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Artificial Intelligence in Holistic Preventive Healthcare- A Narrative Review of Integrative Approaches in Ayurveda, Yoga, and Mental Health

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ABSTRACT: Artificial intelligence is changing the way health is measured in terms of personalized, data-informed and wellness-oriented approaches. In the last ten years, there has been a growing curiosity about how to integrate AI models with traditional Indian systems like Ayurveda and Yoga, with the aim of making this knowledge widely available for disease prevention and holistic optimal health. This narrative review covers research at the intersection of AI and healthcare based on three major domains namely mental health assessment, yoga posture assessment and correction, and Ayurvedic prakriti categorization for personalized healthcare recommendations. In this paper, we review the recent models used in the domains of study, the major discoveries from different models, and their results. It also recognizes the growing potential to design AI-powered integrated healthcare models that utilize the benefits of both modern technology and traditional healthcare systems. The study highlights the huge potential of artificial intelligence to improve the effectiveness, accessibility and customization of preventative health care treatments. To promote holistic preventive health care, this study integrates the research perspectives of Ayurveda, yoga and mental health providing an overview of current research and future objectives.

1. INTRODUCTION

In recent decades, Artificial Intelligence (AI) has led to remarkable benefits in healthcare, mental health and lifestyle management [1,2]. AI techniques such as Machine Learning (ML), Natural Language Processing (NLP) and Deep Learning (DL) have shown great potential in the field of disease prediction, health monitoring and personalized healthcare recommendations [3]. The exponential growth of research in AI and healthcare is evident but the integration of AI with Ayurveda and Yoga is an area that has not been explored much.

There is growing interest in digital platforms for yoga, AI-assisted meditation tools and prakriti classification systems based on Ayurveda. This means an increasing willingness to combine modern computational approaches with traditional systems in prevention, total health and health consciousness. This convergence may democratize personalized healthcare, and deliver age-old practices to the masses via digital technologies. This review is motivated by a number of gaps in the existing literature. A majority of the studies on AI in healthcare or digital well-being are from the viewpoint of technology and less concentrated on the principles and practices of traditional Indian systems. Additionally, there are very few studies which attempt to compare approaches that integrate AI techniques with Ayurveda, Yoga and mental health applications.

To bridge these gaps, this paper presents a narrative review of the research at the intersection of AI, healthcare and ancient Indian systems. The reviewed studies are broadly categorized into three major domains, namely mental health assessment, yoga pose detection and correction, and Ayurvedic prakriti classification for personalized healthcare. In this review we discuss

the state of the art in these fields in order to identify current achievements, challenges and opportunities for future development. Section II provides a short description of ancient Indian systems and describes AI in healthcare. Section III discusses the related work on mental health prediction; yoga pose analysis and prakriti classification using ML and DL techniques. IV. Analytical Observations from the Surveyed Literature Key challenges and future research directions are discussed in Section V. Finally, the paper concludes with the discussion on integration of AI with traditional Indian knowledge systems for holistic preventive healthcare and better quality of life.

2. BACKGROUND

2.1 Artificial Intelligence in Preventive Healthcare systems

AI is becoming a recognized technology in healthcare, providing new ways to diagnose disease, treat it and monitor patients. ML algorithms are powerful tools for diagnosis and prediction of disease. They can analyse medical images, tissue samples and tumour data to identify and classify different types of cancer and assess the risk for developing cardiovascular diseases and other health conditions [1],[2]. NLP has also made significant contributions to the healthcare sector by extracting valuable information from electronic health records, patient-generated data, medical documents and other healthcare-related textual sources. These AI capabilities have paved the way for more effective, faster and accurate clinical decision support systems [4]. The use of AI in mental health assessment has been actively growing in areas such as: AI-based emotion recognition systems, conversational agents and recommender systems for stress management have been developed to cope with the growing mental health challenges of the modern society [5]. AI-enabled mobile health (mHealth) technologies are extensively used in the management of chronic diseases and continuous monitoring of well-being [6].

Recent studies have also indicated the increasing role of AI in integrative medicine. These advances hold promise for integration of AI with ancient Indian systems of knowledge like Ayurveda and Yoga for holistic and preventive healthcare [3],[7].

2.2 Ancient Indian Systems for Holistic Well-Being

Holistic approaches to health, balancing body, mind and spirit are offered by ancient Indian systems based on Yoga, Ayurveda and philosophical texts.

2.2.1 Yoga

Yoga is a system based on the Ashtanga Yoga principles as mentioned in the Yoga Sutras of Patanjali. The term Yoga is wrongly assumed to be only physical body postures. It is a way of life that promotes holistic health by developing physical fitness through asanas, mental and emotional strength through self-discipline and reflection, and inner equilibrium through meditation. Patanjali's Yoga, which is based on the belief that individual and social well-being can be attained when human actions and conduct are in harmony with its ethical and moral principles [8].

With the advent of technology, Yoga has become more accessible and reachable in this age, allowing people to easily include its practices in their daily lives. Digital platforms and intelligent systems have enabled the use of Yoga for stress management, psychological and physiological health improvement, resilience enhancement, and well-being. Therefore, Yoga still offers an organic and sustainable way to promote long-term health and holistic healing [8].

2.2.2 Ayurveda

Ayurveda is one of the oldest systems of medicine in the world; it is based on the principle of personalized healthcare. It stresses on maintaining a balance among the three doshas – Vata, Pitta and Kapha – and adopts a holistic approach to health by taking into account an individual's physical, mental and lifestyle characteristics. Prakriti is a basic concept in Ayurveda where it refers to the individual constitution of a person based on the relative dominance of the three doshas. The Prakriti of a person influences the physical features, mental tendencies, metabolism, susceptibility to diseases and individual lifestyle requirements [9].

In recent years the application of Ayurvedic principles in preventive healthcare has paid increasing scientific interest to the area. It has been shown that a combination of current health care practices with individual health advice, herbal interventions and lifestyle changes helps to maintain health and reduce the risk of disease [9]. Meanwhile, the progress in AI has created new opportunities to incorporate ayurvedic knowledge into digital health systems. Research isongoing on AI-based tools for

prakriti assessment, personalized dietary recommendations based on dosha profiles and intelligent systems that suggest lifestyle modifications according to one's constitution and health needs [9].

3. SURVEY OF EXISTING WORK

In this section, we briefly review the existing work in three fields viz. Role of AI in Mental Health, Yoga and Ayurveda. Each subsection reviews research in these three areas, emphasizing major contributions and emergent trends.

3.1 AI in Mental Health and Well-Being

Mental health has received more attention in recent years because it plays an important role in overall health and well-being. Figure 1 depicts the use of ML algorithms to predict depression, anxiety, stress and suicidal risk symptoms using social media, speech patterns and facial expressions. These trends suggest the increasing importance of ML algorithms in early detection of mental health disorders [11]. Furthermore, AI-based conversational agents have emerged as useful tools to deliver evidence based Cognitive Behavioural Therapy (CBT) to the masses. Woebot has demonstrated efficacy as a digital therapeutic assistant for individuals with mental health concerns [12].

The integration of AI with wearable devices allows for the real-time monitoring of physiological signals like heart rate variability, galvanic skin response, and sleep patterns. Along with the monitoring aspects these technologies can provide personalized insights and stress management strategies which can complement Yoga and meditation practices, both of which have been long associated with promoting mental well-being [13].

Furthermore, DL models have proven promising in predicting suicide ideation and the risk of relapse among patients, ensuring timely intervention and support. Recently, graph-based DL models have been explored for suicide ideation risk prediction using questionnaire-based data as input. These studies show the potential of AI to identify people at risk at an early stage.

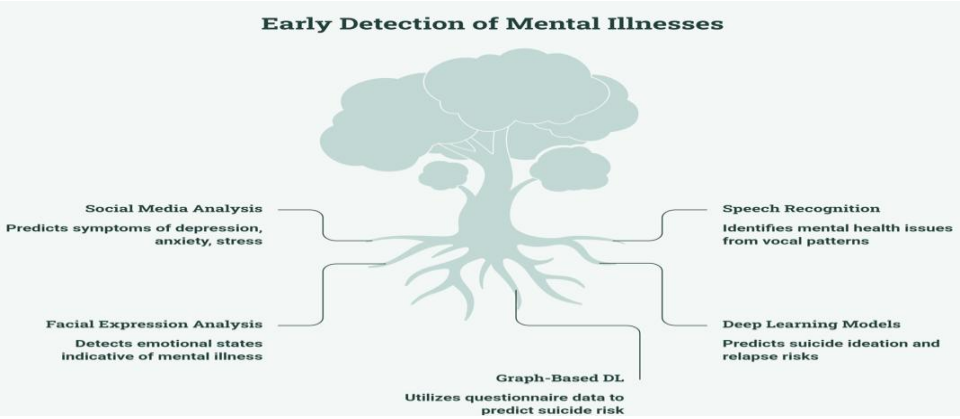

Figure 1. Role of AI in Mental Health

3.2 AI and Yoga

As Yoga is globally recognized as an effective approach to health and wellness, recent technological advancements have resulted in AI-powered tools that offer personalized experiences to make Yoga more accessible for users. With Computer Vision techniques, Yoga postures can now be automatically identified and corrected with real-time feedback during the practice [15]. For example, the YPose framework, a CNN-based model for single-image RGB-based physical posture detection. The framework achieves an accuracy of about 93.3% on standard Yoga-82 dataset, significantly improving over previous baseline method [15]. Other pose estimation frameworks like OpenPose and MediaPipe are used to estimate posture alignment, improve accuracy and enable safe practice of Yoga [16]. Fig. 2 [17] demonstrates the application of AI-powered recommendation systems to suggest personalized Yoga routines according to an individual's health condition and fitness goals. The hybrid recommendation model that combines rule-based and DL techniques allows users to explore the dynamic evolution of Yoga practices for applications such as stress relief and rehabilitation programs [18].

While there has been significant progress, as evidenced in Fig. 2, where current ML and DL algorithms are capable of

accurate Yoga pose recognition, suggesting posture corrections, offering real-time feedback, and generating precision scores, the existing research still remains focused on the physical aspects of Yoga. Less attention has been paid to the use of AI in the larger therapeutic and philosophical aspects of Yoga such as pranayama, meditation and other traditional practices. These are promising areas for future research and may further strengthen the role of AI in holistic preventive healthcare as mediation and pranayama triggers the parasympathetic nervous system which sets the body in self-healing mode.

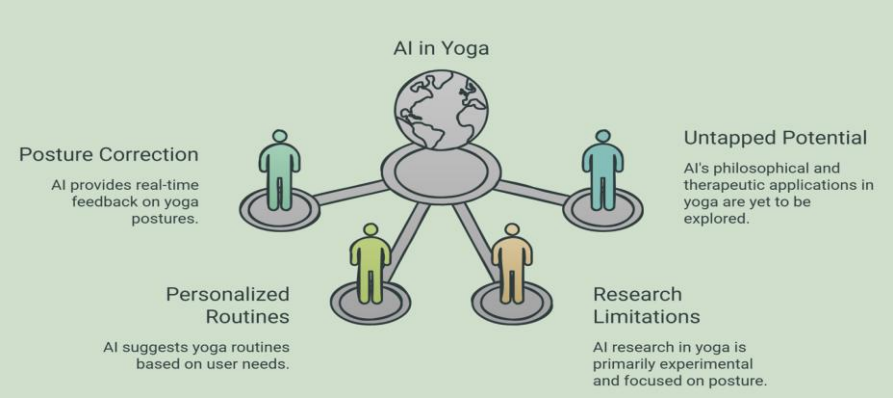

Figure 2. Role of AI in Yoga

3.3 AI and Ayurveda

The Ayurvedic system of medicine is primarily a personalized healthcare system, in which therapeutic solutions are provided according to the individual's prakriti, lifestyle and environmental factors including seasonal variations [19]. Figure 3 depicts the development of AI-based expert systems for classifying an individual's prakriti using supervised ML algorithms trained on symptomatic data, questionnaire responses, and phenotypic characteristics. The imbalances are identified and the herbal formulation is identified using data mining techniques and the ayurvedic pharmacology is analysed [19]. NLP-based tools are being used to digitize the Sanskrit language written Ayurvedic literature and to extract valuable information like therapeutic guidelines and disease–symptom relationships described in the classical texts [20].

We have developed predictive models integrating Ayurvedic knowledge with biomedical data, genomics and metabolomics to aid precision medicine. However, standardization of Ayurvedic terminologies and validation of traditional knowledge through large scale clinical studies are still major challenges indicating important directions for future research [21].

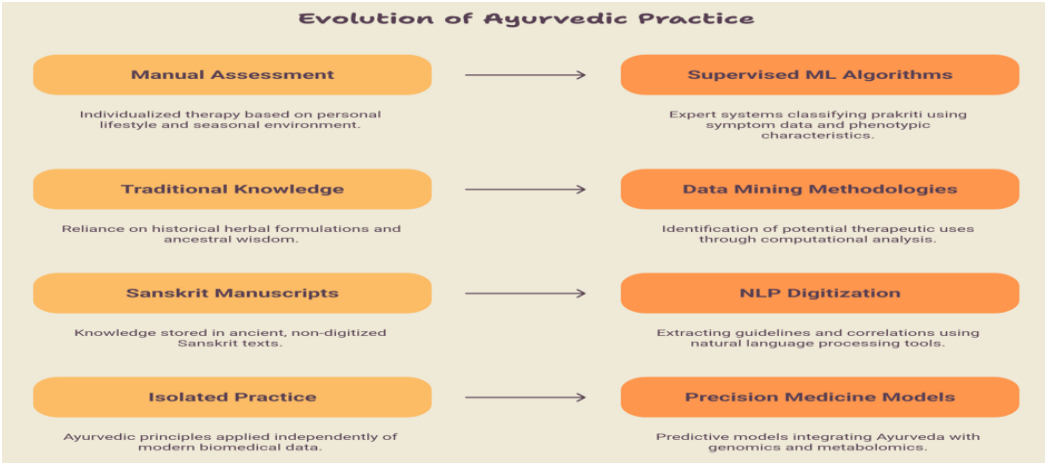

Figure 3. Role of AI in Ayurveda

4. METHODOLOGY

The methodology is a structured narrative review, where the selection and thematic organization are guided by prior survey and review works included within the reference set.

4.1 Study Design

The present study has been designed to carry out a structured narrative review on the role of AI in preventive healthcare, with a special focus on its integration with Ayurveda, Yoga and mental health. Because the subject is new and involves different fields such as clinical medicine, computational intelligence, behavioural sciences and traditional knowledge systems, we decided to use a narrative approach. Similar integrative approaches have been used in previous reviews on AI in healthcare and mental health [1], [7], [26], [35]. Under such a context, preventive healthcare is understood both in the modern medical perspectives and traditional frameworks especially Ayurveda, where concepts like prakriti, dosha balance and lifestyle regulation play main role in early intervention and disease prevention [9], [19], [40].

4.2 Literature Selection Strategy

A focused literature search was conducted to find studies relevant to AI, Preventive Healthcare and its integration with Ayurveda, Yoga and Mental Health. [1], [7], [26].

Inclusion Criteria: Studies were selected based on the criteria if they were peer-reviewed, focused on AI, were within one of the review domains, were published between 2015-2025 and offer review evidences. This thematic organization emphasized the place of modern AI techniques within traditional preventive healthcare practices.

Table 1. Application of AI in different domains that are included in the survey

Domain	Representative Topics	Key References
AI in Healthcare	Diagnosis, prediction, clinical decision support	[1], [2], [3], [7]
Mental Health	Chatbots, CBT, suicide prediction	[5], [11], [12], [24], [25], [27], [28]
Yoga	Pose recognition, feedback, recommendation	[15]-[17], [29]-[33]
Ayurveda	Prakriti, dosha prediction, expert systems	[9], [19], [34], [37], [40]

Exclusion criteria: Studies with lack of clarity in methodology or empirical contribution; non-academic or non-scholarly sources; and studies that were redundant or duplicate with overlapping findings (e.g., similar survey works were carefully consolidated).

4.3 Data Extraction and Synthesis

For each study we extracted data on: Application domains (healthcare, mental health, yoga, Ayurveda, philosophy), AI techniques used on the domain (e.g., DL, ML, NLP, computer vision, etc.), input modalities used to collect data and give as input to the AI models (text, speech, images, wearable data) and key outcomes of the models (e.g., classification accuracy, prediction performance, system effectiveness). The extracted data was analysed by a qualitative and comparative approach. This approach has contributed to the identification of common methodological patterns, technological trends and domain-specific innovations, in agreement with previous surveys on AI-healthcare [1], [4], [26].

4.4 Analytical Approach

The analytical approach included identifying emerging trends in AI-driven preventive healthcare, convergence of modern AI techniques with traditional systems of Ayurveda and Yoga, and to understand existing research gaps especially in integrating Ayurveda and Yoga with AI-based systems. Special attention was given to the role of AI in early detection, monitoring of behaviour and personalised interventions, which are all integral elements of preventive health care.

4.5 Quality Assurance and Limitations

To assess the quality and study limitations, multiple studies within each domain were cross-compared to find out consistent patterns (e.g., mental health chatbot studies [25], [27], [28]), overlapping methodologies (e.g., stress detection using wearable

sensors [13], [24]) were validated using multiple recent review studies [20], [21], [38]. The narrative design constrains this review and it is not a fully systematic protocol like PRISMA. Although efforts were made to include high quality and relevant studies, the selection may not be exhaustive. Faster developments in AI and integrative medicine may also result in newer findings beyond the scope of this review.

The literature of this study was mainly selected from the databases of IEEE Xplore, PubMed, Scopus, ScienceDirect, SpringerLink, and Google Scholar. The keywords used for the selection process were "Artificial Intelligence", "Machine Learning", "Ayurveda", "Yoga", "Mental Health", "Preventive Healthcare", "Conversational Agents", "Prakriti" and "Digital Health".

5. COMPARATIVE ANALYSIS OF EXISTING LITERATURE

5.1 Comparative Analysis of AI Applications in Mental Health

Table 1 summarizes the AI techniques, datasets, key findings, numerical outcomes, and limitations reported in mental health studies published during the past decade. The majority of the studies reviewed used AI techniques to analyze electronic health records and psychometric data to predict risk of suicide. By contrast, a few of the studies reviewed employed AI techniques for therapeutic purposes including conversational agents (chatbots) that provided either support or encouragement during therapy sessions, interventions for mental health, and detection of suicidality (suicidal thoughts). The references used in tables are [4]-[5], [11]-[14], and [25]-[28]. The most commonly identified issues across all of the studies were the various types of datasets, limited diversity of the population from which participants were recruited, and the lack of generalization of the models to other populations. The current study shows that there is lot of improvement in early detection of mental health disorders while challenges related to the data diversity, explainability, privacy, clinical validation, recommendation to authorized experts where the cases are critical still need development on large scale.

Table 2. Application of AI in mental health

Study	AI Technique	Dataset	Key Contribution	Numerical Results
Cummins et al. (2015) *(Doc 1)*	Speech signal processing + Machine Learning	Clinical speech datasets for depression and suicide risk	Highlights speech as a biomarker and synthesizes findings from more than 40 studies	Accuracy reported in reviewed studies: **70–90%** for depression detection
Fitzpatrick et al. (2017) *(Doc 2)*	Rule-based CBT chatbot (Woebot)	Randomized controlled trial (RCT) involving young adults with depression and anxiety	Demonstrated that an automated CBT chatbot significantly reduces depressive symptoms	**PHQ-9** score reduction significant compared with control; **Cohen's d ≈ 0.44**
Shickel et al. (2018) *(Doc 3)*	Deep Learning (RNN, CNN, Autoencoders)	Multiple Electronic Health Record (EHR) datasets from surveyed studies	Comprehensive survey categorizing deep learning methods for structured and unstructured EHR data	Summarized reported accuracies ranging from **70–95%**
Miner et al. (2019) *(Doc 4)*	Rule-based and NLP conversational agents	Siri, Google Now, Cortana, and S Voice responses	Evaluated the quality of real-world responses to mental health-related queries	**<50%** of responses were considered safe or appropriate for sensitive mental health questions
Can et al. (2019) *(Doc 5)*	Machine Learning using smartphone and wearable sensor data	Surveyed real-world stress detection datasets	Reviewed algorithms for stress detection in daily-life environments	Reported detection accuracy ranging from **70–85%**
Choi et al. (2021) *(Doc 6)*	Deep Graph Neural Networks (GNN)	Clinical and psychometric data from young adults	First study to apply GNNs for predicting acute suicidal ideation	**AUC: 0.82–0.85**

Yoo et al. (2024) *(Doc 7)*	Qualitative analysis with computational Human–Computer Interaction (HCI)	Interviews with individuals experiencing depression using AI chatbots	Identified practical benefits, risks, and user experiences associated with AI mental health chatbots	**Qualitative study (No numerical metric reported)**
Dehbozorgi et al. (2025) *(Doc 8)*	Systematic review of Artificial Intelligence in mental health	Review of **110+** AI-based mental health studies	Comprehensive review covering diagnosis, prediction, monitoring, and intervention	Summarized reported accuracies ranging from **70–90%**
Pichowicz et al. (2025) *(Doc 9)*	Machine Learning evaluation of suicide-risk chatbots	Chatbot interaction datasets and evaluation benchmarks	Evaluated chatbot performance in detecting suicidal ideation	**F1-score: 0.65–0.78**; Precision and Recall varied across chatbots
Moylan & Doherty (2025) *(Doc 10)*	Mixed-methods evaluation of AI chatbots	Expert interviews and system assessments	Interdisciplinary evaluation of AI chatbots for clinical mental health support	**Qualitative expert ratings (No numerical metric reported)**

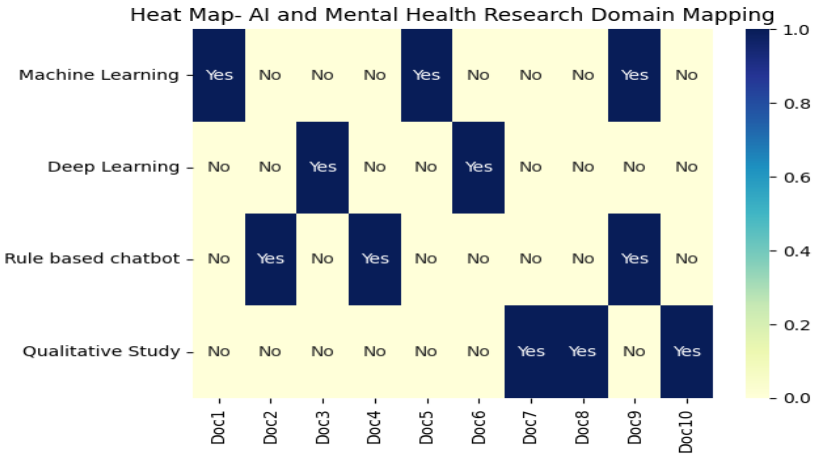

Figure 4. Mapping research documents with AI techniques

From fig 4 indicates that mostly ML algorithms are used to predict the mental health status of people. AI-powered conversational agents are increasingly being explored for mental health assessment and therapeutic support, they are used more in DL based algorithms as indicated from fig 5. DL and graph based neural networks give more accurate interpretation of mental health status around >82% accuracy.

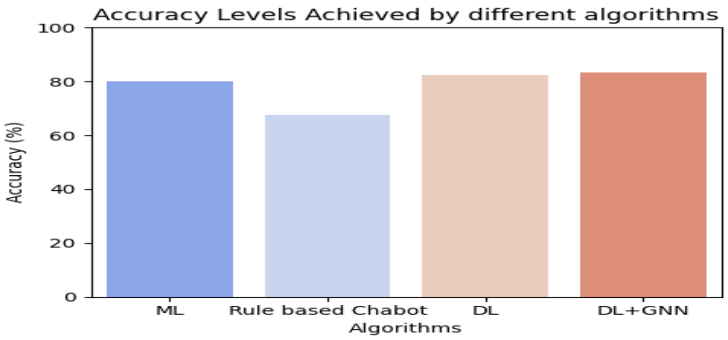

Figure 5. Accuracy levels of AI techniques

5.2 Comparative Analysis of AI Applications in Yoga

Table II is based on applications of AI in Yoga. We summarized key aspects related to methodology, dataset, contribution and performance metrics for each study. The references that were used for this tabular analysis are from [29]-[33]. The most commonly used method in this group of studies is the convolutional neural network (CNN) approach, which is typically complemented by the use of a dual-stream architecture, an LSTM-based (Long Short-Term Memory) model for temporal modelling or the application of real-time extraction of pose landmarks. Dataset size and its complexity vary from smaller custom datasets to large-scale benchmarks like Yoga-82, which influences performance. Smaller pose sets show very high accuracy (up to 97%) on the other hand fine-grained datasets that have many poses show moderate baseline performance (~75%). It is observed that the yoga pose estimation show obvious trend from basic image-related classification problems to more complex approaches, which involve the spatial and temporal characteristics of human poses.

Table 3. Applications of AI in yoga

Study (Year)	AI Technique	Dataset	Key Contribution	Results
Verma et al. (2020) (Doc 1)	Standard CNNs (ResNet, DenseNet, MobileNet)	Yoga-82 dataset: 82 yoga poses	Introduces a large-scale, fine-grained dataset; baseline classification for CNNs	DenseNet-201: 74.91% top-1 accuracy
Talaat et al. (2023) (Doc 2)	Ensemble deep CNN models (Xception, VGGNet, SqueezeNet)	Likely Yoga-82 or similar	Proposes ensemble models for improved pose classification	"Highest classification accuracy" claimed; exact numeric value not available in abstract
Meng & Liu (2025) (Doc 3)	Dual-structure CNN (global + local feature extractors)	Subset of Yoga-82: 5 poses, 280 images	Combines global & local features to improve classification	Accuracy 97.23%, Precision 96.08%, Recall 96.62%, F1 96.35%
Srivastava et al. (2023) (Doc 4)	3D pose estimation + LSTM for temporal modeling	3,939 images, 10 yoga poses	Real-time classification using pose sequences	Reported good Precision, Recall, F1, Accuracy per pose; no single overall accuracy available
Bansal et al. (2024) (Doc 5)	CNN on pose landmarks (real-time video)	Custom dataset: 5 poses, image + video	Real-time yoga pose recognition and feedback system	Claimed effective real-time recognition; no clear overall accuracy provided

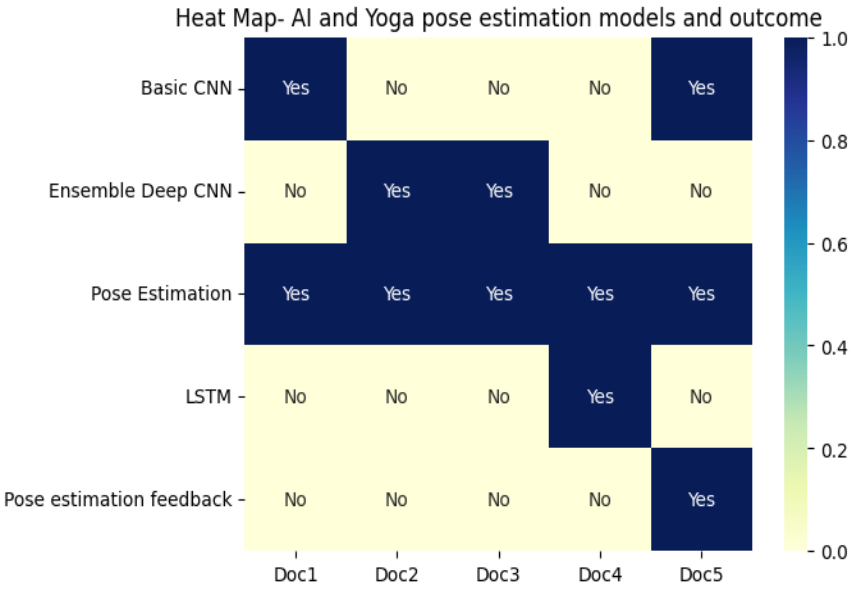

Figure 6. Distribution of AI models employed in Yoga pose estimation

Although research on Yoga pose estimation has been progressing for several decades but for our analysis we have selected last five years papers to understand which models are used for predictions in the recent years and what are their predictions. Fig 6 demonstrates that pose estimation using deep CNN models is very widely used recently as it gives higher accuracy as clearly seen form the table II as well. Fig 7 highlights that the correlation analysis presented in figure shows increasing research interest in deep learning-based CNN approaches for pose estimation as seen from relation between doc 2 and 3 while doc 1 and 5 works closely with providing pose estimation feedback enabling collection of user feedback on the algorithm predictions.

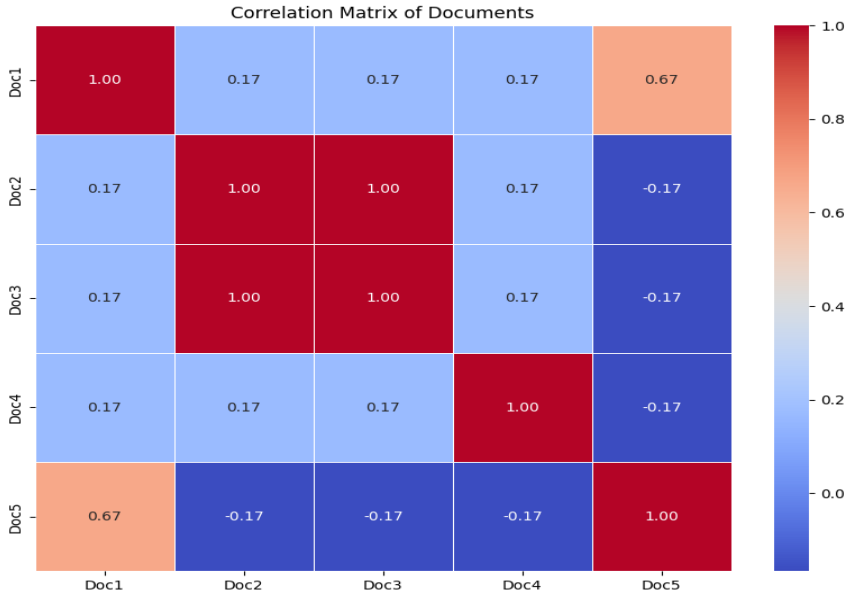

Figure 7. Correlation of research themes among selected Yoga studies

5.3 Comparative Analysis of Applications of AI in Ayurveda

Recent studies indicate a growing interest in applying AI techniques to Ayurvedic healthcare, particularly for personalized medicine and prakriti assessment. The table III discusses how AI models are applied in the domain of ayurveda and referenced from [34]-[38]. Many of the new studies focus on automating the process of determining a person's Prakriti (or

constitution). Once a person has been classified into their prakriti categories, the researchers have proposed personalized herbal formulations, dietary recommendations, and treatment strategies based on that classification. The studies used machine-learning and deep-learning models with the majority of the data consisting of structured clinical data, images, and/or other forms of data. Many of the studies showed how even simple classifiers, such as decision trees and SVMs, performed very well in predicting doshas and diseases. The authors noted that as AI systems continue to advance, there will also be an increase in the practicality of using AI-enhanced diagnostic tools for classifying patients' prakriti's and providing therapeutic recommendations. Collectively, these studies suggest that AI has considerable potential to improve the objectivity and consistency of Ayurvedic diagnosis and personalized treatment planning.

Overall, AI applications in Ayurveda are progressing from rule-based expert systems to data-driven personalized healthcare frameworks. Future work should focus on standardization, multimodal datasets, and clinical validation.

Table 4. Applications of AI in ayurveda

Study	AI Technique	Dataset	Key Contribution	Numerical Results
Shetty et al. (2024) (Doc 1)	Supervised ML classifiers (SVM, decision trees, ensemble models) integrated into CDSS	Clinical & epidemiological data from patients (gestational diabetes dataset)	Demonstrated that ML models can stratify gestational diabetes risk and support Ayurvedic treatment recommendations	Classification accuracy ~75–82% depending on model
Sudha et al. (2025) (Doc 2)	NLP / contextual embeddings (BERT), CNN, Naïve Bayes	Standardized Ayurvedic text corpus (ontology-mapped terms)	Showed that contextual embeddings improve Ayurvedic term classification	BERT achieved 100% classification accuracy (highest among tested models)
Kottawar et al. (2025) (Doc 3)	ML (various), NLP, multimodal data fusion	Phenotypic + questionnaire + genomic features	Proposed an objective AI-based framework for Prakriti assessment	>85% agreement with expert assessment (Prakriti classification)
Shaumya & Kumar (2025) (Doc 4)	Summary of published ML/AI works (e.g., biometric/Prakriti studies)	Meta-synthesis of 32 studies from 2020–2025	Synthesized results on AI use across Ayurveda domains	Reported Prakriti classification accuracy 90–95% in reviewed studies
Majumder et al. (2023) (Doc 5)	Eight ML classifiers (e.g., SVM, RF, etc.)	Phenotypic data on 217 healthy individuals	Compared performance of ML models for Prakriti classification	Performance metrics vary; study concludes enhanced consistency vs subjective assessment

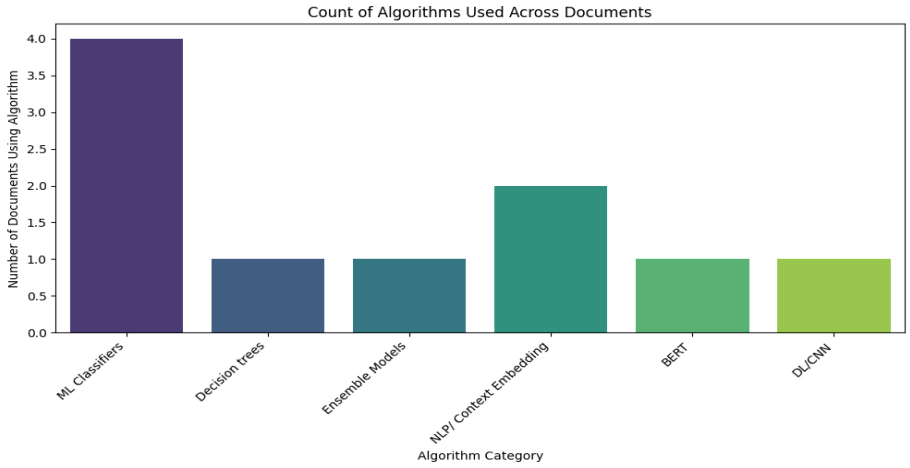

Figure 8. AI techniques used for prakriti classification

Figure 8 highlights that most researchers use ML based classification techniques to classify the prakriti of an individual based on doshas. Then the next common technique is NLP based contextual embeddings to understand the prakriti based on surveys and questioners. While fig 9 shows that the accuracy of predictions is more in BERT and NLP techniques rather than ML based techniques which are more commonly used for classification.

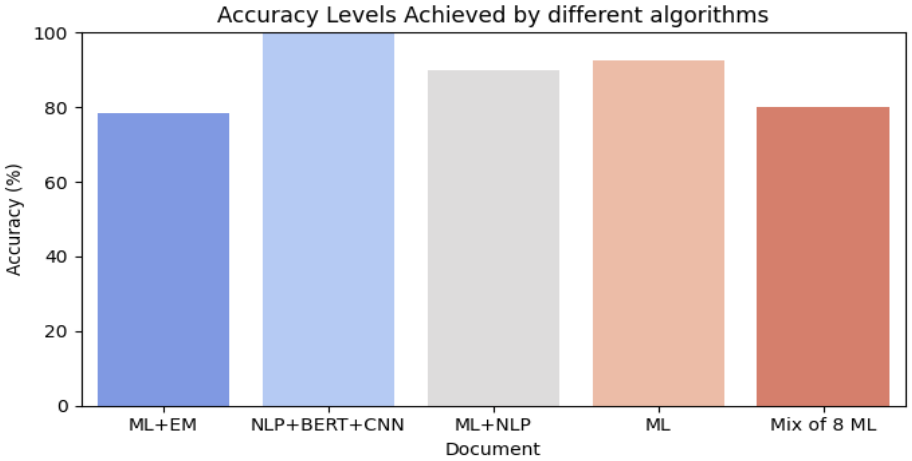

Figure 9. Comparison of prediction accuracy reported in AI-based prakriti classification studies

5.4 Cross-domain Comparative Analysis

Table 5 highlights the most common models used in each domain, the dataset used for analysis, the main challenges found in them and the future scope of research in the studies.

Table 5. Comparative analysis of research domains

Domain	Most Common AI	Dataset	Main Challenge	Future Direction
Mental Health	DL, GNN	EHR, speech	Privacy	Explainable AI
Yoga	CNN	Images	Limited to posture	Pranayama, Meditation integration
Ayurveda	ML, NLP	Questionnaires	Standardization	Clinical validation

6. CHALLENGES AND FUTURE OPPORTUNITIES

Despite significant progress of AI, there are still a number of challenges that need to be overcome for the effective and reliable deployment of AI. In general, there are common limitations in AI models for mental health, such as the availability of high-quality data, challenges in interpreting contextual information, and the lack of clinically validated studies. For example, speech- and sensor-based models suffer from small and heterogeneous datasets, differences across individual speakers resulting in inconsistencies in model performance. Predicting suicide ideation or severe depression is challenging due to class imbalance, high-dimensional data, and absence of external validation. These challenges highlight the significance of standardized datasets and clinically validated AI frameworks to develop resilient mental healthcare systems.

Practical challenges of AI based Yoga frameworks include variations in Yoga styles, variations of pose execution by different practitioners, sensing limitations, changing camera viewpoints and body occlusions, all of which are important in determining the accuracy of pose recognition and classification. But skeleton based image processing methods are more sensitive to variations in clothing, incomplete visibility of the body, and noise from the background. This may impact the reliability of the posture assessment and real-time feedback.

Challenges of AI in Ayurveda: Data heterogeneity, conceptual complexity and lack of clinical validation. The Ayurvedic clinical data is not objective, standardized and recorded using different diagnostic methods, which makes it difficult to develop scalable and generalizable machine learning models. However, some challenges like lack of standardized evaluation metrics, regulatory aspects and ethical implications are there in the implementation of AI based Ayurvedic systems in clinical practice.

The literature review demonstrates the considerable advancements in the addressed areas, but also highlights some important research gaps. All these fields of review are challenged by the absence of large scale, standardised and interoperable datasets that would sufficiently account for the heterogeneity of populations, healthcare practices and real-world settings. Future work should therefore focus on multi-institutional data collection, standard protocols and ethical data-sharing frameworks to facilitate the development of more robust, reliable and generalizable AI models. Another important future research scope is validation of AI based models. Many systems are technically very performant but often lack interpretability, external clinical validation and a meaningful involvement of domain experts in the development process of models. Addressing these challenges will be critical to broader adoption of AI in preventive health. Future work should concentrate on the design of explainable AI models, standard evaluation frameworks and the adoption of collaborative design approaches, where clinicians, Yoga experts and Ayurveda practitioners are actively involved in the entire process of developing AI-based solutions.

7. CONCLUSION

The studies reviewed have clearly highlighted the increasing contribution of AI approaches such as Machine Learning, Deep Learning, Natural Language Processing, Computer Vision and conversational agents in the areas of mental health assessment, Yoga practice and personalized Ayurvedic healthcare making these practices accessible to masses. Most of the current research has been focused on separate domains with little progress in the development of integrated frameworks that combine these classical systems with state-of-the-art AI technologies.

This review also highlights a number of challenges such as the requirement for standard datasets, enhanced validation by clinicians, better interpretability of models and improved collaboration between AI researchers and healthcare practitioners. Our response to these challenges will be critical to the interpretation of research towards robust and clinically validated healthcare solutions. The convergence of Artificial Intelligence with Ayurveda, Yoga and mental healthcare is an exciting area of research in the field of holistic preventive healthcare. The future research in these areas may play a vital role in developing intelligent and personalized healthcare systems that provide long-term well-being solutions and change the paradigm from disease management to disease prevention.

REFERENCES

[1] Esteva A, Robicquet A, Ramsundar B, Kuleshov V, DePristo M, Chou K, et al. A guide to deep learning in healthcare. *Nature Medicine*. 2019;25(1):24–29.
[2] Rajpurkar P, Chen E, Banerjee O, Topol EJ. AI in health and medicine. *Nature Medicine*. 2022;28(1):31–38.

[3] Topol E. High-performance medicine: The convergence of human and artificial intelligence. *Nature Medicine*. 2019;25(1):44–56.
[4] Shickel B, Tighe PJ, Bihorac A, Rashidi P. Deep EHR: A survey of recent advances in deep learning techniques for electronic health record (EHR) analysis. *IEEE Journal of Biomedical and Health Informatics*. 2018;22(5):1589–1604.
[5] Miner AS, Milstein A, Schueller S. Smartphone-based conversational agents and responses to questions about mental health, interpersonal violence, and physical health. *JAMA Internal Medicine*. 2019;176(5):619–625.
[6] Keesara S, Jonas A, Schulman K. COVID-19 and health care's digital revolution. *The New England Journal of Medicine*. 2020;382(23):e82.
[7] Jiang F, Jiang Y, Zhi H, Dong Y, Li H, Ma S, et al. Artificial intelligence in healthcare: Past, present and future. *Stroke and Vascular Neurology*. 2017;2(4):230–243.
[8] Vivekananda S. *Patanjali's Yoga Sutras*. Fingerprint Publishing; 2021.
[9] Nair PP, Nair PG, Shankar KMP. An Ayurvedic personalized prophylactic protocol in COVID-19. *Journal of Ayurveda and Integrative Medicine*. 2022;13(1):100351.
[10] Hirawat S, Bhandari S. AI integration with ancient science. *International Journal of Research Publication and Reviews*. 2024;5(10):2928.
[11] Cummins N, Scherer S, Krajewski J, Schneider S, Epps J, Quatieri TF. A review of depression and suicide risk assessment using speech analysis. *Speech Communication*. 2015;71:10–49.
[12] Fitzpatrick KK, Darcy A, Vierhile M. Delivering cognitive behavioral therapy to young adults with symptoms of depression and anxiety using a fully automated conversational agent (Woebot): A randomized controlled trial. *JMIR Mental Health*. 2017;4(2):e19.
[13] Can YS, Arnrich B, Ersoy C. Stress detection in daily life scenarios using smartphones and wearable sensors: A survey. *Journal of Biomedical Informatics*. 2019;92:103139.
[14] Choi KS, Kim S, Kim BH, Jeon HJ, Kim JH, Jang JH, Jeong B. Deep graph neural network-based prediction of acute suicidal ideation in young adults. *Scientific Reports*. 2021;11:16117.
[15] Yadav SK, Shukla A, Tiwari K, Pandey HM, Akbar SA. An efficient deep convolutional neural network model for yoga pose recognition using single images. *arXiv preprint*. 2023.
[16] Wu Y, Lin Q, Yang M, Liu J, Tian J, Kapil D, Vanderbloemen L. A computer vision based yoga pose grading approach using contrastive skeleton feature representations. *Healthcare*. 2022;10(1):36.
[17] Yeh SC, Yang CK. Yoga pose recognition and motion analysis for a home-based fitness monitoring and health management system. *Signal, Image and Video Processing*. 2025;19:841.
[18] Nouh RM, Lee HH, Lee WJ, Lee JD. A smart recommender based on hybrid learning methods for personal well-being services. *Sensors*. 2019;19(2):431.
[19] Madaan V, Goyal A. Predicting Ayurveda-based constituent balancing in human body using machine learning methods. *Journal of Ayurveda and Integrative Medicine*. 2021;12(3):1–9.
[20] Vineetha V, Rahakrishnan DC, Hadimani GR. Application of artificial intelligence in Ayurveda: A contemporary review. *International Journal of Science and Research*. 2025;14(5).
[21] Shaumya S, Kumar R. Artificial intelligence in Ayurveda: A systematic review (2020–2025). *Journal of Ayurveda and Naturopathy*. 2025;2(2):05–19.
[22] Chandra R, Ranjan M. Artificial intelligence for topic modelling in Hindu philosophy: Mapping themes between the Upanishads and the Bhagavad Gita. *PLOS ONE*. 2022;17(9):e0273476.
[23] Chandra R, Kulkarni V. Semantic and sentiment analysis of selected Bhagavad Gita translations using a BERT-based language framework. *arXiv preprint*. 2022.
[24] Can YS, Arnrich B, Ersoy C. Stress detection in daily life scenarios using smartphones and wearable sensors: A survey. *Journal of Biomedical Informatics*. 2019;92:103139.
[25] Yoo DW, Shi JM, Rodriguez VJ, Saha K. AI chatbots for mental health: Values and harms from lived experiences of depression. *Proceedings of the ACM on Human-Computer Interaction*. 2024;8(CSCW1):Article 122.
[26] Dehbozorgi R, Zangeneh S, Khooshab E, Hafezi Nia D, Hanif HR, Samian P, et al. The application of artificial intelligence in the field of mental health: A systematic review. *BMC Psychiatry*. 2025;25:132.
[27] Pichowicz W, Kotas M, Piotrowski P. Performance of mental health chatbot agents in detecting and managing suicidal ideation. *Scientific Reports*. 2025;15:31652.

[28] Moylan K, Doherty K. Expert and interdisciplinary analysis of AI-driven chatbots for mental health support: Mixed methods study. *Journal of Medical Internet Research*. 2025;27:e67114.
[29] Verma M, Kumawat S, Nakashima Y, Raman S. Yoga 82: A new dataset for fine-grained classification of human poses. In: *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) Workshops*. IEEE; 2020. p. 1038–1039.
[30] Talaat AS, et al. Novel deep learning models for yoga pose estimator. *SN Applied Sciences*. 2023.
[31] Meng X, Liu Z. Yoga pose recognition using dual structure convolutional neural network. *PeerJ Computer Science*. 2025;11:e2907.
[32] Srivastava RP, Umrao LS, Yadav RS. Real-time yoga pose classification with 3D pose estimation model using LSTM. *Multimedia Tools and Applications*. 2023;83(11):33019–33030.
[33] Bansal R, Sharma R, Jain P, Arora R, Pal S, Vishal. DeepYoga: Enhancing practice with a real-time yoga pose recognition system. *Engineering, Technology & Applied Science Research*. 2024;14(6):17704–17710.
[34] Shetty NP, Shetty J, Hegde V, Dharne SD, Mamtha KV. A machine learning-based clinical decision support system for effective stratification of gestational diabetes mellitus and management through Ayurveda. *Journal of Ayurveda and Integrative Medicine*. 2024;15(6):101051.
[35] Jongjiamdee K, Pornwonglert P, Na Bangchang N, Akarasereenont P, et al. Artificial intelligence in traditional medicine: Evidence, barriers, and a research roadmap for personalized care. *Frontiers in Artificial Intelligence*. 2025.
[36] Ranade M. Artificial intelligence in Ayurveda: Current concepts and prospects. *Journal of Indian System of Medicine*. 2024;12(1):53–59.
[37] Madaan V, Goyal A. Predicting Ayurveda-based constituent balancing in human body using machine learning methods. *IEEE Access*. 2020;8:65060–65070.
[38] Nesari TM. Artificial intelligence in the sector of Ayurveda: Scope and opportunities. *International Journal of Ayurveda Research*. 2023;4(2):57–60.
[39] Dixit RK, Haque S, Asif F, Jain A. Artificial intelligence meets AY (Ayurveda): Bridging tradition, technology and super-technology for diabetes care. *Journal of Ayurvedic and Herbal Medicine*. 2025.
[40] Venkatesh A, et al. Prakriti (constitutional typology) in Ayurveda: A critical review. *Frontiers in Medicine*. 2025.