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Bridging Ancient Wisdom and Modern Computing: Indian Knowledge Systems from a Computer Science Perspective

[*]Dr. Greeshma K. V.
[*]Assistant Professor, Department of MCA, School of Computer Applications, Union Christian College (Autonomous), Aluva, Kerala, India **ORCID:** 0000-0002-4558-6936

Abstract - Indian Knowledge Systems (IKS) encompass diverse traditions in philosophy, mathematics, linguistics, medicine, astronomy, and human development, offering valuable perspectives for interdisciplinary education. This paper situates IKS within the broader intellectual history of Computer Science, distinguishing between computing technology and computational thinking. A review of recent research highlights how IKS has been connected to modern domains such as artificial intelligence, natural language processing, and information technology. The core discussion presents conceptual connections between IKS and computing, including *Pramāṇa* (knowledge validation), *Nyāya* (structured reasoning), Pāṇinian grammar (formal language representation), mathematical procedures (algorithmic thinking), coded communication (information security), traditional medicine (health informatics), and Yoga (human-centred technology). These analogical bridges are framed as sources of inspiration rather than claims of direct historical continuity. The paper further examines ethical reflection, educational opportunities, and challenges in integrating IKS into computing curricula, emphasizing the importance of evidence, accuracy, and cultural responsibility. Finally, it identifies future research directions such as Nyāya-inspired explainable AI, Pramāṇa-based evidence validation, computational studies of Pāṇinian grammar, and empirical investigations into IKS-integrated pedagogy. By connecting ancient wisdom with modern tools, the study argues that IKS can foster critical inquiry, interdisciplinary awareness, and responsible innovation in Computer Science education.

Keywords: Indian Knowledge Systems, Computational Thinking, Nyāya, Pramāṇa, Pāṇini, Natural Language Processing, Artificial Intelligence, Responsible Technology, Interdisciplinary Education

1. INTRODUCTION

Computer Science is often perceived primarily through the lens of programming, software development, and digital technologies. Although, its intellectual foundations extend far beyond the physical computer. The core principles such as problem decomposition, symbolic representation, logical reasoning, and systematic procedures existed long before the invention of electronic machines. By distinguishing between computing technology and computational thinking allows us to situate Computer Science within a broader intellectual history, one that connects human reasoning and structured knowledge practices across cultures and centuries.

Indian Knowledge Systems (IKS) provide a particularly rich context for this exploration. Rooted in traditions of philosophy, mathematics, linguistics, medicine, astronomy, and logic, IKS embodies systematic approaches to knowledge acquisition, validation, and application. The National Education Policy (NEP 2020) and University Grants Commission (UGC) guidelines have emphasized the importance of integrating IKS into higher education, encouraging the use of authentic sources, historical records, and rigorous documentation. This institutional recognition highlights the potential of IKS not as a direct precursor to modern computing, but as a valuable intellectual resource that can inspire interdisciplinary inquiry.

The purpose of this paper is therefore not to equate ancient Indian knowledge with contemporary Computer Science, but to highlight conceptual parallels that can enrich teaching, research, and innovation. By examining traditions such as *Pramāṇa* (knowledge validation), *Nyāya* (structured reasoning), and Pāṇinian grammar (formal language representation), alongside mathematical procedures, coded communication, and Yoga, we can uncover insights that resonate with modern computational practices. Such an approach encourages students and researchers to critically reflect on how knowledge is established, how reasoning is justified, and how technology should be developed and used responsibly.

2. LITERATURE REVIEW

Scholarly engagement with Indian Knowledge Systems (IKS) has expanded significantly, with researchers exploring their relevance to computing, artificial intelligence, and higher education. Aithal and Ramanathan (2022) argue that ancient Indian knowledge traditions can act as catalysts for technological innovation, while Mahadevan, Bhat, and Nagendra (2022) provide a comprehensive

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introduction to IKS concepts and applications. Chandratreya, Sharma, and Iyer (2024) emphasize the role of IKS in transforming higher education, and Jaiswal and Singh (2025) highlight how traditional wisdom can be leveraged alongside modern technology to enrich digital learning environments. Patil and Patil (2025) further underline the direct relevance of IKS to Computer Science, situating it within interdisciplinary research.

Several studies have examined specific intersections between IKS and computing domains. Jokhi and Bhatt (2024) discuss the impact of Indian number systems and mathematics on artificial intelligence, while Sewalkar et al. (2025) and Sarma (2026) explore the role of mathematical sciences in AI and machine learning. Mondal (2026) extends this discussion by focusing on IKS contributions to mathematics and computing. Raghuveer and Murthy (2007) provide an early example of applying machine learning to Indian languages, while Vimuktaye (2025) investigates AI applications in Indian languages more broadly. Vaidya et al. (2025) highlight the potential of ancient Indian logic systems for contemporary AI reasoning, and Jajoo and Jajoo (2024) propose an interdisciplinary approach to integrating IKS with robotics and indigenous computing.

Recent scholarship has also emphasized the ethical and pedagogical dimensions of IKS integration. Joshi (2025) examines the role of IKS in generative AI, linking epistemological traditions to modern innovation. Kumar and Ojha (2026) propose a roadmap for computational integration, stressing the importance of neuro-symbolic reasoning and evidence validation. Roy (2026) explores how ChatGPT-assisted integration can bridge ancient wisdom and AI, while Sardar and Baishya (2026) advocate for a value-based approach to combining IKS and AI. Majhi (2025) highlights sustainability as a key outcome of integrating AI with IKS, and Yede (2025) studies the role of AI in embedding IKS into modern education. Nanda and Pradhan (2025) provide a systematic review of AI in mathematics education, identifying global trends and emerging themes. Katiyar (2026) and Jarhad Rohini Somnath (2026) both emphasize opportunities and challenges in applying IKS to IT, machine learning, and data science.

Collectively, these studies demonstrate that IKS can serve as a conceptual bridge to modern computing, offering perspectives on mathematics, logic, linguistics, ethics, and pedagogy. The literature consistently cautions against simplistic equivalence, instead advocating for rigorous methodologies, authentic sources, and interdisciplinary collaboration. This growing body of work underscores the potential of IKS to inspire responsible innovation and enrich Computer Science education.

3. CONCEPTUAL CONNECTIONS BETWEEN INDIAN KNOWLEDGE SYSTEMS AND COMPUTER SCIENCE

The relationship between Indian Knowledge Systems (IKS) and Computer Science can be understood through a series of conceptual bridges that highlight parallels in knowledge, reasoning, language, mathematics, security, medicine, and human-centred design. The guiding principles of *Paramparā* (continuity), *Dṛṣṭi* (perspective), and *Laukika-Prayojana* (practical application) resonate with computing questions about how information is obtained, represented, and validated. Within this framework, *Pramāṇa* offers categories of knowledge validation—perception, inference, analogy, and testimony—that align with processes of data collection and reasoning. Similarly, *Nyāya* provides a structured inferential model that parallels explainable AI, emphasizing transparency and justification.

Pāṇini's *Aṣṭādhyāyī* demonstrates rule-based linguistic representation, inspiring computational linguistics and natural language processing. Mathematical procedures, including techniques popularized in Vedic Mathematics such as *Urdhva-Tiryagbhyam*, illustrate algorithmic thinking and modular problem-solving. Historical practices of coded communication, such as *Mlecchita Vikalpa*, connect to modern concerns in information security, while traditional medical knowledge offers models for classification and diagnosis that can inform health informatics and knowledge representation. Finally, Yoga extends the discussion beyond machines to human-centred computing, encouraging reflection on digital wellbeing, ethical design, and the cultivation of responsibility. Together, these conceptual connections demonstrate how IKS can enrich Computer Science education by providing diverse perspectives on knowledge, reasoning, and responsible innovation.

3.1 Frameworks of Indian Knowledge Systems

IKS can be understood through three guiding principles:

- **Paramparā** – continuity of knowledge
- **Dṛṣṭi** – perspective
- **Laukika-Prayojana** – practical application

These principles resonate with computing questions such as: How is information obtained, represented, and validated? How are systematic procedures designed? How should technological choices be evaluated? Approaching IKS through evidence and interpretation ensures that it is neither romanticized nor dismissed.

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3.2 Pramāṇa and Knowledge Validation

The Nyāya tradition identifies four primary sources of valid knowledge: perception (*Pratyakṣa*), inference (*Anumāna*), analogy (*Upamāna*), and testimony (*Śabda*). These categories provide a framework for discussing data acquisition and reasoning in computing. For example, perception aligns with data collection, inference with modelling, analogy with similarity-based methods, and testimony with trusted sources. Such mappings are heuristic tools for inquiry rather than claims of historical equivalence.

3.3 Nyāya and Structured Reasoning

Nyāya's five-part inferential model—proposition, reason, example, application, conclusion—offers a structured approach to reasoning. This framework parallels contemporary concerns in explainable AI, where transparency and justification of computational outputs are critical. Nyāya does not "invent" AI, but its emphasis on structured inference can inspire models of interpretability and evidence-based reasoning.

3.4 Pāṇinian Grammar and Computational Linguistics

Pāṇini's *Aṣṭādhyāyī* represents one of the most sophisticated grammatical systems in history, employing rule-based derivations akin to formal languages. Modern Natural Language Processing (NLP) similarly relies on parsing, morphological analysis, and semantic representation. Research in Sanskrit computational linguistics demonstrates how Pāṇinian frameworks can inform computational models of language, highlighting the enduring relevance of structured linguistic representation.

3.5 Mathematical Procedures and Algorithmic Thinking

Algorithms are systematic procedures for problem solving, independent of machines. Traditional Indian mathematical techniques, including those popularized in "Vedic Mathematics," illustrate algorithmic structures that can be pedagogically valuable. Techniques such as *Urdhva-Tiryagbhyam* exemplify modular, multi-step procedural thinking and optimization. While their historical attribution to the Vedas is debated, their procedural clarity makes them useful for teaching computational thinking.

3.6 Coded Communication and Information Security

Historical references to coded communication, such as *Mlecchita Vikalpa*, illustrate humanity's long-standing concern with secrecy and controlled information. Modern cryptography, however, is grounded in formal mathematics and computational complexity. The educational bridge lies in using historical practices to introduce the broader problem of information security, while distinguishing them from contemporary cryptographic algorithms.

3.7 Traditional Medicine and Health Informatics

The traditional medical systems relied on observation, classification, and diagnosis. These processes can be conceptually compared with data analysis, feature extraction, and prediction in health informatics. Computational research can contribute to the preservation and representation of traditional medical knowledge through ontologies, multilingual databases, and knowledge graphs. Importantly, historical documentation must be distinguished from scientific validation.

3.8 Yoga and Human-Centred Technology

Yoga emphasizes discipline, attention, and reflection, offering a lens for discussing digital wellbeing and responsible technology. As computing increasingly shapes human behaviour, questions of cognitive workload, ethical design, and human dignity become central. Yoga does not provide technical solutions but encourages reflection on the human dimension of technological development.

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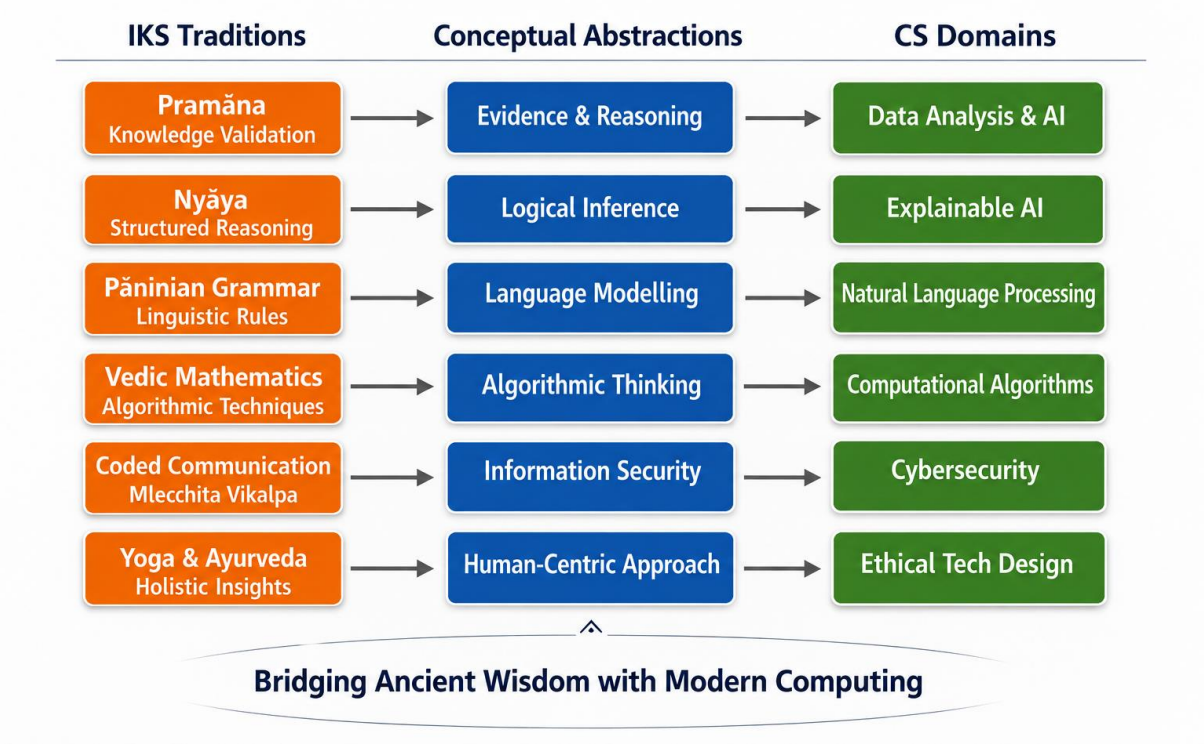

Figure 1. Conceptual Connections between Indian Knowledge Systems and Computer Science

This diagram illustrates how major IKS traditions—*Pramāṇa*, *Nyāya*, *Pāṇinian Grammar*, *Vedic Mathematics*, *Coded Communication*, and *Yoga & Ayurveda*—correspond to conceptual abstractions such as reasoning, inference, modelling, and human-centred approaches, which in turn align with modern Computer Science domains including AI, NLP, algorithms, cybersecurity, and ethical technology design.

4. ETHICAL REFLECTION, EDUCATIONAL OPPORTUNITIES, AND CHALLENGES

Technological feasibility—whether in AI, biometrics, or synthetic media—does not automatically resolve ethical questions of whether such systems should be built or deployed. Indian Knowledge Systems emphasize *Śreyas* (ultimate benefit) over *Preyas* (immediate expedience), and *Dharma* as a guiding principle for responsibility. Integrating these perspectives into computing education can help students critically evaluate the societal impact of technology. At the same time, IKS offers rich opportunities for inquiry-based projects in Computer Science curricula, such as exploring algorithmic structures in traditional mathematics, rule-based reasoning in Nyāya, or computational modelling of Pāṇinian grammar. These projects foster interdisciplinary awareness and align with UGC's emphasis on connecting IKS with contemporary disciplines. However, meaningful integration also requires addressing challenges: ensuring historical accuracy, avoiding simplistic equivalence, fostering collaboration across disciplines, and maintaining cultural responsibility in digitization. Distinguishing between historical documentation and scientifically validated claims is essential for rigorous scholarship, ensuring that IKS contributes to computing education in a way that is both intellectually honest and pedagogically valuable.

5. CONCLUSION AND FUTURE DIRECTIONS

Indian Knowledge Systems provide a diverse intellectual landscape that can enrich Computer Science by offering perspectives on observation, reasoning, representation, and ethical responsibility. Their relevance lies not in proving direct historical continuity but in inspiring inquiry into how knowledge was validated, how reasoning was structured, and how problems were systematically approached. Traditions such as *Pramāṇa*, *Nyāya*, and Pāṇinian grammar resonate with modern domains like data science, explainable AI, and natural language processing, while mathematical procedures, coded communication, and traditional medicine highlight algorithmic thinking, information security, and health informatics. Yoga and philosophical principles such as *Śreyas* and *Dharma* extend this dialogue toward human-centred and responsible technology. Looking ahead, potential research avenues include Nyāya-inspired frameworks for explainable AI, Pramāṇa-based models for evidence validation, computational studies of Pāṇinian grammar, and empirical investigations into IKS-integrated pedagogy. These directions require well-defined methodologies and

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measurable outcomes, ensuring that the integration of IKS into computing education fosters critical thinking, cultural awareness, and responsible innovation.

REFERENCES

[1] Aithal, P. S., & Ramanathan, S. Ancient Indian Knowledge Systems as Catalysts for Technological Innovation: Bridging Tradition with Digital Transformation. *Book: Relevance of Ancient Indian Knowledge to Management of the 21st Century*, *1*, 39-46.
[2] Chandratreya, A., Sharma, R., & Iyer, S. (2024). Bridging ancient wisdom and modern academia: Indian knowledge systems in higher learning. *Transforming higher education through Indian knowledge systems*, *6*.
[3] Jajoo, M. A. P., & Jajoo, M. S. A. INDIAN KNOWLEDGE SYSTEM (IKS) IN ARTIFICIAL INTELLIGENCE, ROBOTICS, AND INDIGENOUS COMPUTING: A INTERDISCIPLINARY APPROACH.
[4] Jaiswal, S., & Singh, H. K. (2025). Indian Knowledge System: Leveraging Traditional Wisdom with Modern Technology. *Transforming Higher Education in the Digital Age*, 138.
[5] Jarhad Rohini Somnath. (2026). Application of Indian Knowledge Systems in Information Technology: Opportunities and Challenges. International Journal of Advance and Applied Research, S7(30), 43–46. https://doi.org/10.5281/zenodo.19908577
[6] Jokhi, D., & Bhatt, M. (2024). IMPACT OF INDIAN NUMBER SYSTEMS AND MATHEMATICS ON ARTIFICIAL INTELLIGENCE.
[7] Joshi, N. The Role of Indian Knowledge System in Generative Artificial Intelligence: Bridging Ancient Wisdom and Modern Innovation.
[8] Katiyar, S. (2026). *Indian Knowledge Systems (IKS) for Artificial Intelligence, Machine Learning and Data Science*. Deep Science Publishing.
[9] Mahadevan, B., Bhat, V. R., & NAGENDRA, P. R. (2022). Introduction to Indian knowledge system: concepts and applications.
[10] Majhi, R. (2025). Integration of Artificial Intelligence (AI) with Indian Knowledge System (IKS) for sustainability. *Indian Knowledge System Through the Ages: From Vedas to Modern Science*, *119*.
[11] Mondal, G. (2026). *Indian Knowledge Systems (IKS) for Mathematics and Computing*. Deep Science Publishing.
[12] Nanda, S. B., & Pradhan, D. K. (2025). Artificial intelligence in mathematics education: A systematic review of global trends and emerging themes. *Journal of Mathematics, Science and Technology Education*, *2*(2), 153-175.
[13] Patil, Y. M., & Patil, S. Y. (2025). Indian knowledge system (IKS) and its relevance to computer science. *Vidyabharati International Interdisciplinary Research Journal*, 11-16.
[14] Raghuveer, K., & Murthy, K. N. (2007, January). Text Categorization in Indian Languages using Machine Learning Approaches. In *IICAI* (pp. 1864-1883).
[15] Roy, B. (2026). From Shastra to Software: Bridging Ancient Wisdom and AI through ChatGPT-Assisted Integration of Indian Knowledge Systems. *Sanskriti: Journal of Humanities*, *3*(1), 48-56.
[16] Russell, S., & Norvig, P. (2020). Artificial Intelligence: A Modern Approach, 4/E.
[17] Sardar, M. S., & Baishya, P. (2026). INTEGRATING THE INDIAN KNOWLEDGE SYSTEM AND ARTIFICIAL INTELLIGENCE–A VALUE-BASED APPROACH. *INDIAN KNOWLEDGE SYSTEM (IKS)*, 325.
[18] Sarma, D. M. (2026). The Role of Mathematics in Artificial Intelligence and Machine Learning. *International Journal of Creative and Open Research in Engineering and Management*, *2*(03).
[19] Sewalkar, A., Sharma, J., Panchal, M., & Gupta, G. (2025). A Significant Approach of IKS in Connecting Mathematical Sciences with AI. *Siddhant-A Journal of Decision Making*, *25*(4), 265-267.
[20] Vaidya, I., Vishvakarma, P., & Vaidya, D. (2025). Harnessing Ancient Indian Logic Systems for Contemporary Artificial Intelligence and Computational Models. *Siddhant-A Journal of Decision Making*, *25*(4), 230-232.
[21] Vimuktaye, S. V. Y. (2025). *AI in Indian Languages* (Doctoral dissertation, Department of Bioinformatics, University of Kerala).
[22] Yede, M. V. S. (2025). A Study on Role of Artificial Intelligence in Integrating Indian Knowledge Systems into Modern Education. *The Nexus of Ideas*, *157*.