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Artificial Intelligence and Indian Knowledge System: A Pathway to Viksit Bharat @2047

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Abstract

The vision of Viksit Bharat @2047 is to develop a vision for a developed and technologically advanced country while maintaining the richness of the intellectual legacy inherent in the Indian Knowledge Systems (IKS). It covers a wide variety of fields ranging from philosophy to medicine, mathematics, linguistics, environmental sustainability, and governance. In recent times, Artificial Intelligence (AI) has been recognized as one of the emerging technologies that has the potential to solve complex problems through the analysis of large amounts of data and the discovery of complex patterns and the ability to make intelligent decisions. This paper attempts to explore the potential synergy between AI and IKS as a viable approach to realizing the vision of Viksit Bharat 2047. This study attempts to understand the potential of AI in the digitalization and interpretation of the knowledge inherent in ancient texts, Sanskrit literature, Ayurveda, and environmental sustainability. In addition to the above, the study attempts to understand the potential of AI in the development of indigenous innovation in the fields of healthcare, education, agriculture, and environmental sustainability. The study is based on a conceptual and interdisciplinary framework, which outlines the opportunities, challenges, and future of AI combining with IKS. It presents that the integration of ancient wisdom, and the new computational intelligence can bring ethical technological growth, culturally dependent innovation, and long-term development of society. The results indicate that the utilization of the Indian Knowledge Systems potentials with the help of Artificial Intelligence can have a substantial impact on the knowledge-based development and will be vital towards achieving the Viksit Bharat 2047 vision.

Keywords: Viksit Bharat, Indian Knowledge System, Sustainable Development, Artificial Intelligence, Education

1. Introduction

Viksit Bharat 2047 vision aims at making India a developed and technologically advanced and knowledge-driven country by the 100th anniversary of the independence of India. To reach this objective, there should be a merger of the contemporary technological advancement and the intellectual heritage of the country. The IKS, which has various disciplines including Ayurveda, Yoga, astronomy, mathematics, linguistics, ecology, and philosophy, is one of the most important intellectual traditions of India.

These types of integrative methods illustrate that AI has the power to confirm and diversify the use of conventional healthcare knowledge in modern medical practice. Moreover, researchers note that the Indian

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philosophical traditions can provide useful ethical insights that could guide the creation of responsible and human-oriented systems of artificial intelligence. Ideas ingrained in the Indian knowledge systems, including holistic thinking, ethical responsibility, and environmental harmony, can help create AI systems that are more focused on societal well-being and sustainability. A combination of these principles and recent AI technologies can contribute to making sure that technological advances and human values or development in the long run are not in contradiction. However, the Artificial Intelligence and the Indian Knowledge Systems integration can be viewed as a strategic course in the context of Viksit Bharat 2047 that contributes to the enhancement of innovation, culture, and sustainable development.

By utilizing AI technologies to preserve and analyze the traditional knowledge and at the same time applying its principles to the modern challenges, India can build a distinct knowledge-oriented ecosystem that will combine ancient wisdom with the modern wisdom. Such interdisciplinary engagement can make the research environment in India stronger; it can also increase innovation capacity and play a leading role towards the achievement of technologically empowered and culturally oriented Viksit Bharat.

These traditional knowledge systems offer comprehensive structures of knowing the nature of the relationship between human beings, technology and nature and have received a new scholarly interest in recent years because of their relevance in contemporary challenges facing the world (Smith, 1967; Sarkozy 2006). Simultaneously, the Artificial Intelligence (AI) has become one of the transformative technologies that can change various industries, such as healthcare, education, agriculture, and governance. Machine learning, natural language processing (NLP), and data analytics are some examples of AI technologies that allow analyzing large amounts of data, learning new things, and making smart decisions. The combination of AI and indigenous knowledge systems is a potential interdisciplinary method of preservation, analysis, and application of traditional knowledge to contemporary situations.

There is growing research on the role AI can play in the process of digital preservation, classification, and interpretation of ancient manuscripts and traditional knowledge repositories, thus making them available to contemporary researchers and policymakers. Recent research notes that AI technologies can be significant in the process of digitizing and interpreting Sanskrit texts and classical Indian literature, which is the core of numerous Indian knowledge traditions. Deep learning models and natural language processing methods are being created to process Sanskrit grammar, to do machine translation and to extract knowledge out of old texts.

The above developments facilitate changing the centuries-old manuscripts into data readable by machine and that can contribute to the case of modern scientific and technical studies. There is also the development of advanced language models and semantic recommendation systems to analyze Sanskrit literature and cultural texts which show the possibilities of AI-based methods to mediate traditional knowledge and modern computational methods.

The other important point of intersection of AI and IKS is in the field of traditional medicine and healthcare, especially Ayurveda and the AYUSH system in general. According to the latest studies, AI and machine learning methods can be used to improve the diagnostic procedure, individualized treatment strategy, and pharmacological research in Ayurvedic medicine. To provide an example, machine learning has been used to examine Prakriti classification and dosha imbalances, which enables custom health recommendations, using the Ayurvedic tradition of combining traditional and modern data-driven approaches.

2. Literature Review

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The interaction of AI and IKS has become a topic of rising interest in recent research as one of the promising methods by which to preserve traditional knowledge and combine it with the latest technological developments. As the significance of digital transformation and knowledge-based development has increased, scholars have started exploring how AI tools like machine learning, natural language processing (NLP), and knowledge representation can be used to preserve, analyze, and reuse the traditional knowledge sources. Some of the studies are oriented at digital preservation of traditional knowledge and cultural heritage. Narayanan stressed the fact that indigenous knowledge can be maintained and shared with the help of digital repositories and intelligent knowledge management systems enabled by digital technologies and AI tools.

On the same note, Kumar and Sharma brought out the possibility of AI-based data mining methods in knowledge extraction of the ancient manuscripts and cultural archives. This research indicate that AI technologies can aid in transforming unstructured historical data into structured digital bodies of knowledge, which can be accessed and researched by more people. Computational processing of Sanskrit and classical Indian texts is another significant area of research. A lot of the Indian knowledge traditions, which are explanations of philosophy, mathematics, linguistics, and medicine, owe their support to Sanskrit literature. Nevertheless, the Sanskrit grammar is too complicated to be analyzed by computers. Sandhan et al. presented SanskritShala, a natural language processing system based on deep learning that is capable of handling Sanskrit texts via tasks like morphological analysis and syntactic analysis.

On the same note, Nehrdich et al. have designed the ByT5-Sanskrit language model which works better in Sanskrit word segmentation, text correction and linguistic analysis. These innovations testify to the increased use of AI to access the rich intellectual tradition inherent in traditional Indian works.

The adoption of AI in the existing healthcare systems and specifically Ayurveda has also been studied by researchers. Ayurveda focuses on personalized medicine in individual body constitution (Prakriti). The machine learning models suggested by Gupta et al. are aimed at the analysis of Ayurvedic clinical data and supporting personalized treatment recommendations. Mallajosyula et al. discussed the perspective of using AI and machine learning methods to analyze Ayurvedic datasets and enhance disease prediction systems.

Also, AI methods have been used in the herbal identification of medicine, the classification of medicinal plants, and drug discovery by Ayurvedic information. These innovations show that AI may have a significant role in the transformation of the traditional healthcare systems without compromising its fundamental principles. The other new topic of research is knowledge extraction and knowledge graph construction based on traditional texts. Terdalkar and Bhattacharya suggested a semantically extracted system in Sanskrit texts to become an input to question-answering systems and knowledge representation using AI. On the same note, scholars have investigated semantic recommendation systems and AI-based search engines that can be used to find the appropriate information based on the ancient Indian literature.

These technologies help the researchers to travel a huge textual corpus with ease and recognize knowledge patterns that otherwise would have been obscured. Besides preservation and analysis, scholars have also explored how Indian philosophical and ethical ideas can help to create responsible AI systems. Sharma and Singh state that dharma, ahimsa, and holistic thinking are some of the principles of Indian philosophical traditions that can offer important information to design ethical and human-focused AI systems.

Another point that researchers raised is that the incorporation of the cultural and ethical insights of the Indian knowledge traditions can be used to mitigate the issue of bias, accountability, and transparency of the AI

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systems. Figure 1 below demonstrates the interaction between AI technologies and IKS.

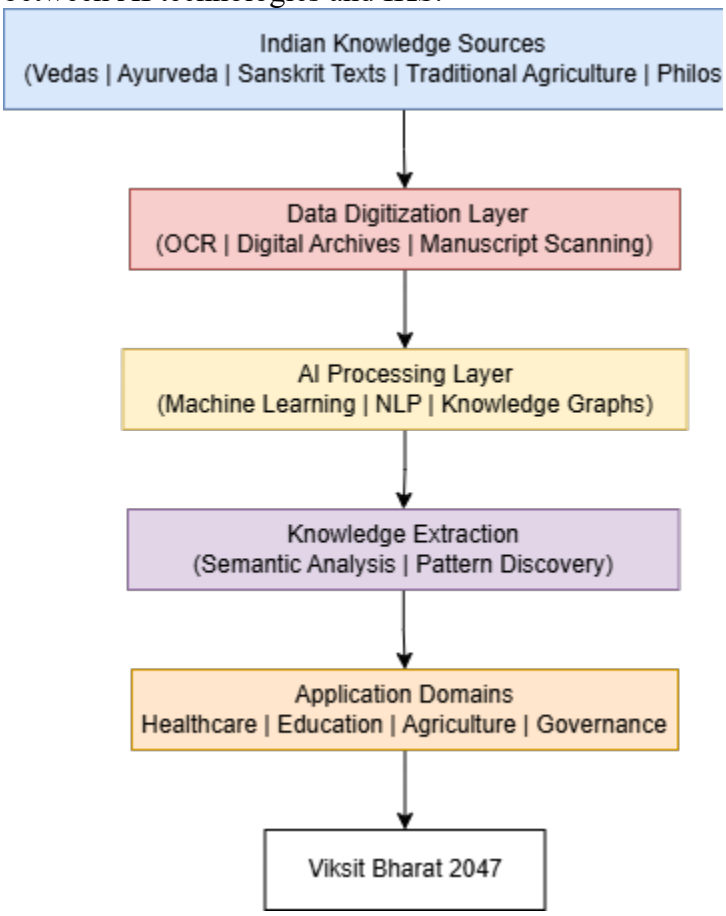

Figure 1: Architecture of AI-IKS Integration

Moreover, there is a recent emphasis on the possibility of using AI and traditional knowledge systems to pursue sustainable development and national innovation objectives (Germinvin 2021). Scientists believe that integrating native environmental experience with artificial intelligence-based analytics can help to achieve sustainable production, water and environmental control. On the same note, interdisciplinary research stresses that combination of AI and traditional knowledge systems can help in achieving economic growth through innovation and through the wider national perspective of Viksit Bharat 2047. Although great progress has been made in using AI to Indian knowledge systems, there are a number of challenges. These are the problems of data access, digitization of traditional manuscripts, standardization of traditional knowledge collections, and cross-disciplinary partnership between technologists and domain specialists. By solving these issues, it will be essential to achieve the full potential of AI-based research in Indian knowledge systems.

Ref	Authors	Research Focus	Methodology	Key Contribution	Limitation
[12]	Narayanan	Digital preservation of IKS	Digital repositories & AI tools	Promotes preservation of indigenous knowledge	Limited technical implementation
[13]	Kumar & Sharma	AI for cultural heritage	Data mining & knowledge extraction	Converts manuscripts into structured data	Requires large datasets
[14]	Sandhan et al.	Sanskrit NLP	Deep learning NLP models	Developed SanskritShala toolkit	Limited dataset availability
[15]	Nehrdich et al.	Sanskrit language models	Transformer-based NLP	Improved Sanskrit text processing	Needs large training data
[16]	Gupta et al.	AI in Ayurveda	Machine learning models	Personalized healthcare analysis	Clinical validation required
[17]	Mallajosyula et al.	AI in Ayurvedic datasets	Predictive modeling	Improved disease prediction	Data standardization issues

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[18]	Sharma et al.	Herbal medicine identification	Image classification using AI	Medicinal plant recognition	Limited species datasets
[19]	Terdalkar & Bhattacharya	Knowledge extraction from Sanskrit	Knowledge graph models	Semantic QA systems	Limited domain coverage
[20]	Raorane & Kole	Sanskrit recommendation systems	AI-based semantic search	Intelligent literature retrieval	Scalability issues
[21]	Sharma & Singh	Ethical AI from Indian philosophy	Conceptual analysis	Ethical AI framework	Lack of implementation
[22]	Verma et al.	Responsible AI frameworks	Interdisciplinary research	Cultural ethics integration	Conceptual stage
[23]	Patel et al.	AI in sustainable agriculture	ML-based environmental analysis	Supports sustainable farming	Data availability
[24]	Ramesh et al.	IKS for innovation ecosystem	Policy & technology analysis	Supports knowledge-driven economy	Needs empirical validation
[25]	Bhat et al.	AI & national development	Interdisciplinary study	Links IKS with Viksit Bharat	Limited case studies

3. Research Gaps

Even though there have been major studies on the intersection between AI and IKS, there are still a number of research gaps that have been identified to be critical. It is necessary to identify these gaps so that a comprehensive framework can be created that will ensure that traditional knowledge is adds to the current technological developments to assist with the vision Viksit Bharat 2047.

Absence of AI-IKS Integrated Frameworks. The literature suggests that the research that has been done is mainly on individual areas of IKS, including Ayurveda, Sanskrit linguistics, or cultural heritage preservation. Nevertheless, few studies have suggested an overall framework of co-locating various elements of Indian knowledge systems with the AI technologies. The recent studies focus on isolated applications instead of an extensive ecosystem between the objectives of knowledge preservation, analytics, and the goals of national development.

Small Digitalized and Structured Data. One of the challenges of the application of AI to Indian knowledge systems is the absence of large-scale digitized sources based on ancient manuscripts and classics. There are many Sanskrit manuscripts that have not been digitized or are otherwise not structured, so they cannot be easily processed by machine learning models. This data shortage greatly limits the creation of advanced AI frameworks to do linguistic analysis, knowledge extraction, and semantic interpretation. Problems with Processing Sanskrit Computationally. Despite achievements in the field of research on Sanskrit NLP, Sanskrit morphology and grammar is complicated, which makes it hard to use machines as models. The research on language models and speech recognition in Sanskrit points that the creation of the correct computational means necessitates huge, annotated sample data sets and dedicated linguistic tools.

Consequently, the use of AI in Sanskrit knowledge extraction is still scanty in relation to popular languages

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like English or Chinese. Absence of Standardised Knowledge Representation Models. One more research gap is associated with how the traditional knowledge is represented in machine-readable formats. There is an early development of knowledge graphs, ontologies, semantic frameworks of representing knowledge of Vedic texts, Ayurveda, and philosophical literature.

It is difficult to implement AI systems in Indian knowledge repositories without standardized knowledge representation models. Lack of Interdisciplinary Cooperation. The field of AI and Indian knowledge systems is usually researched in different academic circles. Computer scientists' dwell on the development of algorithms, whereas the representatives of traditional knowledge dwell on historical or philosophical conception. The absence of interdisciplinary partnership hinders the creation of powerful AI models that can be used to interpret conventional sources of knowledge.

Inconclusive AI Uses in the conventional health care systems. Despite the promising nature of AI in Ayurveda and other traditional healthcare systems that some studies have been conducted, real-life applications are few. According to researchers, the issue of standardization of data, clinical validation, and the lack of integration with modern healthcare systems remains impediments to the widespread implementation of AI-driven solutions in conventional medicine.

Ethics and Culture in the Development of AI. Ethical frameworks based on Indian philosophical traditions are not common in the current AI research. Although the idea of dharma, ahimsa, and overall well-being might find its way into the creation of responsible AI systems, this view is still underexplored in the current AI studies framework. Disparity in National Development Perspective. The majority of AI and IKS research is related to technical or domain-specific systems, whereas the number of studies relating these innovations to national development plans, including Viksit Bharat 2047, is very low. Research is required to help understand how AI-based applications of Indian knowledge systems can help make innovations, create sustainable economic growth, and make use of knowledge at a national level.

4. AI and IKS: Proposed Framework to Integrate Viksit Bharat 2047

The combination of both offers a viable strategy in both conserving the ancient knowledge and at the same time utilizing the new computational technologies to resolve issues in contemporary society. To successfully utilize the opportunities of both fields, this paper suggests a conceptual framework that would help to digitize, analyze, and apply Indian knowledge systems to add to the national plan of Viksit Bharat 2047.

The proposed model has four significant layers, i.e. knowledge acquisition and digitization, knowledge processing and analysis, application domains, and socio-economic impact. The layers are the main milestones on the way to the transformation of traditional knowledge into actionable insights with the aid of artificial intelligence technologies.

4.1 Layer of Knowledge Acquisition and Digitization

The initial phase of the framework is on the gathering, digitization, and conservation of traditional knowledge resources. The Indian knowledge systems are mostly recorded in the form of ancient manuscripts, scriptures and classical literature most of which are in the form of Sanskrit or local languages. It is necessary to computerize these resources to allow them to be subjected to computational processing and research. Scanned manuscripts can be turned into machine-readable formats using AIs as optical character recognition (OCR), document image recognition, and text digitization. Also, these may be digitized and stored in digital libraries and knowledge repositories to allow massive data analysis and sharing of knowledge. The latest progress made in the field of AI-based document processing systems has enhanced the

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accuracy of text recognition in historic manuscripts and archival documents to a great extent. Metadata annotation and classification also form part of the digitization process and make the knowledge sources be organized based on their domains like Ayurveda, astronomy, linguistics, philosophy, and environmental sciences. The computerized repositories allow the researchers to more effectively access and process traditional knowledge.

4.2 Knowledge Processing and Analysis Layer

After having digitized the knowledge sources, the second step is the processing and analysis of the extracted information with the application of artificial intelligence. The interpretation of rich textual data and the discovery of patterns in conventional, knowledge-based systems are some of the problems that can be worked on through AI technologies, machine learning, natural language processing (NLP), knowledge graphs, and semantic analysis. The methods of natural language processing are very important in the analysis of textual materials in Sanskrit and the classical literature, making it possible to perform such tasks like segmentation of words, translation and meaning acquisition.

The algorithms of the machine learning can also be used to analyze both text and numerical data to determine the relationships between the two knowledge domains. The relationships among ideas, concepts, and entities that exist in the traditional knowledge systems can also be expressed using knowledge graphs and ontology-based models. The ability to discover ancient texts and meaningfully interpret them through the use of such structured knowledge representations enables AI systems to combine these insights with the modern science field. Figure 2 below shows Conceptual Representation of the Proposed Framework

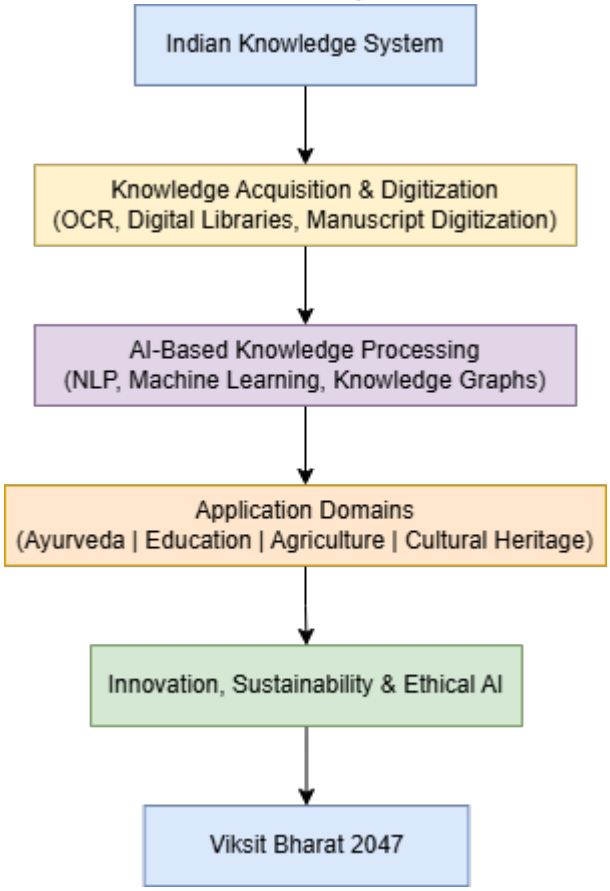

Figure 2: Conceptual Representation of the suggested Framework.

4.3 Application Layer

The third phase of the framework involves the implementation of AI-enabled knowledge derived out of the Indian knowledge systems to address practical issues in different sectors.

a. Healthcare and Ayurveda

Artificial intelligence can help to improve the usage of Ayurvedic knowledge by interpreting patient information and predicting disease trends, as well as assist in the formation of personalized treatment recommendations. AI diagnostic models have the potential to combine old medical knowledge and new healthcare analytics to enhance the efficacy of treatment.

b. Knowledge Dissemination and Education.

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Indian knowledge traditions could be integrated into the modern curricula with the help of AI-powered educational platforms. Intelligent tutoring systems, online knowledge systems and virtual learning environment can assist students to explore not only traditional knowledge but also the new scientific fields.

c. Sustainable Environmental Management and Agriculture.

Indian traditional knowledge comprises of sustainable agriculture practices, ecology that focuses on harmony with nature. These traditional practices can be combined with the modern data analytics, which consist of AI-driven environmental monitoring systems and predictive models, to enhance agricultural productivity and environmental sustainability.

d. Preservation of Cultural Heritage.

Artificial intelligence will also be helpful in preservation and restoration of cultural artifacts, historical documents, and traditional art forms. The system of image recognition, virtual reality platforms and digital archiving can be used to preserve and popularize the cultural heritage of India among the future generations.

e. Socio-Economic Impact Layer

The last phase of the offered framework brings out the overall social and economic effect of blending AI and Indian knowledge systems. India can enhance innovation-driven growth, sustainable development, and cultural preservation using AI technologies to analyze and apply the traditional knowledge.

Contact with AI and IKS can help shape the knowledge-based industrial sector, advance interdisciplinary research, and assist in the field of healthcare innovation, educational technology, and sustainable agriculture. Moreover, the use of moral and philosophical rules found in Indian cultures in AI systems may help to make artificial intelligence responsible and anthropomorphic.

Such an integrated approach is not new; such a holistic integration is congruent with the national vision Viksit Bharat 2047 that focuses on technological development, preservation of cultural heritage, and sustainable development as the main pillars of national development.

5. Conclusion

The combination of Artificial Intelligence (AI) and Indian Knowledge Systems (IKS) is a promising research direction toward the gap between conventional wisdom and advancement in technological innovation. The Indian tradition of knowledge involves a rich store of knowledge in medicine, linguistics, philosophy, environmental science and governance. Incorporated into the analytical and computing abilities of artificial intelligence, these knowledge systems of the past can be converted into resourceful materials to solve modern socio-economic issues in the society. This paper discussed the opportunities of synergy between AI and Indian knowledge systems and one of the conceptual frameworks that emphasized the role of AI in digitalizing, analyzing, and applying traditional knowledge in different fields. The framework shows how AI technologies, including machine learning, natural language processing, and knowledge representation models could be applied to classical texts, cultural heritage maintenance issues, and how information on the traditional repositories might be converted into actionable insights. Such technologies have a potential to substantially improve the availability and usability of the source of ancient knowledge, allowing the scientists and policymakers to combine the traditional knowledge with the current scientific activity. The use of AI-powered solutions in the areas of Ayurveda, sustainable agriculture, education, and environmental management provides a picture of how incorporating indigenous knowledge and modern technologies can be used to advance sustainable development and innovation. Moreover, the integration of ethical concepts based on Indian philosophical traditions into AI development

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frameworks can also help to form the responsible and human-oriented AI systems. This strategy will match the overall national goals of Viksit Bharat 2047 that aims at a technological advancement, an economic development based on knowledge and safeguarding cultural heritage. Overall, the Artificial Intelligence and Indian Knowledge Systems integration can play an important role in creating the knowledge-oriented, culture-based, and technologically empowered community. India can use the attributes of both ancient wisdom and the latest computational intelligence by taking the advantage of both to promote innovation, research, and global competitive knowledge-based economy.

Future Research Directions

Even though there are great opportunities in the integration of AI and Indian Knowledge Systems, there are other spheres that need to be researched and developed. Massive Digitalization of ancient manuscripts. Further work needs to be done as future research to create a better system of AI-powered optical character recognition (OCR) and document analysis to allow the proper digitization of ancient manuscripts with Sanskrit and regional languages. By developing large-scale online repositories, more of the traditional knowledge sources will be subjected to comprehensive computational study.

a. Sanskrit Natural Language Processing Model Development

The development of Sanskrit NLP technologies is one of the research priorities. Future research must be directed at creating big, annotated corpora, transformer-based language models, and multilingual AI systems that can be able to handle classical texts and extract structured knowledge.

b. Indian Knowledge Systems Knowledge Graphs and Ontologies

The creation of the knowledge graphs and ontology-based structures to capture relationships between concepts of Indian knowledge traditions is another critical direction of research. This type of system would enable AI models to process and apply traditional knowledge in more useful ways in contemporary research and innovation settings.

c. AI-based Applications in conventional Healthcare Systems

More studies are needed on the application of AI and data-driven analytics to Ayurveda and other traditional healthcare systems. To come up with dependable healthcare solutions, clinical validation, standard datasets, and interdisciplinary partnerships between medical practitioners and AI researchers will be fundamental.

d. Ethical Frameworks to be incorporated in AI development

The Indian schools of thought offer some useful ethical insights that can be used to create responsible AI systems. Future studies need to discuss ways in which the notions of dharma, holistic well-being, and ethical responsibility may be included in the system of AI governance. Viksit Bharat 2047 Policy and Innovation Ecosystems. Lastly, a study ought to be conducted into ways in which the combination of AI and Indian knowledge systems can facilitate a national innovation agenda, policy formulation, and entrepreneurship systems. The interdisciplinary cooperation between technologists, policymakers, and traditional knowledge scholars will particularly be instrumental in achieving the Viksit Bharat vision.

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