

The Algorithmic Librarian: AI, Data Curation, and the Future of Research Collaboration

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This paper explores the evolving role of academic and research librarians in the age of artificial intelligence (AI), focusing on AI literacy, algorithmic accountability, and data stewardship. It examines how librarians are adapting to the technological landscape, emphasizing their role in promoting AI literacy, ethical AI practices, and interdisciplinary collaboration within academic environments. This study offers an integrated, thematic synthesis that foregrounds librarians' evolving roles as educators, ethical stewards, and research collaborators. Through a critical analysis of current literature, the paper highlights key competencies necessary for navigating the complexities of AI integration in research and education. The study also proposes recommendations for fostering AI literacy programs, enhancing data management skills, and advocating for responsible AI use, aiming to empower librarians as stewards of AI ethics and innovation. Ultimately, this research underscores the transformative potential of libraries in shaping AI-aware, ethical, and collaborative academic communities.

Background of Study

In the 21st century, the academic and research landscape is being radically reshaped by artificial intelligence (AI), data-intensive methodologies, and algorithmic systems. At the heart of this transformation are academic and research libraries, known for safeguarding scholarly knowledge, facilitating research, and cultivating information literacy. As digital technologies evolve, these libraries—and the professionals who manage them—are experiencing fundamental changes in their core functions, infrastructure, and identities.

AI-driven tools, such as generative models (e.g., ChatGPT), machine learning algorithms, and intelligent discovery systems, now influence how knowledge is produced, accessed, and validated in higher education and research environments (Cordell, 2020; Zhao et al., 2024). From automating metadata generation to enabling complex data curation and research assistance, AI systems have expanded the library's role from knowledge custodianship to dynamic research collaboration.

The emergence of the “algorithmic librarian” reflects this evolution, as librarians are increasingly seen as mediators between human researchers and automated systems. These professionals are tasked not only with deploying algorithmic tools but also with evaluating

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their implications for research integrity, access, and academic freedom (Clark et al., 2017). The influence of algorithmic infrastructures on search, discovery, and knowledge visibility underscores the need for librarians to critically engage with the ethical and epistemological issues introduced by AI.

AI's potential comes with profound ethical and social concerns. These include algorithmic opacity, misinformation, cultural bias, and environmental costs (Rainie & Anderson, 2017; Crawford, 2021; Rettberg, 2022; Ludvigsen, 2022). AI training processes often rely on exploited labor, as seen in reports of low-wage content moderators working under harsh conditions to filter training data (Perrigo, 2023). Furthermore, algorithmic systems risk reinforcing dominant worldviews, marginalizing non-Western perspectives, and exacerbating existing inequities (Rettberg, 2022).

Nonetheless, AI also presents significant opportunities for libraries to innovate—from personalized recommendation engines to enhanced discovery platforms and new models of digital literacy instruction (Deshpande et al., 2023; Motoki et al., 2023). As Hillier (2023) and Carolus et al. (2023) argue, AI integration demands robust literacy models that empower both librarians and users to interact ethically and effectively with intelligent systems.

By mapping current scholarly and professional discourse, this paper contributes to the theoretical conceptualization of the algorithmic librarian and offers actionable insights for professional development, curriculum design, and policy formation. The significance of this work lies in its dual aim: to support librarians' evolving practice amid technological disruption; and to advocate for socially responsible AI implementation in higher education.

Statement of the Problem

While AI technologies are rapidly integrated into library systems, a significant knowledge gap exists concerning the readiness of academic librarians to adapt to algorithmic and data-centric environments. There is limited literature synthesizing the emerging roles of librarians in AI-enhanced research collaborations, particularly regarding the ethical dimensions of algorithm use, issues of transparency and bias, and AI literacy in practice.

These issues highlight the need to examine how librarians are evolving in response to AI-driven changes, the challenges they face, and the competencies required.

Objectives of the Study

This study aims to:

1. Examine the emerging roles of librarians in the context of AI integration in research and knowledge production.
2. Explore how librarians are responding to challenges related to algorithmic bias, transparency, and explainability.
3. Identify frameworks and competencies that support AI literacy and digital interaction among librarians and researchers.
4. Analyze case studies and theoretical perspectives to highlight best practices in AI-supported data curation and collaborative scholarship.

Significance of the Study

The significance of this study lies in its contribution to the growing discourse on AI in libraries, offering a critical synthesis of both literature and practice. It makes a theoretical contribution by enhancing the conceptual understanding of the "algorithmic librarian," a crucial paradigm

for 21st-century knowledge workers. Furthermore, it supports professional development by guiding the design of AI literacy programs tailored specifically for librarians, enabling their informed participation in digital scholarship. In terms of ethical engagement, the study addresses challenges such as toxicity in AI and labor exploitation in AI model training, promoting socially responsible technology adoption within libraries. Lastly, the research informs policy and practice by offering insights that can shape institutional strategies for integrating AI into library systems, fostering the development of infrastructures that are innovative and ethically sound.

Scope and Delimitations

This study focuses specifically on academic and research libraries and librarians. It analyses their evolving roles in the context of AI integration, with attention to data curation, research collaboration, and digital literacy development. Rather than collecting primary data through interviews or surveys, the study uses a literature review approach. It draws from peer-reviewed articles, institutional reports, and policy documents.

Review of Related Literature

Algorithmic Literacy and Mediation

Algorithmic literacy is emerging as a core competency in academic librarianship as AI-driven systems increasingly shape access to information. While Finn (2017a, 2017b) emphasized the cultural implications of algorithmic systems, Long and Magerko (2020) framed AI literacy as the ability to critically assess and apply AI across contexts. These foundational views align with Clark et al.'s (2017) analysis of how opaque algorithms influence user behavior in discovery tools, and raise concerns echoed by Rainie and Anderson (2017), who warned that algorithmic mediation can automate credibility judgments. Rettberg (2022) added that systems like ChatGPT reinforce dominant cultural values, calling attention to the librarian's role in preserving diverse epistemologies. Together, the literature highlights not only the technical but also the sociocultural stakes of algorithmic systems, as well as the need for librarians to lead in fostering user awareness of algorithmic influence.

Data Curation and Machine Learning in Libraries

AI's reliance on large-scale data underscores librarians' expanding role in data curation and digital infrastructure. Cordell (2020) documented the integration of machine learning in tasks such as metadata generation, while Ridley (2019) advocated for explainable AI to ensure transparency in automated decisions. Crawford (2021) pointed to the environmental and ethical costs of AI, suggesting libraries should champion responsible innovation. Zhao et al. (2024) emphasized the need for librarian-led ethical guidance in generative AI use. Supporting this shift, Calzada Prado and Marzal (2013) called for integrating data and information literacy, while Lo (2023) proposed prompt engineering as a practical instructional tool. While the literature broadly supports librarians' central role in AI-era data practices, it also reveals a gap in applied models that balance automation with ethical oversight.

Competency Frameworks for AI Literacy

Efforts to define AI literacy in academic settings have produced a range of theoretical and applied frameworks. Hillier (2023) proposed a model for institutional engagement, while Carolus et al. (2023) emphasized ethical and interactional competencies through their Digital

Interaction Literacy Model. These build on earlier reconceptualizations of internet literacy by Bauer and Ahooei (2018). Dogruel et al. (2022) introduced a validated algorithmic literacy scale, offering tools for educational assessment. Existing frameworks like the ACRL's *Framework for Information Literacy in Higher Education (Framework)* (2015) have been adapted to include AI-specific competencies (Long & Magerko, 2020; Yi, 2021), with applied examples found in programs developed by Wheatley and Hervieux (2023) and Kong et al. (2021). These studies collectively underscore librarians' evolving role as educators, though further research is needed on implementation across varied institutional contexts.

Ethical, Social, and Environmental Concerns

Librarians are increasingly called to address the ethical and societal risks of AI adoption. Hagendorff (2024) mapped core ethical dilemmas in generative AI, while Motoki et al. (2023) and Deshpande et al. (2023) revealed AI's potential to perpetuate bias and toxicity. Perrigo (2023) highlighted labor exploitation in AI training pipelines, underscoring librarians' need to consider upstream ethical issues. Global frameworks cataloged by Jobin et al. (2019) and Corrêa et al. (2023) offer governance tools for institutional policy making. Fergusson et al. (2023) warned of AI's role in amplifying surveillance and misinformation, and Ludvigsen (2022) raised concerns about its environmental footprint. These sources collectively argue for librarians' active role in institutional ethics and sustainability, though concrete strategies for intervention remain underdeveloped.

Scholarly Collaboration and Redefining Librarian Roles

AI is also reshaping librarians' institutional identities, situating them as collaborators in research and policy development. Cox (2024) and Annapureddy et al. (2024) noted librarians' growing influence in AI pedagogy and digital scholarship. Kong et al. (2021) showed how librarian-led AI literacy programs foster interdisciplinary learning. Diakopoulos (2014), and Ridley and Pawlick-Potts (2021) highlighted librarians' role in mediating algorithmic systems, ensuring transparency in user interaction. Clark (2018) emphasized their contributions to algorithmic accountability, while Markauskaite et al. (2022) linked their work to emerging research infrastructures. Engagement in global AI ethics discourse (Jobin et al., 2019; Corrêa et al., 2023) and sustainability advocacy (Ludvigsen, 2022) further extends librarianship into strategic leadership domains. This evolution, however, raises questions about institutional capacity and long-term support for such expanded roles.

Methodology

The study utilizes a literature review method, focusing on peer-reviewed journal articles, institutional reports, academic blog entries, and authoritative preprints. This approach is suitable for synthesizing existing knowledge, identifying key themes, and uncovering gaps in the current literature.

Research Questions

This study is guided by the following research questions:

1. How are algorithmic systems and AI technologies influencing the roles and responsibilities of academic and research librarians?
2. What competencies and literacies are essential for librarians to effectively navigate AI-enhanced research environments?

3. What ethical and socio-political concerns arise from the integration of generative AI in scholarly communication, and how can librarians address them?
4. In what ways can librarians contribute to more inclusive, ethical, and collaborative research ecosystems through AI and data stewardship?

Data Sources and Selection Criteria

The literature selected for this review was drawn from a range of scholarly publications, professional frameworks, and global policy documents. The selection was guided by the following inclusion criteria:

1. Thematic relevance: Sources were included if they directly addressed at least one of the following core themes:
 - AI literacy and algorithmic awareness
 - Data literacy and information curation
 - Ethical and governance frameworks for AI
 - The evolving roles of librarians in digital and AI-enhanced research environments
2. Scholarly and professional authority: Preference was given to peer-reviewed journal articles, academic conference proceedings, and internationally recognized organizational reports.
3. Contemporary scope: Only publications released between 2013 and 2024 were considered to ensure contemporary relevance. Special emphasis was placed on literature produced from 2019 onward, coinciding with the rapid rise in generative AI technologies and their educational implications.
4. Librarianship and higher education focus: Works were prioritized if they contextualized AI, data, and algorithmic systems within academic and research libraries, or within the broader information literacy and digital ethics discourse in higher education.
5. Language and accessibility: Only English-language sources were included for consistency and accessibility.

Limitations

As a literature review, the study is limited by the availability and scope of existing research. It does not include primary data collection, such as surveys or interviews. Additionally, while every effort was made to include diverse viewpoints, the reliance on English-language sources may have excluded valuable non-English contributions. Despite these limitations, the methodology provides a rigorous and comprehensive foundation for examining the impact of AI on academic librarianship, guiding both theoretical discourse and practical developments.

Findings

The literature reviewed in this study highlights five key thematic areas that define the evolving roles, competencies, and ethical responsibilities of academic and research librarians in the age of artificial intelligence (AI). These findings represent a synthesis of recent scholarship, offering insight into how librarians are navigating a rapidly changing research and technological ecosystem.

Expanding Competencies in AI and Algorithmic Literacy

Librarians are increasingly positioned as educators and facilitators of AI literacy, a role that extends beyond technical fluency to encompass critical thinking, ethical awareness, and digital

agency. Annapureddy et al. (2024) proposed twelve competencies essential to generative AI literacy, including prompt design, bias detection, and accountability evaluation. Cox (2024) expanded on this by framing responsible generative AI literacy as an intersection of algorithmic, AI, and ethical literacies.

These developments build upon early efforts to foster algorithmic awareness in library practice (Clark, 2018) and are reinforced by empirical work from Dogruel et al. (2022), who developed and validated an algorithm literacy scale for assessing user competencies. Libraries have adapted the ACRL *Framework* to integrate AI-specific competencies (Long & Magerko, 2020; Yi, 2021), thus embedding algorithmic literacy into institutional learning strategies.

Instructional programs such as the workshop series designed by Wheatley and Hervieux (2023), and the AI literacy course evaluated by Kong et al. (2021), demonstrate librarians' emerging pedagogical roles in fostering AI fluency among students and faculty. Lo (2023) further operationalized this shift through the CLEAR framework, which incorporates prompt engineering into library instruction to encourage critical engagement with AI-generated information.

Data Literacy, Curation, and Research Infrastructure

The integration of AI in academic workflows has intensified the need for robust data literacy and stewardship within libraries. As AI systems rely on large volumes of structured data, librarians have assumed greater responsibility for supporting the entire data lifecycle, from acquisition and organization to ethical use and reuse. Calzada Prado and Marzal (2013) emphasized the importance of aligning data literacy with traditional information literacy, a view echoed by Cox (2024), who argues that librarians must be equipped to manage both the technical and ethical dimensions of data infrastructure.

Markauskaite et al. (2022) proposed that data fluency is a core capability for navigating AI-enhanced learning environments, positioning librarians as key support agents in facilitating data-related competencies among researchers. Lo (2023) demonstrated how librarians can teach prompt engineering to improve user interactions with AI, while Pinski and Benlian (2023) highlighted the importance of librarians in supporting ethical research data management as part of broader AI literacy efforts.

In practice, librarians are also involved in curating metadata, designing interoperable systems, and supporting open science initiatives. These roles not only enable responsible AI use but also uphold principles of transparency, reproducibility, and equitable access to data-driven research tools and outcomes.

Ethical, Social, and Environmental Dimensions of AI

As algorithmic systems become embedded in research infrastructures, librarians are emerging as ethical stewards responsible for advocating transparency, fairness, and sustainability. The literature points to a range of ethical challenges, including algorithmic bias (Motoki et al., 2023), misinformation (Hagendorff, 2024), and the amplification of harmful discourse in AI outputs (Deshpande et al., 2023). Rettberg (2022) cautioned that even multilingual AI systems like ChatGPT reflect monocultural values, while Perrigo (2023) exposed the exploitative labor conditions involved in AI dataset moderation.

These concerns underscore the need for institutional policies informed by global ethics guidelines. Jobin et al. (2019) and Corrêa et al. (2023) cataloged hundreds of AI ethics frameworks and governance documents that can guide libraries in developing locally relevant ethical

standards. Fergusson et al. (2023) emphasized the broader societal risks posed by generative AI, including surveillance and manipulation, reinforcing the urgency of librarian involvement in institutional AI governance.

Environmental concerns also emerge in the literature, with Ludvigsen (2022) highlighting the high energy costs associated with training and deploying large-scale AI models. As advocates for sustainability, librarians are uniquely positioned to raise awareness about the environmental footprint of AI and promote responsible technology procurement within academic institutions.

Information Behavior and Critical Thinking in the Age of AI

AI systems have reshaped how users search for, evaluate, and engage with information, making critical thinking and information behavior central to the librarian's instructional mission. Grizzle et al. (2021), in collaboration with UNESCO, called for media and information literacy as a foundation for global citizenship—an imperative that AI intensifies. Dogruel et al. (2022) showed that algorithmic literacy enhances users' ability to question AI-generated content, helping them recognize how algorithms influence credibility and visibility.

Pinski and Benlian (2023) proposed a reflective judgment framework as part of AI literacy, encouraging users to think beyond surface-level outputs and consider the socio-technical processes that generate them. Lo's (2023) CLEAR framework gives practical shape to these ideals, using prompt engineering as a tool for facilitating deeper user-AI interaction.

Librarians play a crucial role in fostering these competencies through workshops, classroom instruction, and integrated digital literacy programs. Their guidance enables users to critically navigate algorithmically curated environments and develop a more nuanced understanding of credibility, authorship, and knowledge authority in the age of AI.

Redefining the Role of Librarians in Research Collaboration and Innovation

The evolving information ecosystem has expanded the role of academic librarians from support staff to integral collaborators in research, pedagogy, and policy making. Librarians now co-lead AI literacy initiatives (Cox, 2024), design interdisciplinary courses (Kong et al., 2021), and partner with faculty in embedding ethical AI instruction into curricula (Annapureddy et al., 2024).

Ridley and Pawlick-Potts (2021) and Diakopoulos (2014) emphasized librarians' critical role in mediating interactions between users and algorithmic systems, ensuring transparency, accountability, and equitable access to information. Clark (2018) argued that librarians are not merely reactive but active in shaping algorithmic infrastructures that affect scholarly communication and digital discovery.

Their growing involvement in institutional planning, grant writing, and global discourse on AI ethics (Jobin et al., 2019; Corrêa et al., 2023) signals a profession in transition. Librarians are also advocating for sustainable AI practices (Ludvigsen, 2022), ethical labor conditions (Perrigo, 2023), and inclusive knowledge ecosystems (Rettberg, 2022). These developments suggest a broader redefinition of librarianship as both a strategic and ethical profession, rooted in service but empowered by leadership and innovation.

Conclusion

This study explored how academic librarians are navigating and responding to the growing presence of artificial intelligence (AI), algorithmic systems, and data-centric practices in

higher education. A thematic synthesis of current literature makes clear that the profession is undergoing a significant transformation, one that expands the traditional boundaries of librarianship into domains of digital ethics, instructional innovation, research collaboration, and AI policy development.

The findings highlight five major areas where academic librarians are leading change. First, AI and algorithmic literacy have become core instructional competencies, positioning librarians as educators who empower users to engage critically and ethically with emerging technologies. Second, the integration of AI into research has elevated the librarian's role in data stewardship, requiring fluency in data curation, metadata architecture, and responsible data use. Third, librarians are taking on ethical and environmental leadership roles, advocating for transparent AI governance and sustainable technology practices. Fourth, they are guiding users in developing critical thinking and reflective information behavior to navigate AI-generated content. Lastly, librarians are increasingly embedded in interdisciplinary research, curriculum design, and institutional policymaking, thus redefining their role as collaborative partners and strategic contributors to academic innovation.

This shift affirms that academic librarians are not merely adapting to technological change; they are actively shaping how AI is integrated into the scholarly ecosystem. Their ability to bridge technical expertise with human-centered values makes them indispensable actors in ensuring that AI is deployed in ways that are equitable, ethical, and educationally sound. As AI continues to evolve, the academic library must remain a proactive, principled space for supporting innovation, fostering digital literacies, and promoting responsible technological futures.

Recommendations

Building on the findings of this study, which underscore the transformative roles of academic librarians in AI-integrated environments, the following recommendations aim to guide institutional and professional development across key areas: competencies, ethics, research collaboration, and sustainability.

Develop and Institutionalize AI and Algorithmic Literacy Training

Academic libraries should prioritize the integration of AI and algorithmic literacy into professional development and instruction. As highlighted by Annapureddy et al. (2024), Cox (2024), and Wheatley and Hervieux (2023), these competencies are central to librarians' evolving roles. Institutions should align with existing models such as Hillier's (2023) AI Literacy Framework and Lo's (2023) CLEAR model to create structured learning opportunities. Librarians should be supported in leading AI-focused instructional programs that foster critical engagement with algorithmic bias, ethical risks, and generative technologies (Clark, 2018; Yi, 2021).

Enhance Data Literacy and Stewardship Capabilities

As emphasized by Calzada Prado and Marzal (2013) and Cox (2024), librarians must be equipped to manage the entire data lifecycle in AI-supported research. Training should encompass data curation, ethical use, preservation, and responsible sharing. Academic libraries should expand data services to support faculty and students engaged in AI-intensive research, ensuring alignment with ethical and FAIR data practices.

Commit to Ethical Leadership and Transparency in AI Practices

Librarians should take a proactive role in shaping institutional AI policies grounded in transparency, fairness, and sustainability. Librarians, as noted by Jobin et al. (2019), Diakopoulos (2014), and Fergusson et al. (2023), can serve as ethical leaders in guiding responsible AI adoption. This includes raising awareness of labor and environmental implications of AI systems (Perrigo, 2023; Ludvigsen, 2022) and promoting inclusive, accountable governance frameworks.

Foster Interdisciplinary Collaboration and AI Research Innovation

Librarians should be positioned as essential partners in interdisciplinary AI research and curriculum design. As suggested by Cox (2024) and Ridley and Pawlick-Potts (2021), libraries can bridge technical and nontechnical domains by facilitating inclusive, ethical collaboration. Institutional investment in shared AI infrastructure and librarian participation in research teams will support this role.

Promote Critical Media and Information Literacy

To address the challenges of AI-generated misinformation and opaque algorithms, libraries must embed critical AI literacy into their services. Dogruel et al. (2022) and Pinski and Benlian (2023) stress the importance of fostering users' ability to evaluate algorithmic outputs. Programs should incorporate tools like Lo's (2023) CLEAR framework and promote critical engagement with AI-generated content across disciplines (Ridley, 2019).

Advocate for Sustainable and Responsible AI Practices

Librarians should contribute to institution-wide sustainability goals by advocating for low-impact AI tools and ethical procurement policies. As Ludvigsen (2022) highlights, awareness of AI's environmental costs is critical. Libraries can lead discussions on sustainable computing, support low-carbon AI initiatives, and promote long-term ecological responsibility in digital scholarship.

These recommendations are grounded in the literature and provide a forward-looking framework to support the evolving roles of academic librarians in the algorithmic age. By implementing these strategies, academic libraries can play a central role in shaping an ethical, inclusive, and sustainable future for AI in higher education.

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