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AYURVEDIC MANUSCRIPTOLOGY IN THE AGE OF DIGITAL HUMANITIES AND ARTIFICIAL INTELLIGENCE

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ABSTRACT

Ayurvedic manuscripts represent a significant repository of traditional medical knowledge, preserving diverse information related to disease concepts, diagnostic approaches, therapeutic interventions, pharmacology and regional medical practices. Despite their scholarly importance, many manuscripts remain inaccessible due to physical deterioration, script diversity, inadequate cataloguing and limited availability of trained experts. The emergence of Digital Humanities has introduced innovative approaches for the preservation, organization and dissemination of manuscript resources through digitization, digital repositories, metadata management and online accessibility. More recently, Artificial Intelligence has expanded the scope of manuscript research by facilitating script recognition, Optical Character Recognition (OCR), Natural Language Processing (NLP), automated text analysis and knowledge extraction from large textual collections. These technologies have transformed manuscriptology from a primarily preservation-oriented discipline into a dynamic field of digital scholarship and computational research. However, technological interventions cannot replace the interpretative expertise required for the contextual understanding of Ayurvedic texts. This article examines the role of Digital Humanities and Artificial Intelligence in Ayurvedic manuscriptology, highlighting their applications, opportunities, challenges and future prospects. It argues that the meaningful integration of traditional manuscript

scholarship with contemporary digital technologies can contribute significantly to the preservation, accessibility and revitalization of Ayurvedic knowledge for future generations.

KEYWORDS: Ayurvedic Manuscriptology, Digital Humanities, Artificial Intelligence, Optical Character Recognition, Natural Language Processing.

INTRODUCTION

The Indian knowledge tradition has long emphasized the preservation, transmission, and dissemination of knowledge through textual sources. A vast corpus of knowledge encompassing philosophy, literature, science, medicine, astronomy and spirituality has been preserved in the form of manuscripts. These manuscripts represent invaluable repositories of intellectual and cultural heritage, providing insights into the evolution of knowledge systems across centuries. The significance of textual learning is reflected in the classical statement, *"Śāstraṃ jyotiḥ prakāśārthaṃ darśanaṃ buddhir ātmanaḥ."*[1] which underscores the role of textual knowledge as a source of illumination and intellectual understanding. Within this tradition, manuscripts have served not merely as physical documents but as enduring vehicles for the preservation and transmission of scholarly wisdom. According to the Antiquities and Art Treasures Act (1972), manuscripts are recognized as a category of antiquities. The Act describes a manuscript as a handwritten document possessing scientific, historical, literary or aesthetic significance, provided that it has existed for a minimum period of seventy-five years.[2]

Among the various branches of traditional Indian knowledge, Ayurveda occupies a distinctive position owing to its comprehensive approach to health, disease prevention, diagnosis and therapeutics. While foundational Ayurvedic texts such as *Bṛhattrayī* and *Laghutra*yī are widely studied, a substantial portion of Ayurvedic knowledge remains preserved in unpublished manuscripts housed in libraries, monasteries, temples, research institutions and private collections.[3] These manuscripts contain valuable information related to pharmacology, therapeutics, regional medical practices, formulations, disease classifications and clinical observations that may not be available in printed editions. Consequently, Ayurvedic manuscriptology has emerged as a specialized field dedicated to the identification, cataloguing, preservation, decipherment, editing and interpretation of these textual resources.

Despite their immense scholarly value, Ayurvedic manuscripts face numerous challenges. Physical deterioration caused by age, environmental factors, biological damage and improper storage threatens their long-term survival. In addition, the diversity of scripts such as *Śāradā*, *Grantha*, *Nandināgarī*, *Telugu*, *Malayāḷam* and regional variants presents significant difficulties for researchers. Limited accessibility, inadequate cataloguing and the scarcity of experts trained in manuscript studies further restrict the utilization of these resources. As a result, a considerable proportion of Ayurvedic manuscript heritage remains unexplored and underutilized.

Recent advances in Digital Humanities have created new possibilities for addressing these challenges. Digital Humanities, an interdisciplinary domain that integrates humanities scholarship with digital technologies, has transformed approaches to the preservation, documentation and dissemination of cultural heritage. In the context of Ayurvedic manuscriptology, digitization, digital repositories, metadata management, text encoding and online accessibility have facilitated the preservation of fragile manuscripts while expanding opportunities for scholarly engagement. Digital technologies have enabled manuscripts to be transformed from static archival resources into searchable and interconnected knowledge systems, thereby enhancing their visibility and research potential.[4]

The emergence of Artificial Intelligence (AI) has further expanded the scope of manuscript research. Technologies such as Optical Character Recognition (OCR), machine learning, handwritten text recognition, Natural Language Processing (NLP) and computational text analysis offer innovative tools for the study of manuscript collections. AI-assisted methods can support script recognition, automated transcription, terminology extraction, semantic analysis, manuscript comparison and critical editing. Furthermore, computational approaches to Ayurvedic texts facilitate the identification of drug–disease relationships, therapeutic patterns and historical developments within the Ayurvedic knowledge system. Such applications have the potential to accelerate research while uncovering insights that may remain difficult to detect through conventional methods alone.[5]

However, technological advancements should not be viewed as substitutes for traditional scholarship. The interpretation of Ayurvedic manuscripts requires linguistic expertise, contextual understanding, philological analysis and domain-specific knowledge that cannot be entirely replicated by computational systems. Therefore, the most effective approach lies

in the integration of traditional manuscriptological methods with contemporary digital and artificial intelligence technologies.

Although several studies have examined manuscript preservation, digitization and individual applications of Artificial Intelligence in Ayurveda, a comprehensive framework integrating Ayurvedic Manuscriptology, Digital Humanities and Artificial Intelligence remains relatively underexplored. Most existing studies focus on specific technological interventions or preservation strategies rather than examining their collective role in transforming manuscript-based knowledge systems. Therefore, there is a need to explore how these interdisciplinary approaches can work together to enhance the preservation, accessibility, interpretation and knowledge extraction of Ayurvedic manuscripts.

Against this background, the present article explores the evolving role of Digital Humanities and Artificial Intelligence in Ayurvedic manuscriptology. It examines the opportunities, challenges, and future prospects associated with the application of these technologies in manuscript preservation, analysis, and knowledge discovery, while highlighting their potential contribution to the revitalization and global dissemination of Ayurvedic knowledge.

Challenges in Ayurvedic Manuscriptology

Ayurvedic manuscripts constitute an important component of India's medical and intellectual heritage. Despite their immense value, several challenges hinder their preservation, accessibility and scholarly utilization. These challenges not only threaten the survival of manuscripts but also limit the exploration of the knowledge embedded within them.

One of the most significant concerns is the physical deterioration of manuscripts. Traditional writing materials such as palm leaves, birch bark and handmade paper are highly susceptible to environmental factors, including humidity, temperature fluctuations, fungal infestation, insect damage and mechanical wear. Over time, many manuscripts become fragile, faded, or incomplete, making their preservation increasingly difficult.

Another major challenge is the diversity of scripts and languages employed in Ayurvedic manuscripts. Historical texts have been recorded in scripts such as *Śāradā*, *Grantha*, *Nandināgarī*, *Bengāli*, *Telugu*, *Malayāḷam* and *Devanāgari*, among others.[6] The declining number of scholars trained in reading these scripts has created significant barriers to

manuscript interpretation and critical study. Furthermore, variations in orthography, scribal practices and regional linguistic conventions often complicate textual analysis.

Accessibility remains another critical issue. A considerable number of Ayurvedic manuscripts are preserved in libraries, temples, monasteries, research institutes and private collections, many of which remain inadequately catalogued. In numerous cases, scholars are unaware of the existence or location of valuable manuscripts. The absence of comprehensive catalogues and standardized documentation systems further restricts their utilization for academic research.

The preparation of critical editions presents additional challenges. Multiple manuscript versions of the same text frequently contain omissions, interpolations, scribal errors, and textual variations. Establishing an authoritative text requires extensive comparison and philological expertise, making the process both labor-intensive and time-consuming.

Moreover, the interdisciplinary nature of Ayurvedic manuscript research demands expertise in Sanskrit, manuscriptology, Ayurveda, paleography, codicology and textual criticism. The limited availability of scholars possessing such multidisciplinary competencies continues to impede progress in the field.

These challenges underscore the necessity for innovative approaches that can complement traditional manuscriptological methods. In this context, Digital Humanities and Artificial Intelligence offer promising tools for enhancing preservation, accessibility, textual analysis and knowledge extraction from Ayurvedic manuscript collections.

Digital Humanities and Artificial Intelligence in Ayurvedic Manuscript Research

The emergence of Digital Humanities has transformed the manner in which manuscripts are preserved, studied and disseminated. By integrating digital technologies with traditional humanities scholarship, Digital Humanities provides innovative solutions for addressing many of the challenges associated with Ayurvedic manuscript research. It enables the preservation of fragile manuscript collections while simultaneously enhancing their accessibility and scholarly utility.

Digitization constitutes one of the most significant contributions of Digital Humanities to manuscriptology. High-resolution digital imaging facilitates the creation of accurate digital surrogates of manuscripts, reducing the need for physical handling and minimizing the risk of

damage. Digital repositories further enable the systematic storage and organization of manuscript collections, ensuring their long-term preservation and wider accessibility. Through metadata management and standardized cataloguing practices, researchers can efficiently identify, retrieve, and compare manuscripts from diverse collections.

In addition to preservation, Digital Humanities promotes the development of interconnected knowledge systems. Text encoding technologies facilitate the representation of manuscript content in machine-readable formats, enabling advanced searching, indexing and textual analysis. Online platforms and digital archives have also encouraged collaborative scholarship by allowing researchers from different geographical regions and disciplinary backgrounds to access and contribute to manuscript studies. Consequently, manuscripts are no longer confined to physical archives but have become part of an increasingly interconnected digital research environment.

The growing availability of digitized manuscripts has created opportunities for the application of Artificial Intelligence in manuscript research. Artificial Intelligence provides computational methods capable of processing large volumes of textual and visual data with remarkable efficiency. These technologies are increasingly being employed to support the identification, transcription, analysis and interpretation of manuscript materials.

Machine learning–based script recognition systems can assist in identifying historical scripts such as *Śāradā*, *Grantha* and *Nandināgarī*, thereby facilitating the reading of texts that were previously accessible only to a limited number of specialists. Similarly, AI-powered Optical Character Recognition (OCR) technologies enable the conversion of manuscript images into machine-readable text, making textual content searchable and amenable to computational analysis.

Natural Language Processing (NLP) has emerged as another valuable tool in Ayurvedic manuscript research. NLP techniques facilitate terminology extraction, semantic analysis, automated indexing, text classification, drug identification, and disease mapping. These capabilities allow researchers to explore extensive textual corpora more efficiently and to identify relationships that may remain unnoticed through manual analysis alone.[7]

Artificial Intelligence also contributes to the preparation of critical editions by enabling the systematic comparison of multiple manuscript versions. Computational tools can identify

textual variants, omissions, additions and scribal differences, thereby assisting scholars in reconstructing more reliable textual readings. Although expert interpretation remains indispensable, AI significantly reduces the time required for preliminary textual comparison.

Beyond textual processing, Artificial Intelligence has expanded the possibilities of knowledge mining and computational Ayurveda. The analysis of large collections of digitized manuscripts can reveal patterns related to medicinal substances, therapeutic formulations, disease descriptions and treatment strategies. Such investigations may contribute to a deeper understanding of the historical development of Ayurvedic concepts and provide valuable insights for contemporary research.

Thus, the convergence of Digital Humanities and Artificial Intelligence is reshaping Ayurvedic manuscriptology. While Digital Humanities provides the infrastructure for preservation, accessibility and digital scholarship, Artificial Intelligence enhances the capacity to analyze, interpret and derive meaningful knowledge from extensive manuscript collections.

DISCUSSION

The integration of Digital Humanities and Artificial Intelligence into Ayurvedic manuscriptology represents a transformative paradigm in the preservation, interpretation and dissemination of traditional medical knowledge. While manuscript studies have historically depended upon labor-intensive processes of transcription, cataloguing, textual criticism and philological analysis, contemporary digital technologies have significantly expanded the methodological possibilities available to researchers. The digitization of manuscript collections, coupled with computational tools for data processing and analysis, has enabled unprecedented access to textual resources and facilitated new forms of interdisciplinary scholarship.

Digital Humanities initiatives have contributed substantially to the development of digital repositories, standardized metadata frameworks and collaborative research infrastructures that enhance the accessibility and sustainability of manuscript heritage. These innovations have democratized access to knowledge by transcending geographical and institutional limitations. Simultaneously, Artificial Intelligence has introduced advanced computational capabilities, including handwritten text recognition, script identification, automated

transcription, textual collation, semantic analysis and knowledge extraction, thereby accelerating the study of large and complex manuscript corpora.

Nevertheless, the application of Artificial Intelligence to Ayurvedic manuscripts is accompanied by significant challenges. The heterogeneous nature of manuscript materials, variations in script and orthography, linguistic complexity, damaged folios and the presence of specialized technical terminology often limit the accuracy of automated systems. Furthermore, many Ayurvedic manuscripts contain culturally embedded concepts and context-dependent meanings that cannot be fully interpreted through computational approaches alone. Consequently, AI-generated outputs must be critically evaluated and validated through the expertise of manuscriptologists, Sanskrit scholars, historians of medicine and Ayurvedic practitioners.

It is equally important to recognize that the value of Ayurvedic manuscripts extends beyond their textual content. Their interpretation requires engagement with historical context, intellectual traditions, regional knowledge systems and evolving medical practices. Therefore, Artificial Intelligence should not be viewed as a substitute for traditional scholarship but rather as a powerful complementary tool that augments human expertise and expands research possibilities.

Future advances in machine learning, natural language processing, semantic web technologies, knowledge graph construction and multilingual language models are expected to revolutionize Ayurvedic manuscript research. Emerging computational frameworks may facilitate highly accurate manuscript transcription, automated translation, semantic interlinking of concepts and dynamic knowledge discovery across dispersed textual collections. Such innovations have the potential to establish integrated Ayurvedic knowledge ecosystems that support interdisciplinary investigations involving Ayurveda, manuscriptology, linguistics, medical history, pharmacology, data science and digital heritage studies.

More importantly, the systematic computational exploration of digitized manuscripts may enable the rediscovery of previously neglected or inaccessible knowledge preserved within manuscript traditions. Hidden therapeutic formulations, regional clinical practices, historical epidemiological observations, pharmacological insights and intellectual developments documented across centuries may be identified, analyzed and contextualized through

advanced digital methodologies. These discoveries may not only enrich historical understanding but also contribute to contemporary evidence-informed research, innovation and policy development in traditional medicine.

The convergence of manuscriptology, Digital Humanities and Artificial Intelligence therefore represents far more than a technological advancement; it signifies a new epistemological framework for engaging with traditional knowledge systems. By integrating computational efficiency with rigorous philological and domain-specific scholarship, researchers can ensure both the preservation and revitalization of Ayurvedic intellectual heritage. The future of Ayurvedic manuscriptology lies in fostering collaborative partnerships among manuscriptologists, Sanskrit scholars, Ayurvedic experts, digital humanists, information scientists and AI researchers. Such interdisciplinary cooperation will be essential for transforming manuscript collections from static historical records into dynamic sources of knowledge capable of informing future research, education and healthcare innovation. In this manner, the digital age offers an unprecedented opportunity not only to preserve Ayurveda's textual legacy but also to unlock its untapped intellectual potential for the benefit of future generations.

CONCLUSION

Ayurvedic manuscripts constitute a valuable repository of traditional medical knowledge and continue to play an essential role in understanding the historical development of Ayurveda. However, challenges related to preservation, accessibility, script diversity and textual complexity have limited their comprehensive exploration. The emergence of Digital Humanities has provided effective mechanisms for digitization, cataloguing, preservation and dissemination of manuscript resources, while Artificial Intelligence has introduced innovative approaches for transcription, script recognition, textual analysis and knowledge extraction.

The integration of these technologies has transformed Ayurvedic manuscriptology from a predominantly preservation-oriented discipline into a dynamic field of digital scholarship and knowledge discovery. Nevertheless, technological tools cannot substitute the interpretative expertise of manuscriptologists, Sanskrit scholars, and Ayurvedic practitioners. Rather, they serve as complementary instruments that enhance research efficiency and broaden analytical possibilities.

As digital technologies continue to evolve, their thoughtful application has the potential to unlock previously inaccessible dimensions of Ayurvedic knowledge. The collaborative integration of traditional manuscript scholarship with Digital Humanities and Artificial Intelligence may not only ensure the preservation of manuscript heritage but also facilitate its meaningful contribution to contemporary research, education and healthcare. Consequently, the digital transformation of Ayurvedic manuscriptology represents an important step toward preserving the past while enabling future knowledge innovation.

REFERENCES

1. Vidyanath R, translator. *Charaka Samhita of Agnivesa with Cakrapani Commentary*. Vol. 1. Varanasi: Chaukhambha Prakashan; Sūtrasthāna 9/24. p. 323.
2. Antiquities an art Treasures Act,1972 available on https://www.india code.nic.in>bitstream PDF
3. National Mission for Manuscripts, available on https://www.namami.gov.in
4. Chandrashekhar Nistane V, Ramprakash Mishra B(2024). A Brief Review of Digitalization as a modern and technical face of Manuscript preservation. Journal of Ayurveda and integrated Medical Sciences. DOI:10.21760/jaims.9.5.15
5. Kartik sharma, Aashish Patel, Aswini Ramchandran. Uses and Relevance of A.I in Ayurveda. Journal of Ayurveda and integrated Medical Sciences. DOI:https://doi.org/10.21760/jaims.9.10.32
6. National Mission for Manuscripts, available on https://www.namami.gov.in
7. Vinayak Bhat. Revolutionizing Sanskrit Research : In depth application of AI tools in Indological studies. International journal of Advanced Academic Studies. DOI: https://www.doi.org/10.33545/27068919.2025v7.i7b.1577.