*Modern American Journal of Engineering, Technology, and Innovation*
**ISSN(E):** 3067-7939
Volume 2, Issue 5, May, 2026
**Website:** usajournals.org


# THE ROLE OF ARTIFICIAL INTELLIGENCE SCANNERS IN LIBRARY-INFORMATION ACTIVITIES: OPPORTUNITIES AND PROSPECTS

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**Abstract**
Artificial intelligence scanners are advanced technology capable of fundamentally changing the processes of converting, storing, and managing library resources in electronic form. This article analyzes the directions of using artificial intelligence scanners in libraries, their main advantages, capabilities, and prospects for implementing artificial intelligence in library activities.

**Keywords:** Library, scanner, artificial intelligence, digitalization, electronic resource, book, publication.

## KUTUBXONA-AXBOROT FAOLIYATIDA SUN'IY INTELLEKTLI SKANERLARNING ROLI: IMKONIYATLAR VA ISTIQBOLLAR

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**Annotatsiya**
Sun'iy intellekt skanerlari kutubxona resurslarini elektron ko'rinishga o'tkazish, saqlash va boshqarish jarayonlarini tubdan o'zgartirishga qodir bo'lgan ilg'or texnologiyadir. Ushbu maqolada kutubxonalarda sun'iy intellekt skanerlarini

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qo‘llash yo’nalishlari, ularning asosiy afzalliklari, imkoniyatlari, shuningdek, sun’iy intellektni kutubxona faoliyatiga joriy etish istiqbollari tahlil qilinadi.

**Kalit so’zlar:** Kutubxona, skaner, sun’iy intellekt, raqamlashtirish, elektron resurs, kitob, nashr.

**Аннотация**

Сканеры с искусственным интеллектом - это передовая технология, способная коренным образом изменить процессы преобразования, хранения и управления библиотечными ресурсами в электронном виде. В данной статье анализируются направления применения сканеров с искусственным интеллектом в библиотеках, их основные преимущества, возможности, а также перспективы внедрения искусственного интеллекта в библиотечную деятельность.

**Ключевые слова.** Библиотека, сканер, искусственный интеллект, цифровизация, электронный ресурс, книга, издание.

Nowadays, society is experiencing the era of artificial intelligence of the information society. During this period, techniques and technologies based on artificial intelligence began to be created in all areas. Modern libraries are also faced with the need to adapt to the requirements of the digital era: this is due to the increase in the volume of information, the speed of information use, and the requirements for storing rare materials. Traditional digitization methods based on manual labor and outdated equipment have become insufficiently effective. Now, scanners based on artificial intelligence have appeared, which, combining advanced artificial intelligence systems, computer vision, and robotics technologies, open up great opportunities for automating processes, improving the quality of digitization, and improving data management. The main purpose of the article is to highlight the capabilities of artificial intelligence scanners within the framework of library and information activities, assess their advantages, and determine future development directions. As is known, one of the first and most important stages of book digitization is scanning. Traditional methods of scanning

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books and documents, although time-tested, have a number of limitations, especially when it comes to old, damaged books. These methods require a lot of time and labor. At the same time, with traditional scanning, the pages of old books and documents are often fragile and can be torn or damaged during the scanning process. The need to open books 180 degrees leads to damage to the book cover. Manually flipping the pages of a book and adjusting the scanner for each bend is time-consuming. Traditional scanners cannot accurately reflect text distortions caused by page curvature or paper defects.

Artificial intelligence scanners are fundamentally changing library processes, automating daily tasks and increasing the accuracy of data processing. Let's consider the main areas of application of these various scanners in library and information activities:

In the field of automatic book digitization, artificial intelligence scanners solve problems such as contactless scanning and damage elimination. Contactless scanning is an innovative method of digitizing documents, in which the scanning device does not physically touch the pages of the book. This technology is especially required when working with rare, ancient or fragile publications, since the preservation of original copies is important. The introduction of artificial intelligence scanners with contactless technology, such as the Kirtas APT BookScan, allows libraries to carefully store materials and perform high-performance digitization. The principle of operation of contactless scanners is based on robotic systems, optical technologies, error correction using artificial intelligence, etc. Scanners are equipped with robotic manipulators that carefully turn over the pages of the book using vacuum suction cups or air currents. For example, in the Kirtas APT BookScan device, pages are separated by air currents, which eliminates mechanical impact. High-sensitivity cameras (with a resolution of up to 600 dpi) capture images of pages at the most convenient angle. This uses a multi-layered illumination system to eliminate glare and shadows.[1]

In the area of distortion correction, AI scanners solve problems such as correcting the curvature of the original (book, magazine, and similar publications) pages, eliminating shadows and glare, and correcting text deformations. Distortion correction is a key step in the processing of scanned books, especially when working with outdated editions or books that cannot be fully opened. Computer

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vision and artificial intelligence (AI) algorithms allow you to automatically correct defects by converting curved lines, darkened, or deformed pages into accurate digital copies. The shadow of a book cover or the glare of glossy paper interfere with reading text. To solve this problem, multi-level illumination is used. In this case, scanners (for example, Zeutschel Omniscan) take several images with different lighting. Artificial intelligence combines them by removing shadows. [2]

It is known that when scanning old publications, texts sometimes become distorted. Deformations occur as a result of uneven printing, damage to the paper, or wear and tear. AI scanners use text segmentation, morphological operations, and generative adversarial networks (GANs) to eliminate text distortion. AI algorithms ignore background artifacts (dust, stains) and highlight individual characters and lines.

Optical character recognition (OCR) addresses the problem of recognizing multilingual texts. Modern artificial intelligence OCR algorithms, such as ABBYY FineReader, Tesseract, and Google Cloud Vision API, can recognize texts in hundreds of languages, including rare, ancient, and even extinct languages. This is achieved using the following technologies:[3]

- Unicode support. The systems cover all Unicode characters, including hieroglyphs (Chinese, Japanese), Arabic script, Devanagari, and Glagolitic alphabets. For example, Tesseract supports more than 100 languages, including Old Slavonic and Sanskrit.
- Transfer learning. For rare languages (such as Ainu or Manchu), models are trained on a small data set using neural network layers pre-trained from common languages.
- Adaptation to historical fonts. Algorithms analyze the characteristics of ancient fonts, such as Gothic Fraktur or Church Slavonic Cyrillic. For example, the Transkribus project specializes in recognizing medieval manuscripts. In 2023, the National Library of Israel digitized 16th-century scrolls in Ladino (Judeo-Spanish) using ABBYY FineReader, achieving 95 percent accuracy.
- □ Working with manuscript materials. Recognizing manuscript text is one of the most complex tasks of OCR. In this, convolutional neural networks (CNN)

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analyze the geometric patterns of letters. For example, Google's HWR+ project recognizes handwritten notes in more than 50 languages.

In the field of metadata processing, AI scanners process metadata using NLP (Natural Language Processing). Metadata is structured data (author, title, keywords, genre, publication date, etc.) to describe resources, which serves as the basis for cataloging, searching, and managing libraries' collections. AI scanners with Natural Language Processing (NLP) integration automate metadata generation, reduce document processing time, and increase accuracy.

In the field of annotation and abstract generation, AI scanners allow you to quickly create a brief description of documents, which facilitates cataloging, searching, and user interaction [4]. Modern methods are divided into two approaches: extractive and abstractive. Extractive methods are based on extracting the most important sentences from the original text without changing their expression. In this case, they assess the importance of sentences based on their relationship to other parts of the text. Sentence the more often it is mentioned or related to key terms, the higher its weight. Abstractive methods create new expressions by restating and generalizing the content of the document. This requires a deep understanding of the context. In this, BART, PEGASUS and T5 neural networks learn to extract and restate the main thing in the pairs "text → annotation".

Currently, there are many software tools aimed at using artificial intelligence in book scanning, and the most popular one for use in library and information activities is ABBYY FineReader. ABBYY FineReader is a software designed to scan documents and convert them into digital format, using OCR (Optical Character Recognition) technology. The program performs all processes based on artificial intelligence, from scanning books to converting them into electronic form.

Google Books is an electronic library that scans millions of books and makes them available to users online [5]. Google Books uses artificial intelligence to automatically scan books, recognize and index text. It can also automatically edit and improve book covers, pages and other parts.

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ScanTailor is a software designed to automatically edit and improve scanned documents. The program uses AI to straighten pages, remove backgrounds and make text clearer. This significantly improves the quality of scanned books.

BookScan is a special device designed for fast and efficient scanning of books. The device uses AI to automatically turn pages, recognize text, and correct errors. This speeds up the scanning process and improves its quality.

Adobe Acrobat is a software designed to create, edit, and manage PDF documents. The program uses AI to recognize scanned documents, process text, and automatically edit documents. It also provides the ability to translate text into other languages.

In short, AI scanners are becoming an integral part of the development of libraries, transforming them from book storage repositories into active digital systems. These AI-based technologies are not limited to automating simple tasks, but are fundamentally changing the approach to storing, processing, and disseminating knowledge, opening up new opportunities for science, education, and culture. AI scanners allow the digitization of sensitive sources, from medieval manuscripts to early 20th-century newspapers. Technologies such as 3D modeling and AI-powered restoration provide precision that is unattainable with manual processing. AI-powered scanners are not just a tool, but an accelerator of the digital awakening of libraries. They are transforming libraries into innovation hubs where the past meets the future, where knowledge becomes alive and interactive. Libraries must now not only adopt technology, but also rethink their role.

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