

Ayurvedic Perspective on Vata Dosha and Neurological Disorders using Machine Learning Techniques

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Abstract: With a focus on the Vata dosha, which controls movement and nervous system functions, Ayurveda offers a comprehensive framework for comprehending and treating neurological disorders. Machine learning (ML) has shown significant promise in the diagnosis of neurological disorders using digital biomarkers: deep learning on EEG connectivity matrices has produced robust classification of schizophrenia and Alzheimer's disease, and voice plus motor examination data has produced near-perfect detection of Parkinson's disease (PD) and rapid eye movement sleep behavior disorder (RBD), with some experimental models achieving up to 100% accuracy. The current state of machine learning in the treatment of neurological disorders is reviewed in this paper, along with the possibility of combining it with contemporary technology to provide better neurological care.

Keywords: Ayurveda; Vata Doshas; Machine Learning; Neurological Disorder

Introduction

Ayurveda, the traditional medical system originating from ancient India, conceptualizes health through the lens of the Tridosha—Vata, Pitta, and Kapha—wherein Vata Dosha governs neural activity, movement, sensory perception, and cognitive functions (e.g., “the nervous system’s activities are governed by Vata Dosha disorders arising from the vitiation of Vata are termed Vatavyadhi,” including conditions like epilepsy, Parkinson’s, migraine, stroke, Alzheimer’s, and multiple sclerosis). Classical texts such as Charaka Samhita attribute neurological dysfunctions to either degenerative (“Dhatukshayjanya”) or obstructive (“Margavarodhjanya”) pathways of Vata imbalance, with treatments aiming to restore neural homeostasis via therapies like Panchakarma, Rasayana, Snehana (oleation), and Swedana (fomentation). Modern computational methods, particularly machine learning (ML), offer novel opportunities to quantitatively integrate Ayurvedic diagnostics with neurology. For instance, ML-based systems have successfully inferred Ayurvedic constitutions (Prakriti) or doshic balance through questionnaire data and sensor fusion, achieving high levels of classification accuracy (e.g., ANNs, K-Nearest Neighbors, SVM, CatBoost with precision and recall above 0.95). Other studies leverage hybrid models—neural networks combined with fuzzy logic or ensemble approaches—to predict Vata–Pitta–Kapha doshas with >90% accuracy, using physiological signals such as pulse waveforms captured via pressure and optical sensors. Simultaneously, ML has demonstrated marked utility in diagnosing neurological disorders using digital biomarkers: deep learning on EEG connectivity matrices has achieved robust classification of Alzheimer’s disease and schizophrenia and voice plus motor examination data has yielded near-perfect detection of Parkinson’s disease (PD) and rapid eye movement sleep behavior disorder (RBD), reaching up to 100% accuracy in some experimental models.

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Therefore, combining these two fields—ML-based neurological prediction and Ayurvedic Vata diagnostics—presents an interdisciplinary research frontier. Training machine learning models on multimodal datasets that comprise clinical outcomes (e.g., presence of Parkinson's, epilepsy, or other Vatavyadhi) and Ayurvedic indicators (e.g., dosha assessments, pulse data, facial or speech markers) allows us to create systems that provide early detection, differential diagnosis, and tailored interventions. This combination promises to open up new avenues for integrative neurology research by fusing the objective, data-driven accuracy of Ayurveda with its holistic wisdom. The rest of the manuscript has been organized as section 2 explains about related work, section 3, discusses the Vata Dosha and Neurological Disorders followed by conclusion.

Related work

The neurological disorders including epilepsy (apasmara), within the Ayurvedic framework, emphasizing the role of vata dosha [1]. The integrated management of Avaranjanya Pakshaghata, highlighting the role of Vata in causing hemiplegia and the treatment approaches combining Ayurveda and allopathy. While it discusses Vata's impact on neurological conditions, it does not explore machine learning applications in this context [2]. The paper focuses on Parkinson's disease, correlated with Kampavata in Ayurveda, characterized by tremors due to Vata imbalance. It talks about Panchakarma therapies as a form of treatment [3]. The subtype of Vata Dosha known as Udan Vayu is discussed in the paper along with its relationship to cognitive processes and how imbalances can result in cognitive deficits. In order to balance Udan Vayu, which may have an indirect connection to neurological health, it highlights Ayurvedic interventions [4]. The importance of reestablishing equilibrium to the Vata dosha, which controls movement and nervous system functions, is emphasized in this paper's discussion of Guillain-Barré Syndrome (GBS) within the framework of Ayurveda. In order to promote the health of the nervous system, it emphasizes Ayurvedic treatment methods like Panchakarma therapy, herbal remedies, and lifestyle changes. People with GBS may recover more quickly if these methods are combined with traditional therapies [5]. Within the framework of Ayurveda, the thorough review by [6] provides a comprehensive explanation of the basic functions of Vata, Pitta, and Kapha in preserving health. Instead of discussing neurological disorders in general or the use of machine learning, the paper [7] focuses on the relationship between Rajo Guna and Vata Dosha in the context of Vataja Unmada, an Ayurvedic psychotic disorder. It highlights how Vataja Unmada symptoms are made worse by Rajo Guna, which impacts mental and physical processes. It does not particularly address machine learning in relation to Vata Dosha and neurological disorders, even though it promotes integrated therapeutic approaches that combine Ayurvedic and modern psychiatric practices. The paper [8] does not specifically address the relationship between neurological disorders, vata dosha in Ayurveda, and machine learning. It focuses on the Ayurvedic understanding and management strategies for Amyotrophic Lateral Sclerosis (ALS), correlating its symptoms with vata-related conditions. The treatment strategies discussed include herbal medications and Panchakarma procedures. An important enhancement [9] in the integration of traditional and modern medical science is the integration of machine learning (ML) techniques to predict both metabolic disorders and Kapha dosha tendencies. The paper [10] discusses Parkinson's Disease (PD) as a neurological disorder with symptoms resembling Kampa Vata in Ayurveda. It emphasizes Ayurvedic management to reduce L-Dopa dosage and improve quality of life. However, it does not address the application of machine learning in analyzing vata dosha or neurological disorders. Further research integrating machine learning with

Ayurvedic principles could enhance understanding and treatment of such conditions, but this specific intersection is not covered in the paper. The paper [11] does not specifically address neurological disorders in relation to vata dosha using machine learning. However, it emphasizes the importance of vata, pitta, and kapha doshas in diagnosing illnesses through pulse analysis (Nadi Pariksha). The research aims to develop modern pulse sensing and analysis methods to assist Ayurvedic physicians, potentially aiding in understanding how imbalances in vata dosha could relate to various health conditions, including neurological disorders, though this is not explicitly covered in the study. The paper [12] does not use machine learning to address neurological disorders in relation to Vata dosha. It focuses on using machine learning and deep learning algorithms to identify the Ayurvedic doshas (Pitta, Kapha, and Vata) based on facial and body visual features. Rather than investigating the relationship between Vata dosha and neurological disorders, the main goal is to automate the diagnosis of dosha imbalances by analyzing body images. Neurological disorders and their relationship to Vata dosha through machine learning are not specifically covered in the paper [13]. By employing Multinomial Naive Bayes and K-modes clustering to classify Prakriti types and Dosha overlap into seven categories, it aims to improve Ayurvedic diagnosis. While it discusses the importance of Doshas in determining health conditions, it does not provide a direct analysis of neurological disorders in relation to Vata dosha through machine learning techniques. The paper [14] discusses the role of Vata Dosha in neurological disorders, particularly spastic paralysis (Pakshaghata), emphasizing its influence on the nervous and muscular systems. However, it does not address the application of machine learning in this context. The focus is on traditional Ayurvedic treatments like Panchakarma and Shamana Aushadha for managing Vata imbalances.

Using Ayurvedic dosha analysis, the paper [15] focuses on creating a machine learning-based prediction model for Parkinson's disease (PD), with a special emphasis on the vata dosha, which is linked to neurological and movement functions. The study computes tridosha scores as inputs for different machine learning algorithms using the MDS-UPDRS-II and MDS-NMSQ scales. With an accuracy of over 92.5%, the study demonstrates the potential of combining Ayurvedic principles with contemporary technology to improve the comprehension and prognosis of neurological disorders like Parkinson's disease. Parkinson's disease, a neurodegenerative condition linked to vitiation of the Vata dosha in Ayurveda, is discussed in the paper [16]. It talks about using Panchakarma therapies and other multimodal treatments to treat symptoms like stiffness and tremors using Ayurvedic principles. It does not, however, discuss the application of machine learning to the analysis of vata dosha or neurological disorders. This study does not address how machine learning can be integrated with Ayurvedic principles. The substantial influence of Vata dosha on health, especially its association with neurological disorders in modern medicine, is covered in the paper [17]. It places a strong emphasis on comprehending the physiological activity of Vata in connection to neurophysiology. However, it does not specifically address the application of machine learning in analyzing Vata dosha or neurological disorders. The integration of machine learning with Ayurvedic principles could be a potential area for future research, but this paper does not explore that intersection. The paper [18] discusses the vata dosha in Ayurveda using machine learning. It focuses on the broader application of machine learning techniques, such as decision trees and neural networks, to recommend individualized Ayurvedic treatments based on patient data. The primary aim is to enhance healthcare accessibility and efficacy through personalized Ayurvedic recommendations, bridging traditional wisdom with modern technology, but it does not delve into specific doshas or disorders. The paper [19] does not particularly address the use of machine learning in relation to neurological disorders

and Vata Dosha in Ayurveda. However, it highlights the association of Vata Dosha with Parkinson's Disease, showing a significant Odds Ratio of 1.036, indicating a probability of Vata Dosha occurrence in PD. The study emphasizes the impact of various diseases and symptoms on Dosha patterns, but it does not incorporate machine learning methodologies in its analysis. The paper [20] does not specifically focusses on the relationship between neurological disorders, vata dosha in Ayurveda, and machine learning. It discusses the neuroprotective properties of Ayurvedic herbs like *Withania somnifera* and *Bacopa monnieri*, detailing their biochemical mechanisms and therapeutic actions against neurodegenerative conditions. The connection between machine learning, Ayurvedic vata dosha, and neurological disorders is not particularly discussed in the paper [21]. It highlights the importance of comprehending Ayurvedic principles using contemporary scientific methods and focuses on the application of Ayurvedic herbs in the treatment of disorders affecting the central nervous system. It talks about Ayurvedic medicine's potential and neuroprotective techniques, but it skips over machine learning applications in this context. Neurological disorders and the vata dosha in Ayurveda using machine learning are not specifically addressed in the paper [22]. Using a web-based application called "Wedaduru," which uses artificial intelligence for diagnosis and remedy analysis based on Ayurvedic principles, it focuses mainly on heart diseases. The system divides heart conditions into groups like Vataja, but it doesn't look at neurological conditions or the wider effects of vata dosha. The goal of the paper [23] is to create a system that uses machine learning algorithms and tongue image analysis to identify Prakriti doshas (Vata, Pitta, and Kapha). The study does not examine the relationship between Vata dosha and neurological disorders, but it does highlight the necessity of sophisticated image processing methods to automate tongue diagnosis. The paper [24] discusses Ayurveda's approach to managing neurological disorders categorized as "Vata" disorders, emphasizing herbal medicines and purification techniques. While it highlights the efficacy of Ayurvedic treatments, it does not specifically address the application of machine learning in this context. Integrating machine learning could enhance the understanding of Vata dosha's role in neurological disorders by analyzing patient data and treatment outcomes, but this aspect is not covered in the research. The paper [25] focuses on predicting Ayurveda-based constituent balancing (prakriti) through machine learning methods, analyzing the balance of Vata, Pitta, and Kapha doshas in healthy individuals. The study emphasizes the effectiveness of machine learning techniques, particularly CatBoost, in classifying dosha types rather than exploring the connection between Vata dosha and neurological disorders. The paper [26] focuses on predicting Ayurvedic constituents (Prakriti) and the performance of various machine learning methods, particularly the AdaBoost algorithm, in enhancing the accuracy of these predictions. While vata dosha is mentioned as one of the three main doshas, the study does not explore its connection to neurological disorders or provide insights on that topic. The paper [27] focuses on automating the identification of Ayurvedic doshas (Vata, Pitta, Kapha) through the analysis of body and face image features. The study emphasizes the visual characteristics influenced by these doshas but does not delve into the implications for neurological disorders or their diagnosis using machine learning techniques. The paper [28] highlights the application of Machine Learning techniques in Ayurveda for disease classification and diagnosis, indicating a growing interest in quantitative analysis of traditional practices. The focus is on improving diagnostic methods and developing medical decision support networks, which could potentially include neurological disorders and their association with vata dosha in future research. The paper [29] discusses neurological disorders, correlating them with Vata dosha in Ayurveda, specifically under the category of Vatavyadhi. It highlights the use of Veerataru (*Dichrostachys*

cinerea Linn.) for managing these disorders, emphasizing its properties in alleviating Vata-related conditions. However, the paper does not address the application of machine learning in this context. It focuses on traditional Ayurvedic practices and herbal remedies rather than modern technological approaches like machine learning. The paper [30] discusses Vata Dosha's significant impact on health, particularly its relation to neurological disorders, which are classified in Ayurveda as Vata disorders. It emphasizes the need to understand Vata's physiological concept concerning the neurological system. However, it does not specifically address the application of machine learning in analyzing or treating these disorders in relation to Vata Dosha. Thus, the intersection of machine learning and Vata Dosha in Ayurveda is not covered in this research. The paper [31] discusses how Ayurveda views neurological disorders as primarily resulting from Vata dosha imbalances. It emphasizes that Ayurvedic treatments aim to restore harmony among Vata, Pitta, and Kapha doshas to alleviate these disorders. While the paper does not specifically address machine learning applications in this context, integrating machine learning could enhance the analysis of Vata dosha patterns and treatment outcomes in neurological disorders, potentially leading to more personalized Ayurvedic interventions. The paper [32] discusses the classification of Ayurveda constitution types (Prakriti) using deep learning algorithms, which could potentially be applied to understand the relationship between vata dosha and neurological conditions. The study emphasizes personalized medicine and the predictive capabilities of machine learning in assessing individual constitution types, which may indirectly relate to disease susceptibility, including neurological disorders associated with vata dosha. The paper [33] discusses neurological disorders in Ayurveda primarily through the lens of vata dosha, which is crucial for maintaining body and mind functions. It highlights that neurological disorders are categorized under Vata Vyadhi, with pathogenesis linked to degeneration (Dhatukshaya) or obstruction (Margavarana) of vata. However, the paper does not address the application of machine learning in this context, focusing instead on traditional Ayurvedic management techniques such as Panchakarma therapies and specific herbs for treatment. The paper [34] focuses on the assessment of Vata, Pitta, and Kapha doshas through an automated machine learning approach, utilizing various algorithms like ANN, KNN, SVM, NB, and DT to analyze body constitutions. The study emphasizes the need for quantitative evaluation in Ayurveda but does not explore the connection between Vata dosha and neurological disorders. The paper [35] focuses on classifying Indian medicinal herbs based on their leaves using computer vision and machine learning techniques, particularly through the Scale Invariant Feature Transform (SIFT) method combined with classifiers like Support Vector Machine (SVM), K-Nearest Neighbor (kNN), and Naive Bayes. The primary aim is to promote Ayurveda by accurately identifying medicinal herbs rather than exploring dosha-related conditions. The paper [36] focuses on predicting Ayurvedic dosha through an Adaptive Neuro Fuzzy Inference System (ANFIS) that analyzes individual data to forecast potential future diseases based on dosha classification. The system achieved a 92.1% success rate using data from 567 individuals, but it does not delve into the relationship between vata dosha and neurological disorders. The paper [37] discusses the overall impact of lifestyle factors on health and the use of AI and machine learning to analyze diseases related to poor lifestyle choices. The integration of modern technology aims to enhance the diagnosis process in Ayurveda while maintaining its foundational principles, potentially benefiting various health conditions, including those influenced by dosha imbalances. The paper [38] focuses on the Nadi Pariksha technique for assessing physical and psychological conditions, emphasizing pulse wave analysis and its application in cardiovascular research. The study utilizes machine learning, particularly the Support Vector Machine

(SVM), to analyze pulse signals related to the three doshas (Vata, Pitta, and Kapha), but does not explore neurological disorders directly. The relationship between neurotransmitters and vata dosha is the main topic of the paper [39], which emphasizes how both are necessary for physiological processes. Although it talks about neurotransmitters' excitatory properties and how they relate to vata vridhi lakshanas, it skips over machine learning applications in this context. As a result, the provided research does not examine how these topics intersect. A hybrid machine learning method for tailored Ayurvedic medication recommendations based on Prakriti evaluation and symptom analysis is the main topic of the paper [40]. To suggest treatments, the system examines the patient's symptoms and physical makeup.

Vata Dosha and Neurological Disorders

A new method for comprehending and treating neurological disorders is provided by the combination of machine learning and Ayurvedic ideas, especially the Vata dosha. One of the three main bio-energies in Ayurveda, vata dosha, is closely related to neurophysiological processes and is linked to movement, communication, and cognition. Through the analysis of each person's Prakriti (body constitution) and symptoms, machine learning can improve the personalization of Ayurvedic treatments by suggesting suitable interventions. This method is especially pertinent when discussing neurological conditions, as Vata imbalances are frequently linked to them.

1. Vata Dosha and Neurophysiology

Neurological disorders associated with Vata imbalances include Vataja Unmada, which is characterized by erratic thoughts and unstable motor activities [7]. The study [41] examines how traditional Ayurvedic ideas mesh with contemporary neurophysiology, concentrating on the relationship between Vata dosha and neurophysiological processes. Similar to neurophysiological processes like nerve impulses and neurotransmitter activity, vata dosha regulates movement and cognitive abilities.

2. Machine Learning in Ayurvedic Treatment

To improve the management of dosha imbalances, a hybrid machine learning approach [40] can evaluate Prakriti and symptoms to suggest customized Ayurvedic treatments. This approach avoids the complexity of deep learning by using clustering and classification algorithms to produce effective and understandable results.

3. Ayurvedic Interventions for Neurological Disorders

As evidenced by the treatment of Guillain-Barré Syndrome, Ayurvedic therapies like Panchakarma, herbal remedies, and lifestyle changes seek to support the nervous system and restore Vata balance [5]. Disorders like dysphonia and anxiety are caused by imbalances in Udan Vayu, a subtype of Vata that is essential for speech and cognition. Pranayama and other Ayurvedic techniques can aid in balancing Udan Vayu [4]. Although Ayurveda offers a comprehensive framework for comprehending and treating neurological conditions, combining it with machine learning presents a promising path toward personalized medicine. This method can improve the accuracy of Ayurvedic treatments, which could benefit patients with neurological disorders associated with Vata. To fully achieve the potential of this integrative approach, however, more research and cooperation between Ayurvedic and contemporary medical professionals are necessary.

Conclusion

According to Ayurveda, a variety of neurological disorders are associated with imbalances in the Vata dosha, which is considered to be essential to neurological health. By combining traditional knowledge with contemporary technology, machine learning improves the accuracy of dosha assessment and facilitates individualized Ayurvedic treatments for better neurological care.

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