Potential Application of Artificial Intelligence in Enhancing Ayurvedic Diagnostics W.S.R. to Rogi Pariksha (Patient Examination)

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Abstract
Ayurveda, an ancient Indian system of holistic medicine, uses a comprehensive patient evaluation method called Rogi Pariksha. This technique integrates various observational, tactile, and interrogative diagnostic elements, including Nadi (pulse), Jihva (tongue), Mutra (urine) Pariksha etc. However, traditional methods are often criticized for their subjectivity and inconsistency. Artificial Intelligence (AI), particularly machine learning (ML), deep learning (DL), natural language processing (NLP), and computer vision (CV), presents significant potential to address these challenges. This paper explores in detail how AI can enhance Ayurvedic diagnostics by increasing precision, reproducibility, and scalability. With a deep dive into technological frameworks, implementation strategies, case studies, and ethical considerations, the article proposes a pathway for modernizing Ayurvedic diagnostics without compromising its foundational principles.

Keywords: Ayurveda, artificial intelligence, rogi pariksha, machine learning, deep learning, diagnostic standardization, integrative medicine.

Introduction
Ayurveda, translating to "the science of life," is a traditional system of medicine that has been practiced in India for over 5,000 years. Central to Ayurvedic practice is Rogi (atur) Pariksha, a comprehensive patient examination method that assesses physical, mental, and spiritual health. The traditional methods, while holistic, are often subjective and rely heavily on the practitioner's experience. The integration of AI offers an opportunity to bring objectivity and standardization to these diagnostic processes.

Every science or field of study must be adapted to incorporate recent advancements and technological progress to keep up with the evolving times. Artificial Intelligence (AI) represents a significant advancement, and its application can enhance the value of ancient wisdom. Ayurveda, an age-old system of medicine, aims to cure ailments and promote well-being. By leveraging AI, we can effectively utilize this valuable reservoir of knowledge for the benefit of humanity. Artificial intelligence is an emerging technology impacting our lives, especially the healthcare sector. Ayurved is a personalised medical system which involves dynamic analysis for diagnosis of diseases and treatment of ailments. AI will assist Ayurved doctors during diagnosis of diseases and treatment of ailments, improving the outcome of intervention. Darshan Pariksha (Visual Examination) is an important modality in clinical examination, useful in evaluation of signs-symptoms related to Tongue, Skin, Urine, Stool etc. The steps involved are identification of use cases for application of AI, Dataset collection and organization, AI modelling, Prediction and Remodeling.

Use of AI in indigenous system of medicine is a vital but inspiring task. AI will aid in development of non-invasive technologies for early diagnosis of diseases-conditions using Ayurveda core principles. Using real life clinical data more refined, reliable and clinically validated models can be developed. This paper will guide Ayurvedic people about methodical systematic design for development of AI based models based on fundamentals of Ayurvedic diagnosis in the context of Patient examination.

Aim and Objectives
To understand the AI techniques, it's Adaptability in the fields of Ayurvedic diagnostics w.s.r. to Patient examination.

Understanding Rogi Pariksha (Patient Examination) in Ayurvedic Literature:
Rogi Pariksha is Traditionally Categorized as [1]:
Trividha Pariksha:
i). **Darshana (Observation):** General appearance, gait, posture.
ii). **Sparshana (Palpation):** Touch-based assessments including pulse, temperature.
iii). **Prashna (Interrogation):** Inquiries about symptoms, lifestyle, and emotional state.

Ashtasthana Pariksha:
i).   Nadi (Pulse)
ii).   Mutra (Urine)
iii). Mala (Stool)
iv).   Jihva (Tongue)
v).   Shabda (Speech)
vi).   Sparsha (Touch)
vii). Drik (Eyes)
viii). Aakriti (Body Shape)

Despite their holistic intent, these methods lack quantifiable metrics, making consistent diagnosis challenging.

Artificial Intelligence in Healthcare:
AI is increasingly deployed in diagnostics, patient management, and treatment personalization. Notable subfields include [2]:
- Machine Learning (ML)
- Deep Learning (DL)
- Natural Language Processing (NLP)
- Computer Vision (CV).

These technologies enable systems that can perform diagnosis.

Utility of AI in Roga Nidana: Diagnostic methods of Ayurveda involve the RogaPareeksha such as Nidana Panchaka and the Rogi Pareeksha such as DwiVidha, TriVidha, ChaturVidha, AshtaVidha, DashaVidha Pareeksha and Sushrutokta Dvadasha Pariksha etc, requiring years of experience. AI algorithms can analyse patient data, clinical history, and investigations to identify patterns and associations that may not be apparent to human practitioners. This allows for precise, reliable, and early diagnosis allowing for timely intervention thus preventing Upadravas (complications) [3].

AI in Disease Pre-screening Tools: As in Ayurveda a disease diagnosis is based on the Vaidya's personal skill, interest, and knowledge about the clinical condition, a disease can be diagnosed here in many ways like on the basis of Dosh kshya-vrudhi Avastha or on the basis of Srotas involvement in etiopathogenesis or on the basis of cardinal symptoms like Jwara, Vibandha, Atisara, Shwash, Kasa etc. Assessment of Agni (digestive or metabolic fire) is the first step to properly diagnose or to treat any etiopathogenesis. Every clinical condition develops due to their particular Nidanasevana, so a pre-screening of all the factors may help Vaidya to achieve the final diagnosis than Vaidyas can treat these conditions as per their way to diagnose the disease. In Ayurveda for disease pre-screening and early detection of disease Purvaroopa of particular disease are well described by use of AI we can develop tools for convenience of researchers and practitioners. In disease pre-screening, medical data is interpreted by computers. The term "computer-aided pre-screening tool" (CAPST) describes this. In medicine, CAPST enhances the precision of diagnosis. When making the final diagnosis, medical professionals typically seek a second opinion based on the results of the CAPST. For an individual to receive successful therapy, a timely and accurate diagnosis and prediction of illness risk are essential first steps. Over the past several years, AI based machine learning technology has experienced substantial advancements and is now successfully applied in numerous intelligent applications that address issues in a wide range of areas. Whether these methods can be successfully used in medicine for disease pre-screening and diagnosis, as well as what kind of data training and learning

are among the most intriguing concerns. There are a plethora of real-world instances of issues where machine learning techniques are effectively implemented. Numerous of them demonstrated a notable increase in categorization accuracy [4].

AI in Diagnosis of Diseases and Developing Diagnostic Tools:
- Saving time during the diagnosis process and enabling efficient diagnosis and treatment without compromising Ayurvedic principles are the key objectives of fusing technology with Ayurveda. This process involves AI to aid in the diagnosis of diseases. Ayurveda classifies diseases into various categories based on their symptoms, causes, and effects on the body. AI can analyze these classifications and predict the likelihood of a disease based on the patient's symptoms and health history with Prakruti, Vikriti, Desh, Kal, Sar, Sahana etc. (Dashvidha Parikasha). This can enable early detection and treatment, thereby improving patient outcomes. Using Artificial Intelligence in Nadi, Jivha and Akruti etc. [5]
- The Ayurvedic diagnosis instrument for Rogi Pariksha is Astavidh Pariksha by Yogaratnakar; the initial diagnostic tool is Nadi Pariksha. The first-ever portable Nadi monitoring gadget to precisely evaluate inner health or metabolism is the Nadi Tarangini. Previously available exclusively to elite Ayurvedic practitioners, Nadi Pariksha (Nadi monitoring) is now available digitally at Ayurvedic clinics, hospitals, spas, and wellness centres. Although the knowledge of Ayurveda is not new to us, AI has combined it with simpler language to make it easier for us to grasp inner health with just a single click [6].
- Nadi Pariksha (Pulse Diagnosis) AI-powered sensors like photoplethysmography (PPG) capture pulse waveforms. These waveforms are analyzed using ML models to classify Vata, Pitta, and Kapha imbalances. Tools like Nadi Tarangini offer real-time pulse analysis. The Nadi Pariksha is a well-known term used by Ayurvedic practitioners to assess patient's physical and psychological conditions as well as their Tridoshas (Vata, Pitta, and Kapha). Pulse wave velocity has garnered a lot of attention lately as a reliable marker of cardiovascular disease. To create an Internet of Things-enabled machine learning model, the significance of pulse wave velocity in cardiovascular research is taken advantage of. Three optical pulse sensors, the frist one is (SEN11574), second CC3200 Launchpad XL, a PC, and third an Internet of Things cloud platform make up the suggested system. Together, these parts gather and analyze pulse signals. Vata, Pitta, and Kapha are represented by different pulse impulses that are captured by the three sensors. The experiment is conducted on the captured data using different machine learning techniques. Out of the experiment result the Support vector machine(SVM) with parameter optimization technique gave 92.1% which outperformed all other techniques [7].
- AI is used for the evaluation of Jivaha (tongue), Akruti, Mutra (urine), Mala (stool), etc. Color recognition, patterning, and digitization were constraints in the tongue diagnosis system that was in use at the time. In a research study, they has demonstrated the ability to categorize and measure color trends or advancements using artificial intelligence. Furthermore, Hu *et al*. (2019) had shown a substantial association between the AST or ALT and certain tongue features, providing promising results for the use of AI in preventive medicine. It was discovered that

< 11 >

ALT was correlated with tooth marks and an expanded tongue, and that AST was correlated with thick tongue hair and violet fur. Regardless, it can be said that the thicker tongue is almost certainly accompanied with illness signs and symptoms. The tongue's coating and lack thereof can be compared to different holograms, which could aid in determining the Dosha condition of Aama and Nirama. Jihva Pariksha (Tongue Diagnosis) CV algorithms extract features such as tongue color, texture, and shape. CNNs diagnose systemic conditions such as diabetes and indigestion. A study from NIT Karnataka showed 85% accuracy using DL techniques [8, 9].

- AI will help to standardize Tail Bindu Pariksha of urine and also will help to accurately prognosis of diseases. The integration of AI will help to analyse Samprapti (etio-pathogenesis) and Samprapti Ghatka, detection of diseases, making accurate final diagnosis, and precision Ayurvedic interpretations with the help of modern parameters. AI based assessment should be developed to properly understand the concepts of Agni, Aam, Strotos, Oja etc., To analyze the degree of Dosha kshaya-Vardhi, degree of Srotas-dusti, degree of Dushya involvement etc. AI based software should be developed [10].

- AI may play a crucial role to develop and establish Ayurvedic diagnostic laboratories. AI frequently employs Decision Tree, Random Forest, ANN, SVM, Regression, Naïve Bayes, and deep learning models like Convolutional Neural Network, Recurrent Neural Network, and Natural Language Processing to identify various illnesses. A thorough review of the diseases, their signs and symptoms, related conditions, risk factors, and datasets appropriate for creating predictive models is also provided [11].

- Mutra and Mala Pariksha (Urine and Stool Analysis) AI integrates image recognition and colorimetry to detect anomalies. Smart diagnostic tools are being developed with embedded AI. Similarly, using AI, different face expressions can be compared to standards to assist us understand Akruti Pariksha. Similarly we can develop standard holograms to assess Skin, Mala, Mutra, Hair, Nails, Eyes, Shukra, Doshdushya Tartamya (graded quantification), Anshansh Kalpana (micro observation of Dosha) as per traits and structural changes etc.Drik and Aakriti (Eye and Morphology Assessment) Facial recognition and morphometric analysis help determine Prakriti and identify anomalies. DL models analyze facial and body morphology to map doshic types [12].

- Prashna Pariksha (Voice and Speech Analysis) NLP analyzes sentence structure and emotional tone to derive psychological status. AI chatbots trained on Ayurvedic texts support virtual consultations [13].

Challenges and Ethical Considerations
- **Data Scarcity:** Ayurveda lacks large-scale digitized datasets [14].
- **Validation:** AI tools need validation in clinical settings.
- **Interpretability:** AI models must be explainable.
- **Bias and Ethics:** Addressing privacy and bias is essential [15].

Proposed Integration Framework
- Standardization Protocols
- Collaborative Ecosystem
- Hybrid Tools
- Training and Education [16].

Future Prospects AI and Ayurveda Diagnostic Field can Revolutionize Healthcare by Enabling:
- Predictive analytics
- Global telehealth platforms
- Inclusion in national healthcare policy
- Digital twin-based personalized care

Conclusion
AI enhances Ayurvedic diagnostics by adding objectivity and reproducibility. Ayurveda emphasizes individualized treatment through understanding the patient's constitution (Prakriti) and current imbalances (Vikriti). Rogi Pariksha forms the cornerstone of diagnosis and includes tools that are centuries old but not standardized by modern metrics. Modern healthcare faces growing pressure for scalable, consistent, and evidence-based diagnostic methods. AI offers powerful data processing capabilities that align with these needs and can bridge the gap between ancient wisdom and contemporary healthcare expectations. Interdisciplinary innovation and ethical implementation can lead to a future where traditional knowledge and modern science coexist to benefit global health.

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< 13 >