Artificial Intelligence Literacy of Library Science in the Digital Intelligence Era: Connotation, Framework and Training Path

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ABSTRACT

In the digital intelligence era, amid knowledge ecosystem transformation and library service intelligent upgrading, Artificial Intelligence (AI) literacy has become a pivotal competency for library science to enhance its core competitiveness. Beyond technical proficiency, it integrates technological cognition, information insight, and professional expertise, evolving from traditional information literacy to a paradigm of "technological cognition, scenario adaptation, ethical judgment, and value commitment". Based on library science's professional traits, this paper develops the KSAVE AI Literacy Framework—five interrelated dimensions: Knowledge (interdisciplinary integration), Skills (AI tool application & problem-solving), Attitudes (learning openness & critical thinking), Ethics (data privacy & academic norms), and Values (humanistic care & knowledge equity). It further proposes three cultivation pathways: a "theory-tool-ethics" trinity curriculum (educational system), a collaborative model of in-school training, industry-academia cooperation, and international benchmarking (practical empowerment), and resource provision, activity-driven initiatives, and librarian capacity building (ecosystem development). This study guides library science in adapting to AI advancement, balancing technical rationality and humanistic spirit, and enabling librarians to evolve from technology users to knowledge ecosystem co-builders—ultimately safeguarding libraries' public service and knowledge dissemination values in the digital intelligence era.

Keywords: *Library science, Artificial intelligence literacy, Digital intelligence era, KSAVE Framework, Human-machine collaboration, Data ethics, Intelligent service scenarios, Literacy cultivation pathways.*

1. INTRODUCTION: CONNOTATION AND EVOLUTION OF AI LITERACY IN THE DIGITAL INTELLIGENCE ERA

1.1 Era Positioning and Core Characteristics of AI Literacy

Amid the deep integration of digitalization and intelligence, AI literacy has emerged as a core competency in library science, serving as a pivotal enabler for professionals to navigate future transformations in knowledge services. It requires library science professionals not only to understand the fundamental principles of AI—such as how machine learning converts data into knowledge-based predictions via algorithmic models, and how natural language processing (NLP) supports effective human-machine interaction—but also to achieve deep integration of technology and professional practice.

Intelligent tools must be integrated into the full workflow of library operations, including collection development, circulation services, and reference consulting. For example, deep learning-based cataloging systems can rapidly identify bibliographic elements—including subject headings and classification codes—but professionals need strategic thinking to embed these systems into workflows, rather than merely mastering tool operation [2].

In the context of human-machine collaboration, human value judgment remains irreplaceable. While AI excels in data processing and pattern recognition, decisions on complex cultural, emotional, and ethical issues depend on human empathy and ethical principles. In personalized reading recommendations, for instance, AI can filter books of potential interest based on users' borrowing history, but professionals must evaluate the ideological depth of recommended content by integrating cultural contexts and reader needs. This prevents algorithms from prioritizing low-quality content driven solely by click-through rates, thereby safeguarding the quality and value orientation of knowledge services [3].

1.2 Paradigm Shift from Information Literacy to AI Literacy

Traditional information literacy centers on information retrieval and acquisition (e.g., manual keyword-driven database searches), whereas AI literacy constitutes a qualitative leap in both cognitive approaches and competency sets.

Technologically, library science professionals can leverage AI to proactively conduct knowledge discovery and organization. For example, AI enables the extraction of information from massive literature datasets to construct knowledge graphs, facilitating a shift from fragmented information retrieval to systematic knowledge exploration [4]. In intelligent cataloging, large language models (LLMs) can automatically generate classification codes and subject terms, replacing time-consuming and error-prone manual cataloging processes [5].

The expansion of the ethical dimension is a distinguishing feature of AI literacy. The application of AI in libraries gives rise to critical issues, including:

- Copyright ownership (e.g., defining the rights holder of AI-generated literature summaries);
- Algorithmic bias (unfair resource recommendations caused by biased training data);
- Data privacy (protecting reader information in behavior analysis).

Professionals must possess ethical awareness to continuously evaluate the rationality of technology applications and ensure that technology serves human needs [6].

In terms of innovation-driven development, AI literacy transforms libraries from traditional resource centers into hubs of knowledge innovation. For example:

- Machine learning-powered personalized recommendation systems generate customized booklists based on readers' borrowing history and browsing behavior, stimulating their enthusiasm for knowledge acquisition [7];
- Intelligent consulting robots supported by NLP provide 24/7 responses to common queries, improving service efficiency [8].

2. CONSTRUCTION OF THE KSAVE FRAMEWORK FOR AI LITERACY IN LIBRARY SCIENCE

To systematically cultivate AI literacy among library science professionals and provide a structured professional development pathway, this paper develops the KSAVE Framework, which encompasses five interrelated dimensions as elaborated below:

2.1 Knowledge: Three-Dimensional Construction of an Interdisciplinary Knowledge System

Library science professionals are required to develop a three-dimensional knowledge structure that integrates "core technology + interdisciplinary synergy."

First, core technical knowledge includes:

- Machine learning (e.g., K-means clustering algorithms for automatic thematic grouping of literature, thereby enhancing the efficiency and consistency of classification [5]);
- Natural language processing (e.g., text summarization tools for extracting core content from academic literature [9]);
- Data science (e.g., optimizing resource allocation through the analysis of reader borrowing and search data [10]).

Second, interdisciplinary knowledge focuses on the integration of AI and library science, such as:

- Intelligent retrieval systems that improve accuracy via semantic understanding;
- Deep learning technologies for ancient book restoration [14].

This forms a "technology + profession" composite knowledge structure [13], enabling professionals to bridge technical principles and practical library needs.

2.2 Skills: Practical Ability Matrix for Intelligent Business Scenarios

Based on theoretical knowledge, professionals need to develop a dual-core ability matrix comprising tool application and problem-solving.

Firstly, tool application proficiency involves mastering:

- AIGC tools (e.g., ChatGPT for supporting literature review composition [2], MidJourney for generating visual knowledge graphs [7]);
- Intelligent analysis platforms (e.g., Tableau for predicting book demand using historical borrowing data [10]).

Secondly, problem-solving capabilities require professionals to design AI-driven solutions to address practical pain points, such as:

- Building a multimodal search model (integrating text, images, and voice) to address inefficiencies in cross-language retrieval;
- Developing voice interaction and image recognition systems to assist visually impaired and elderly readers in accessing resources [3] [5].

2.3 Attitudes: Openness and Critical Thinking Amid Technological Change

Faced with the rapid evolution of AI, professionals must balance technological acceptance with critical thinking.

On one hand, they need to proactively track technological advancements (e.g., the application of GPT-4 in intelligent Q&A [7]) and exchange AI implementation strategies through industry conferences, fostering the perception that "technology empowers rather than replaces humans." For example, in intelligent cataloging, AI handles basic tasks, but manual verification remains necessary to mitigate algorithmic errors [6].

On the other hand, they must remain vigilant against the risk of "algorithmic dependence." In intelligent recommendations, for instance, manual intervention is required to break information cocoons, and recommendation results should be optimized based on library collection characteristics and cultural values [3]. Additionally, a rigorous review mechanism for AI-generated content must be established to curb the spread of misinformation [9].

2.4 Ethics: Responsibility and Norms in Technology Application

AI application in libraries must adhere to two core ethical principles: data ethics and academic ethics.

- Data ethics: Compliance with standards such as the General Data Protection Regulation (GDPR) is obligatory. Professionals must explicitly inform users of data collection purposes and retention periods, as well as obtain their informed consent. Federated learning can be employed to achieve "data usability without visibility"; for example, when analyzing reader borrowing behavior, local data is encrypted before participating in collaborative analysis [9, 11].
- Academic ethics: Mechanisms for detecting AI-generated content must be established (e.g., using GPTZero to identify AI-assisted sections in academic papers [6]). Additionally, AI-generated abstracts and book reviews in digital resource libraries should be clearly labeled to avoid confusing readers about information sources [3].

2.5 Values: Professional Commitment to Technological Humanism

AI literacy in library science must be centered on "technological humanism" to ensure that services align with the fundamental nature of libraries and uphold social equity.

- Alignment with service essence: When developing AI voice navigation systems for visually impaired readers, professionals must balance the clarity and personalized configuration of voice prompts while integrating cultural connotations—this mitigates the digital divide stemming from an overemphasis on technology [12].
- Upholding social equity: AI can be used to optimize resource allocation (e.g., intelligently distributing digital resources based on regional economic levels and cultural needs) or develop multilingual service platforms, ensuring equal access to knowledge for users in different regions

and with diverse language backgrounds [1] [14].

3. CULTIVATION PATHWAYS AND PRACTICAL INNOVATION OF AI LITERACY IN LIBRARY SCIENCE

3.1 Educational System: A "Theory-Tool-Ethics" Trinity Curriculum

The curriculum is designed to build a comprehensive foundation for AI literacy, with three core modules:

3.1.1 Core Theoretical Courses

These courses lay the foundation for comprehending the integration of AI and library science.

- Frontiers in AI and Library Science systematically explains the application of technologies such as machine learning and deep learning in intelligent search and personalized recommendations [1] [6];
- Theory of Intelligent Information Organization focuses on methods including knowledge graph construction and intelligent classification [5], enabling students to grasp the underlying logic of technology-business integration.

3.1.2 Practical Tool Courses

"AI Tool Application Workshops" enhance hands-on capabilities by teaching tools such as:

- iThenticate (for academic originality detection);
- Canva AI (for converting borrowing data into visual charts);
- BERT-based tools (for intelligent cataloging) [2] [5] [10].

These workshops strengthen students' problem-solving skills in digital scenarios.

3.1.3 Ethics Seminars

Case-based teaching on "Library Ethical Dilemmas in the AI Era"—for instance, analyzing instances of inaccurate resource recommendations by university library recommendation systems resulting from biased user profiling—explores strategies to enhance algorithmic fairness and strengthen data privacy protection [3, 9, 11], fostering students' ethical decision-making abilities.

3.2 Practical Empowerment: Scenario-Based AI Literacy Cultivation Model for Libraries

A multi-tiered practical model is proposed to bridge the gap between theory and practice:

- In-School Training: Relying on the library's intelligent service platform, practical positions are established, including "AI Resource Organization," "Intelligent Consulting Services," and "User Behavior Analysis." Students can optimize retrieval models, train consulting robots, and analyze reader data to enhance practical capabilities [2] [5] [8] [10].
- Industry-Academia Collaboration: Collaborations with enterprises such as Chaoxing and Tongfang CNKI allow students to engage in projects such as developing "large model-based AI subject service assistants" [13]. Students participate in the entire process from needs analysis to model development, gaining insights into corporate technical standards and business requirements, and improving their ability to apply theory to practice [7].
- International Benchmarking: Drawing on the University of Arizona Library's AI Literacy Certification Program [10], a hierarchical assessment mechanism is established, covering "basic tools, complex problem-solving, and ethical decision-making." Students who pass the assessment can obtain qualifications such as "Library AI Application Specialist," enhancing their global competitiveness [2] [3] [5].

3.3 Ecosystem Development: The Core Role of University Libraries in AI Literacy Education

University libraries play a pivotal role in building a sustainable AI literacy ecosystem, with three key initiatives:

- Resource Provision: An "AI Literacy Learning Resource Library" is built, integrating authoritative resources—including TensorFlow tutorials and the Library AI Application White Paper—and providing guidelines on academic compliance for mainstream text-generating AI tools [2] [6] [8] 10] to meet diverse learning needs.
- Activity-Driven Initiatives: Competitions such as the "AI Empowering Library Services" Innovation Contest (e.g.,

developing intelligent navigation systems and ancient text OCR correction tools [14]) and "AI Ethics Salons" stimulate learning enthusiasm and enhance ethical awareness [3] [7].

- Librarian Empowerment: A "dual-qualified" teaching team is formed, combining library technical experts and university faculty—library experts provide hands-on guidance, while university teachers deliver theoretical instruction. Additionally, AI tool manuals and ethical guidelines are dynamically updated to align with industry trends [10] [15].

4. CONCLUSION

4.1 Dynamic Balance Between Technological Iteration and Educational Lag

The rapid advancement of AI—particularly the continuous iteration of large language models (e.g., GPT-5's multimodal capabilities for analyzing image and audio-based literature [5])—is reshaping literature retrieval paradigms. However, library science curricula often lag behind these developments.

A "dynamic curriculum update mechanism" is therefore required, integrating the latest industry practices each semester. For example, in 2025, some libraries used AIGC to create animated training videos [15]; such practices can be integrated into coursework to ensure that students acquire proficiency in cutting-edge technology applications [6] [7].

4.2 Expanding Disciplinary Boundaries While Upholding Professional Characteristics

The integration of library science with computer science and data science is deepening, but professionals must uphold the discipline's core principles. In AI-based literature classification, for instance, the knowledge hierarchy of the Dewey Decimal Classification (DDC) remains a critical guide for algorithm design. The advantages of AI (e.g., machine learning, NLP) should be integrated while upholding the scientific rigor and professional integrity of literature classification [4] [13].

4.3 Adaptation of Literacy Standards to Globalization and Localization

Internationally recognized AI literacy standards (e.g., UNESCO's Framework on AI Literacy [1]) should be referenced to align with global benchmarks. Simultaneously, it is essential to develop an AI literacy index system tailored to Chinese contexts, integrating Chinese industry standards such as the *Digital Library Intelligent Service Specifications* [14], to promote mutual recognition between domestic and international practices [1] [11].

In the digital intelligence era, AI literacy in library science fundamentally embodies the deep integration of technical rationality and humanistic spirit. By leveraging a cultivation system anchored in "knowledge foundation, skill empowerment, and ethical guidance," library science can reshape its core competitiveness amid the AI wave, transforming professionals into co-builders of knowledge ecosystems and providing sustainable intellectual support for the inheritance and innovation of human civilization. In the future, library science must continuously adapt to technological changes, adhere to its professional essence, and explore innovative paths to achieve sustainable development in the digital intelligence era.

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