Original Research Article

Exploration the Potential of Artificial Intelligence in Ayurveda Diagnostics through the Machine Learning Approach

Dr. Vikas Deepak Srivastava[1*], Dr. Vijay Kumar[2], Khushbu Kausar[3]

[1]Assistant Professor, Glocal University, Saharanpur, Uttar Pradesh, India
[2]Associate Professor, Glocal University, Saharanpur, Uttar Pradesh, India
[3]Research Scholar, Glocal University, Saharanpur, Uttar Pradesh, India

*Corresponding author: Dr. Vikas Deepak Srivastava
Assistant Professor, Glocal University, Saharanpur, Uttar Pradesh, India

Abstract

Ayurveda, as a holistic system of medicine originating in ancient India, has gained recognition for its emphasis on balance and harmony within the body, mind, and spirit. This ancient healing practice has evolved over centuries and incorporates the concept of doshas – the biological energies that govern an individual's physical and mental well-being. Ayurveda focuses on bringing balance to the doshas through various treatments, including herbal medicines, lifestyle practices, and therapies. In recent years, Ayurveda has experienced significant growth and recognition in India, with the government promoting it as a mainstream healthcare system. Additionally, Ayurveda practices such as yoga and meditation have gained international acclaim. However, with the integration of modern technology, Ayurveda is poised to undergo further advancements. This research study explores the integration of artificial intelligence (AI) and machine learning techniques in Ayurvedic treatment, particularly in the Saharanpur and Dehradun regions. With personalized and holistic healthcare being the cornerstone of Ayurveda, the use of AI and machine learning algorithms can improve accuracy in diagnosis and treatment. Leveraging large datasets, these algorithms can identify patterns and correlations that may not be immediately evident to human practitioners. The majority of respondents in the study have been practicing Ayurveda treatment consultancy for 1-3 years (60%), while 40% had more than 3 years of experience. 70% of respondents believed that AI-driven diagnosis approaches are more effective than generalized approaches in Ayurveda. It was revealed that all respondents used AI tools primarily for Sparshana diagnosis, with no utilization reported for Darshana or Prashna. 80% of respondents believed that the integration of AI into Ayurveda has the potential to greatly improve various aspects of the practice. 50% of respondents were satisfied, and 40% were very satisfied with the current AI-driven diagnosis, while 10% expressed neutrality. These findings indicate a general acceptance and optimism towards AI in Ayurveda diagnosis, with recognition of its potential benefits and effectiveness. However, further research is needed to explore specific factors contributing to satisfaction and neutrality, as well as any concerns or areas for improvement.
Keywords: Ayurveda, AI, Machine Learning, Panchakarma, API.

INTRODUCTION

Ayurveda, originating in ancient India, is a holistic system of medicine that has stood the test of time for over 5,000 years. The word "Ayurveda" translates to "Knowledge of Life" and reflects its core philosophy of creating balance and harmony within the body, mind, and spirit.

The history of Ayurveda traces back to the ancient scriptures known as the Vedas, where the knowledge of health and healing was documented. It is believed that Ayurveda was passed down through divine teachings from enlightened sages to humanity. Over the centuries, Ayurveda evolved and incorporated insights from various scholars and practitioners, solidifying its foundation as a comprehensive healing system.

A fundamental principle of Ayurveda is the concept of doshas, which are biological energies that govern an individual's physical, mental, and emotional characteristics. There are three primary doshas: Vata, Pitta, and Kapha. Each dosha is a unique combination of the five elements - ether, air, fire, water, and earth. Vata is associated with movement and governs functions like breathing and circulation. Pitta represents metabolic processes and controls digestion, metabolism, and energy production. Kapha governs structure and

Citation: Vikas Deepak Srivastava, Vijay Kumar, Khushbu (2024). Exploration the Potential of Artificial Intelligence in Ayurveda Diagnostics through the Machine Learning Approach. *Saudi J Econ Fin, 8*(3): 67-73.

67

stability, influencing body weight, immunity, and lubrication.

Ayurvedic treatment focuses on bringing balance to the doshas by identifying the root cause of disease rather than merely suppressing symptoms. It employs a combination of herbal medicines, dietary modifications, lifestyle practices, detoxification methods, and therapies like massage (Abhyanga), cleansing techniques (Panchakarma), and meditation.

In recent years, Ayurveda has experienced significant growth and recognition in India. The government has taken measures to promote Ayurveda as a mainstream and complementary healthcare system. Ayurveda medical colleges have been established, and research is being conducted to validate the efficacy of Ayurveda treatments. The integration of Ayurveda with modern medicine has gained momentum, fostering a holistic approach towards patient care. Additionally, Ayurveda resorts, retreats, and wellness centers have become popular, attracting people seeking natural healing and rejuvenation.

The global interest in Ayurveda has also been on the rise, with people recognizing its ability to provide personalized and preventive care. Ayurveda practices, including yoga and meditation, have gained international acclaim for promoting overall well-being and stress management.

As Ayurveda continues to flourish, it offers a comprehensive and integrated approach to healthcare, honouring the wisdom of ancient traditions and embracing scientific advancements. With its emphasis on balance, harmony, and natural healing, Ayurveda stands as a beacon of hope for those seeking a holistic approach to health and wellness in today's fast-paced world.

According to a study conducted by the authors, human body constitution (prakriti) and the three doshas (VATT, PITT, KAPH) play a crucial role in determining an individual's health and susceptibility to illness. The study validates a questionnaire with 28 characteristics and uses machine learning techniques to analyze data from 807 healthy individuals. The results reveal that CatBoost, a machine learning algorithm, performs the best for constitution recognition (Vishnu Madaan *et al*., 2020).

Ayurveda, the ancient system of medicine originating from India, has been gaining renewed attention and interest in recent years. Alongside this traditional healing practice, there has been a rising use of machine learning techniques in the context of Ayurvedic treatment in India.

Ayurveda emphasizes personalized and holistic healthcare based on an individual's unique constitution and dosha imbalances. Traditionally, Ayurvedic practitioners diagnose and treat patients based on their observation, knowledge, and experience. However, the integration of machine learning in Ayurveda is transforming the way diagnoses are made and treatments are prescribed.

Machine learning algorithms leverage large datasets and complex patterns to analyze a patient's symptoms, medical history, and dosha imbalances. These algorithms can identify patterns, correlations, and predictors that may not be readily apparent to human practitioners. By analyzing vast amounts of data, machine learning models can assist Ayurveda experts in making accurate diagnoses and suggesting personalized treatment plans.

The use of machine learning in Ayurveda can contribute to advancements in precision medicine, helping practitioners tailor treatments to individual patients' needs. Additionally, machine learning can aid in predicting disease outcomes and evaluating the effectiveness of various treatment approaches based on real-world evidence.

The Ayurveda Pharmacopoeia of India (API) is a comprehensive reference book that lists standards and specifications for the quality, purity, and safety of Ayurveda medicines. It contains detailed descriptions of ingredients, preparation methods, and dosage forms used in Ayurveda formulations. The Pharmacopoeia is published by the Ministry of Health and Family Welfare, Government of India, and serves as a reliable resource for regulatory authorities, manufacturers, and practitioners in ensuring the quality of Ayurveda medicines. Data support for the Ayurveda Pharmacopoeia of India includes information on traditional Ayurveda texts, scientific studies, analytical methods, and expert opinions, providing a well-rounded scientific basis for the standards and specifications set forth in the Pharmacopoeia.

In India, the rising use of machine learning in Ayurveda aligns with the country's push towards integrating technology in healthcare. The government of India has initiated several programs and collaborations to encourage the development and implementation of artificial intelligence and machine learning in various sectors, including healthcare.

The combination of Ayurveda's ancient wisdom and the power of machine learning has the potential to enhance the accuracy, efficiency, and accessibility of Ayurveda treatments. It blends traditional wisdom with modern technological advancements, paving the way for a more integrated and effective approach to healthcare in India and beyond. As the field continues to grow, the synergy between Ayurveda and machine learning has the potential to revolutionize the way we diagnose, treat, and prevent diseases in the future.

The use of various machine learning models in the treatment of Vata, Kapha, and Pitta diseases within the Ayurveda domain has shown promising results in recent years. Here's a breakdown of their application:

1. Classification Models: Classification models, such as Naive Bayes, Decision Trees, and Support Vector Machines (SVM), have been utilized to classify patients into Vata, Kapha, or Pitta dosha categories based on their symptoms, dosha imbalances, and medical histories. These models learn from labeled data and create decision boundaries to accurately classify new patient cases.

$$P(y \backslash x1 \ldots\ldots xn) = \frac{p(x1\backslash y)P(x2\backslash y)\ldots p(xn\backslash y)p(y)}{P(x1)P(x2\ldots P(xn)}$$

2. Clustering Models: Clustering techniques like K-means clustering and hierarchical clustering have been employed to identify patterns and group patients based on their dosha imbalances and symptom profiles. This helps in understanding disease clusters and tailoring treatment approaches accordingly.
3. Regression Models: Regression models like Linear Regression and Random Forest Regression have been used to predict the severity of Vata, Kapha, or Pitta imbalances based on various input variables. These models estimate the imbalances and guide practitioners in developing personalized treatment plans.
4. Recommendation Systems: Recommendation systems, including Collaborative Filtering and Content-Based Filtering, have been employed to suggest specific Ayurveda treatments based on a patient's dosha imbalances, symptoms, and medical history. These models utilize past patient data to recommend appropriate treatments to new patients.
5. Deep Learning Models: Deep learning models, such as Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks, have been explored to analyze complex patterns in medical images (such as tongue examination) and time-series data (such as pulse diagnosis). These models help in identifying specific dosha imbalances and assisting in disease identification and treatment.

The application of these machine learning models in the domain of Ayurveda offers a data-driven and personalized approach to disease treatment. By leveraging large datasets and advanced algorithms, practitioners can enhance the accuracy of diagnosis, develop customized treatment plans, and improve patient outcomes in Vata, Kapha, and Pitta diseases. Continued research and development in this field hold great potential for the integration of machine learning into Ayurveda, contributing to the modernization and advancement of this ancient healing system.

LITERATURE REVIEW

➢ Bale Anura *et al*., (2022) this review explores the utilization of Ayurveda, the science of life, for maintaining health and prolonging lifespan. It highlights the increasing demand and acceptance of Ayurveda worldwide, leading to the need for modernization and advanced techniques in Ayurveda Pharmaceutics. The article suggests the application of Artificial Intelligence (AI) to meet the demands of Ayurveda medicine and overcome challenges in drug manufacturing. The review discusses the potential of AI in various sectors of Ayurveda pharma, aiming for global acceptance of Ayurveda. It emphasizes the efficacy of Ayurveda in treating chronic conditions that are often untreatable by other medical systems.

➢ Srivastav Vikas *et al*., (2023) this study focuses on consumer perception of Ayurveda and the wellness industry in Odisha, India. The study conducted a survey to assess consumer perception of Ayurveda and its long-term health benefits in the cities of Bhubaneswar and Cuttack. The Kruskal-Wallis test was used to compare consumer rankings on various variables related to Ayurveda. The study found that consumers in both cities perceive similar long-term benefits and minimal side effects from Ayurveda. However, there was a significant difference in consumer perception of the natural method of healing between the two cities. The findings of this study provide valuable insights for policymakers and industry professionals to promote Ayurveda and foster consumer confidence in its benefits.

➢ Lakshmi Bheemavarapu *et al*., (2023) point out on the use of Machine Learning (ML) models in Ayurveda for Prakriti identification. ML models are employed to automate manual work and have become valuable tools in healthcare, including Ayurveda. The traditional Ayurvedic system utilizes ML models to understand human nature, identify disease causes, diagnose diseases, and create personalized treatment plans. Prasna Pariksha, a type of assessment, is used to determine an individual's Prakriti or body constitution. Developing ML models for Prakriti identification using Prasna Pariksha benefits both individuals and Ayurvedic practitioners, aiding in personal health management and enhancing disease diagnosis and treatment

RESEARCH METHODOLOGY

1. **Problem Identification and Formulation**: The research problem is to explore the integration of AI and Machine learning in Ayurveda and its impact on diagnosis and treatment practices. Specific research questions

such as "What are the potential benefits of AI and Machine learning in Ayurveda diagnosis?", "What challenges exist in implementing AI in Ayurveda?", and "How do Ayurveda practitioners perceive the integration of AI in their practice?".

2. **Research Design:** A qualitative research design was utilized to gather in-depth insights and understanding of the research topic. Semi-structured interviews and focus group discussions were conducted with five Ayurveda practitioners from Saharanpur and five from Dehradun. This will enable us to explore their experiences, perspectives, and challenges related to the integration of AI and Machine learning in Ayurveda.

3. **Data Collection:** Primary data in context of research study at hand have been collected through semi-structured interviews and focus group discussions. The participants were selected based on their experience and expertise in Ayurveda practice.

4. **Data Analysis:** Thematic analysis has been conducted to identify common themes and patterns within the data. The responses have been coded and categorized into themes related to the benefits, challenges, and perceptions of AI integration in Ayurveda. The analysis involved an iterative process of data coding, theme development, and refinement.

5. **Interpretation and Reporting:** The findings have been interpreted and discussed, providing insights into the potential benefits, challenges, and perceptions of AI and Machine learning integration in Ayurveda practice

Sample: 5 Ayurveda practitioner consultants from Saharanpur and 5 Ayurveda practitioner consultants from Dehradun.

Research Gap:

The research gap in the area of Ayurveda diagnosis and the use of AI and machine learning approaches in Saharanpur and Dehradun as sample areas is the lack of comprehensive studies that examine the integration of these technologies in Ayurveda healthcare settings. While there is some literature focusing on the use of AI and machine learning in healthcare, there is limited research specifically exploring their application in Ayurveda diagnosis and treatment.

There is a need for research that explores the challenges and opportunities in integrating AI and machine learning in Ayurveda diagnosis, particularly in Saharanpur and Dehradun. This includes studying the effectiveness and accuracy of these technologies in diagnosing Ayurveda conditions and recommending personalized treatment plans. Additionally, research is needed to understand the perspectives and experiences of Ayurveda practitioners and patients regarding the use of AI and machine learning in their healthcare journey.

Moreover, the research gap also lies in investigating the potential benefits and outcomes of integrating AI and machine learning in Ayurveda healthcare settings. This includes examining the impact of these technologies on treatment outcomes, patient satisfaction, and overall healthcare delivery. Understanding the barriers to the successful adoption and implementation of AI and machine learning in Ayurveda, such as concerns about data privacy and ethical considerations, is also crucial.

Overall, conducting comprehensive studies that address the integration, challenges, benefits, and outcomes of AI and machine learning in Ayurveda diagnosis in Saharanpur and Dehradun will contribute to enhancing the healthcare practices and outcomes in these regions.

Objective of the study
- To investigate the potential uses and benefits of AI and machine learning approaches in Ayurveda diagnosis and treatment, specifically focusing on the Saharanpur and Dehradun regions
- To explore the perspectives and experiences of Ayurveda practitioners regarding the use of AI and machine learning in their healthcare journey.

ANALYSIS, RESULT& DISCUSSION

Table 1: How long have you been practicing in ayurveda treatment consultancy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-3 years	6	60.0	60.0	60.0
	More than 3 years	4	40.0	40.0	100.0
	Total	10	100.0	100.0	

Source: Primary Data

The majority of the respondents in the study have been practicing in Ayurveda treatment consultancy for 1-3 years, accounting for 60% of the total sample. On the other hand, 40% of respondents have been practicing for more than 3 years. It is evident that there is a relatively new generation of practitioners in Ayurveda, but a significant proportion of experienced practitioners are also present.

Table 2: Do you think AI driven diagnosis approaches are more effective than generalized approaches

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	7	70.0	70.0	70.0
	No	3	30.0	30.0	100.0
	Total	5	100.0	100.0	

Source: Primary Data

According to the data presented, 70% of the respondents believe that AI-driven diagnosis approaches are more effective than generalized approaches. This indicates a positive perception and acceptance of AI technology in the field of diagnosis. On the other hand, 30% of the respondents do not think that AI-driven approaches are more effective. This could be due to various reasons such as concerns about accuracy, trust in traditional methods, or a lack of understanding about the potential benefits of AI in diagnosis. Overall, these findings suggest a fair level of acceptance and optimism towards the potential of AI in improving the effectiveness of diagnosis approaches in the field of Ayurveda.

Table 3: In Which sort of diagnosis you mostly use AI tool

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Sparshana	10	100.0	100.0	100.0
	Darshana	0	0.0	0.0	100.0
	Prashna	0	0.0	0.0	100.0
	Total	10	100.0	100.0	

Source: Primary Data

According to the data, all respondents (100%) reported using AI tools primarily for Sparshana diagnosis in their Ayurvedic practice. This finding suggests that AI technologies are predominantly utilized in the context of touch-based diagnosis in Ayurveda. It is noteworthy that no respondents reported using AI tools for Darshana (visual examination) or Prashna (questioning) diagnosis. This indicates a specific focus and application of AI in the realm of Sparshana diagnosis, potentially due to its compatibility with data-driven and algorithmic approaches. However, it should be acknowledged that the absence of AI utilization for Darshana and Prashna diagnosis might be influenced by various factors such as limited availability or applicability of AI tools for visual and questioning-based assessments in Ayurveda. Further research is necessary to explore and understand the reasons behind this notable variation in the use of AI tools across different diagnostic methods in Ayurveda practice.

Table 4: What aspects of Ayurveda do you think can be improved with the integration of artificial intelligence

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	To great extent	8	80.0	80.0	80.0
	To some extent	2	20.0	20.0	20.0
	Total	10	100.0	100.0	100.0

Source: Primary Data

The data suggests that 80% of the respondents believe that the integration of artificial intelligence (AI) into Ayurveda has the potential to greatly improve various aspects of the practice. This indicates a widespread recognition of the benefits that AI can bring to Ayurveda, such as enhancing diagnosis accuracy, personalizing treatments, and improving overall outcomes.

On the other hand, 20% of the respondents feel that AI integration in Ayurveda has the potential to improve aspects to some extent. This more cautious perspective may reflect a belief that while AI has potential, it may not completely revolutionize every aspect of Ayurveda.

Overall, these findings highlight the positive outlook on the integration of AI in Ayurveda and suggest that it has the potential to significantly enhance various facets of the practice. Further research is needed to identify specific areas where AI can be most impactful and to address any concerns or barriers associated with its integration.

Table 5: How likely are you to trust personalized Ayurveda wellness solutions suggested by an AI-based system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very likely	7	70.0	70.0	70.0
	Likely	2	20.0	20.0	20.0
	Neutral	1	10.0	10.0	10.0
	Total	10	100.0	100.0	100.0

Source: Primary Data

According to the data, 70% of the respondents reported being satisfied with the integration of AI and machine learning in Ayurveda diagnosis. This indicates a positive perception and acceptance of these technologies in enhancing the diagnostic process within the field of Ayurveda.

On the other hand, 20% of the respondents stated a neutral level of satisfaction, implying a lack of strong positive or negative sentiment towards the integration of AI and machine learning. It is possible that these respondents are still uncertain about the effectiveness or impact of AI in Ayurveda diagnosis.

Additionally, 10% of the respondents expressed dissatisfaction with the integration. This might be due to several reasons, including challenges or limitations faced during implementation, concerns about accuracy or reliability, or a preference for traditional diagnostic methods.

Overall, these findings highlight the need for further research and exploration of the specific factors that contribute to satisfaction or dissatisfaction with the integration of AI and machine learning in Ayurveda diagnosis. Identifying and addressing these factors can help improve the utilization and effectiveness of these technologies in Ayurveda.

Table 6: How satisfied are you with the current AI driven diagnosis

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	neutral	1	10.0	10.0	10.0
	satisfied	5	50.0	50.0	50.0
	very satisfied	4	40.0	40.0	40.0
	Total	10	100.0	100.0	100.0

According to the data provided, 50% of the respondents reported being satisfied with the current AI-driven diagnosis, indicating a positive perception of the effectiveness and usefulness of AI in the diagnostic process.

Furthermore, 40% of the respondents reported being very satisfied with the current AI-driven diagnosis, suggesting a high level of reassurance and confidence in the accuracy and reliability of the AI technology used in diagnosis.

Interestingly, 10% of the respondents expressed a neutral level of satisfaction, implying a lack of strong positive or negative sentiment towards the current AI-driven diagnosis. This response could be due to various reasons, such as limited experience or familiarity with AI-driven diagnosis or a need for further evidence of its effectiveness.

Overall, these findings highlight generally positive sentiments towards the current AI-driven diagnosis in Ayurveda. However, further research is needed to explore the specific factors that contribute to satisfaction or neutrality, as well as any potential concerns or areas for improvement. Understanding these factors can help enhance the integration, acceptance, and utilization of AI-driven diagnosis in Ayurveda and improve patient outcomes.

CONCLUSION

In conclusion, this study examined the Ayurveda, as a holistic system of medicine, has been gaining recognition for its emphasis on balance and harmony. The integration of modern technology, particularly artificial intelligence (AI) and machine learning has the potential to revolutionize the practice of Ayurveda. The majority of practitioners have been practicing for 1-3 years, indicating a mix of experienced and newer professionals. The perception towards AI-driven diagnosis approaches in Ayurveda is positive, with 70% of respondents believing in their effectiveness. AI tools are predominantly used for Sparshana diagnosis, highlighting the potential of data-driven approaches. Furthermore, practitioners are optimistic about the integration of AI, with 80% believing it can greatly improve various aspects of Ayurveda. Satisfaction levels with current AI-driven diagnosis are positive, with 50% satisfied and 40% very satisfied. The integration of AI and machine learning in Ayurveda holds promise in enhancing accuracy, personalization, and efficiency in treatment. Machine learning models, such as classification, clustering, regression, recommendation systems, and deep learning, offer a data-driven and personalized approach to disease treatment. The Ayurveda Pharmacopoeia of India serves as a reliable resource for ensuring the quality and safety of Ayurveda medicines. The rising use of machine learning in Ayurveda aligns with India's push towards integrating technology in healthcare. The combination of Ayurveda's ancient wisdom and machine learning techniques has the potential to reshape healthcare practices and improve patient outcomes. Continued research and development in this area will further contribute to the advancement and modernization of Ayurveda.

REFERENCES
- Bheemavarapu, L., & Rani, K. U. (2023). Machine Learning Models Used For Prakriti Identification Using Prasna Pariksha in Ayurveda – A Review, *72*(1).
- Bidve, P., & Mishra, S. (2023). Enhancing Ayurvedic Diagnosis using Multinomial Naïve

Bayes and K-modes Clustering: An Investigation into Prakriti Types and Dosha Overlapping.

- Narang, S. (2018). Ayurveda based Disease Diagnosis using Machine Learning, *5*(3).
- Pesala, B., & Mukerji, M. (2021). Reinventing Ayurveda for the 21st Century.
- Sabharwal, P. (2023). Evolution of Tools for Scientific Validation of Ayurveda in Amalgamation with Artificial Intelligence – A Review.
- Srivastava, V. D. (2023). Exploring the Potential of Ayurveda and Wellness Industry with special focus on Consumer Perception in Odisha: An Entrepreneurial Prospects, *6*(4).
- Madaan, V., & Goyal, A. (2020). "Predicting Ayurveda-Based Constituent Balancing in Human Body Using Machine Learning Methods," in IEEE Access, 8, pp. 65060-65070. doi: 10.1109/ACCESS.2020.2985717.
- www.ayushportal.nic.in