- [ChatGPT vs Bard vs Bing AI: The 2023 AI Battle](#)
- [The Prompt Engineering Librarian](#) (paywall)
- [AI Prompt Engineering Isn't the Future](#)
- [Application of Artificial Intelligence \(AI\) In Libraries and Its Impact on Library Operations Review](#)
- [How Well Does ChatGPT Handle Reference Inquiries? An Analysis Based on Question Types and Question Complexities](#)
- [Evaluating Generative AI Tools: a checklist](#)
- [The Rise of AI: Implications and Applications of Artificial Intelligence in Academic Libraries](#)
- [An AI Toolkit for Libraries](#)
- [Library Copyright Alliance Principles for Copyright and Artificial Intelligence](#)
- [Developing a library strategic response to Artificial Intelligence](#)

CARL responses to artificial intelligence issues

- [CARL submission to Pre-Budget consultations 2024 \(2023\)](#)
- [Consultation on a Modern Framework for Artificial Intelligence and the Internet of Things. \(2021\)](#)
- [Brief to the Ontario Government's consultation Trustworthy Artificial Intelligence \(AI\) Framework. \(2021\)](#)

Examples of AI LibGuides, Primers, and Other Resources in CARL Institutions

University of Victoria:

- Scholarly use of A.I. tools
https://libguides.uvic.ca/AI_Tools
- The use of artificial intelligence tools and implications for Academic Integrity
<https://teachanywhere.uvic.ca/academic-integrity/the-use-of-artificial-intelligence-tools-and-implications-for-academic-integrity/>
- UVic AI Safety Reading Group
<https://uvicai.ca/reading-group/>

Université du Québec à Montréal:

- ChatGPT et intelligence artificielle : utilisation de ChatGPT en contexte universitaire
https://uqam-ca.libguides.com/ChatGPT_et_IA/Utilisations
- Intégrité académique et citer ChatGPT
- https://uqam-ca.libguides.com/ChatGPT_et_IA/Integrite_et_citer
- Forces et faiblesses
https://uqam-ca.libguides.com/ChatGPT_et_IA/Forces_faiblesses
- Invites efficaces
https://uqam-ca.libguides.com/ChatGPT_et_IA/Invites_efficaces

Carleton University:

- Artificial Intelligence (AI) - Tools
<https://library.carleton.ca/guides/subject/artificial-intelligence-ai-tools>
- Teaching Resources: Generative Artificial Intelligence
<https://carleton.ca/tls/teachingresources/generative-artificial-intelligence/>