

Yoga and Artificial Intelligence: A Review of The Potential Applications of AI in Yoga Research and Practice for Neurological Disorders

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Abstract-Yoga has become an integral component of many people's lives around the world in recent years. Yoga emphasizes physical, mental, and spiritual links and is a health-promoting exercise method. On the other hand, doing yoga incorrectly and spraining your muscles can lead to pain and other health complications. A broad spectrum of issues impacting the nervous system are designated as neurological disorders. These conditions can be minor, like migraines, or severe, like multiple sclerosis and Parkinson's disease. Due to their complexity, many illnesses can be difficult to diagnose and treat. The use of holistic methods, especially yoga, has demonstrated potential in recent years for symptom relief and enhancing the general health of those with neurological illnesses. In addition, the development of artificial intelligence (AI) has improved our comprehension of these illnesses and offered creative approaches to individualised therapy regimens. The goal of artificial intelligence is to simulate, create, apply, and study the theory, technique, application system, and technology involved in increasing human intelligence. This paper discusses the benefits, drawbacks, and future prospects of applying artificial intelligence to the field of mental illness in an effort to serve as a resource for the field's sustainable development and also gives a succinct synopsis of the utilization of AI for examining yoga's impacts on neurological health and the potential for personalized therapies.

Keywords: Artificial Intelligence, Yoga, Neurological disorders, Machine learning, Computer vision

INTRODUCTION

With origins in ancient traditions, yoga is a comprehensive practice that has garnered international recognition for its benefits to the body, mind, and spirit. It is the destroyer of pain and the reliever of anguish, according to the Bhagavad Gita. Because of its numerous physical, psychological, and spiritual advantages, yoga has recently gained popularity all around the world. The United Nations General Assembly proclaimed June 21st, 2014, as the "International Day of Yoga". Yoga has gained significant attention in the medical research community over the past ten years, and a plethora of literature has been suggested for a range of medical uses, such as cardiac rehabilitation, positive body image intervention mental diseases, etc. ^[1] In order to live a stress-free existence, yoga and meditation have long been utilised as conventional approaches in alternative health. In addition to being a popular form of leisure exercise, yoga has gained popularity recently for its potential benefits in lowering stress and anxiety, boosting physical fitness, elevating mood, and enhancing general well-being. As science and technology advanced, people's quality of life increased, and sports and exercise including yoga, became popular and stylish forms of

physical fitness. Many professionals find yoga to be inconvenient due to traditional training methods because they are preoccupied with work during class hours. This demonstrates the fundamentals of thoughtful yoga instruction in various contexts. ^[2]

UNDERSTANDING ARTIFICIAL INTELLIGENCE

The term Artificial intelligence, coined in 1956, refers to the capability of machine to learn from and process information, ultimately enabling them to mimic human-like thinking. ^[3] It is employed to address a broad range of practical problems. Machine learning (ML) is the foundation of artificial intelligence. It is a collection of techniques and algorithms designed to solve classification, clustering, and forecasting issues. Promising opportunities exist for the practical application of AI and ML. ^[4] AI has become a disruptive technology with applications in many different fields. The US Food and Drug Administration has granted approval to at least 29 Artificial intelligence medical devices and algorithms across various domains. These include radiograph interpretation, management of glucose levels in patients with diabetes mellitus, analysis of electrocardiograms, and

diagnosis of sleep disorders The impact of AI in healthcare is expanding. Notably, hospitals will receive reimbursement for the first time from the Centers for Medicare and Medicaid Services in 2020 for an AI platform designed to facilitate early stroke diagnosis.^[3] Translational research on the underlying science's uses in radiology develops in tandem with it. These developments have benefited neuroradiology.^[5] Artificial intelligence has the potential to speed up the process of identifying and treating diseases by synthesising vast amounts of data quickly and using computer analysis to identify specific behavioural patterns. A constant flow of increasingly accurate and efficient DL architectures for image processing is being produced by developments in the computer science discipline of computer vision. These technologies can be leveraged to create a free, user-friendly, application that works wherever. Since neurological diseases pose intricate problems, incorporating AI with yoga therapy could lead to more individualised treatment plans and improved results.

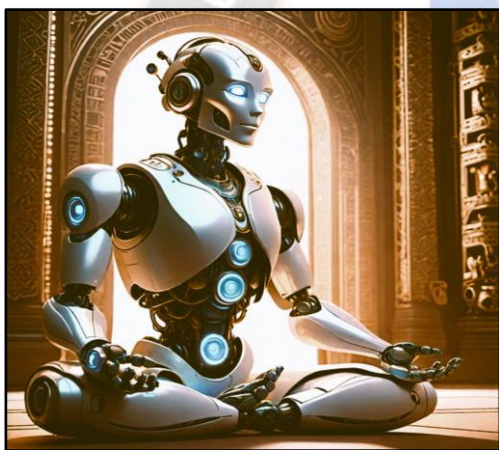


Figure 1: Depiction of advanced humanoid robot practicing yoga.

Recognising Yoga's Therapeutic Potential

Yoga is a complex discipline that includes breathing exercises (asanas), meditation, ethical teachings, and physical postures (pranayama). Regular yoga practice has been associated with numerous health advantages, such as stress reduction, enhanced flexibility, and better cognitive function, based on research findings. In the context of neurological disorders, yoga has been explored as a complementary therapy to alleviate symptoms and improve overall quality of life for individuals with conditions such as multiple sclerosis, epilepsy, and Parkinson's disease.

Exploring the Psychotherapeutic Potential of Traditional Yoga Philosophy

In ancient yoga scriptures, the guru or teacher provided individual or group guidance by systematically elucidating concepts. This would assist in restructuring the individual's perception in order to resume their duty. It was highlighted that achieving moksha, or self-realization, is the ultimate aim of a person, going beyond their mental and emotional states. An account of a conversation between a man named Rama and his guru/teacher, Vashishtha, is found in a traditional literature known as Yoga Vashishtha. Rama is experiencing suicidal thoughts and feelings of hopelessness and helplessness. Rama eventually overcomes his sadness and regains mental clarity after speaking with his master Vashishtha. He then resumes his earthly responsibilities with a detached attitude (vairagya). In BG, the teacher (Krishna) counsels the disciple (Arjuna) who is undergoing panic, anxiety, and depressive symptoms (Vishada) due to a stressful situation. The teacher guides the disciple in coping with stressful situations through the application of selfless action (Karma Yoga), acceptance (Bhakti Yoga), self-discipline (Raja Yoga), and knowledge (Jnana Yoga). Similarly, in the Taittiriya Upanishad, a dialogue between the mentor (Varuna) and student (Brighu) addresses the student's existential crisis by facilitating a systematic exploration of the five layers of holistic existence (panchakosha). These Vedic texts provide insights into expediting the journey towards a heightened state of consciousness (brahman/moksha) and achieving a harmonious state of physical, mental, and emotional well-being. The possibilities of using these texts in a clinical context have not yet been thoroughly investigated.^[6]

Potential Use of Artificial Intelligence in Yoga Research to Treat Neurological Disorders

Yoga has been the subject of numerous researches to support its use as an alternative therapy technique in addition to traditional medicine for a variety of neurological problems.^[7]

- ❖ **Epilepsy:** To examine imaging data in the realm of epilepsy, machine learning methods have been extensively employed. Furthermore, ML algorithms have been utilized to determine the lateralization of intractable temporal lobe epilepsies, aiding in epilepsy surgery.
- ❖ **Stroke Prevention and Rehabilitation:** Stroke is the second leading cause of adult mortality in the United States, accounting for almost 5.8 million deaths annually globally, according to the World Health Organisation.

Relaxation has been shown to have beneficial benefits on coronary artery disease, hypertension, diabetes, carotid atherosclerosis, and diabetes-related disorders, all of which have been linked to the occurrence or recurrence of stroke. Bell and Seyfer have detailed certain modifications to yoga poses those individuals with neurological diseases like multiple sclerosis and stroke might use to improve their limited mobility.^[8]

❖ **Dementia and Neurodegenerative Disorders:** It has been demonstrated that AI increases the diagnosis precision of a number of neurodegenerative illnesses, including dementia. With a classification accuracy of more than 84%, Machine learning algorithms have been successfully used to automatically distinguish Alzheimer's disease from vascular dementia.

❖ **Multiple Sclerosis:** The condition known as multiple sclerosis (MS) affects the myelin sheath protecting the spinal cord, causing debilitation and demyelinating symptoms. The illness affects cognitive, motor, and sensory skills and manifests in varied degrees of severity. There isn't a treatment. However, there are treatments that aim to reduce the rate at which the illness progresses in order to manage symptoms and restore or preserve a suitable quality of life. Since some medications have bad side effects and are difficult for patients to tolerate, many turn to other forms of treatment, including yoga.

❖ **Fibromyalgia:** Fibromyalgia is a condition characterised by increased sensitivity to all stimuli in the body. It manifests as a range of symptoms, such as pain, difficulty sleeping, and exhaustion. Several randomized control studies indicate that yoga can lead to improvements in various fibromyalgia symptoms, encompassing pain, fatigue, stiffness, sleep disturbances, depression, cognitive function, anxiety, tenderness, balance, vitality, and muscular strength.^[9-11]

❖ **Peripheral Nervous System Disorders:** Peripheral Nervous System Conditions have also demonstrated improvement with yoga. A randomized, controlled study examined the effectiveness of Hatha Yoga in alleviating symptoms of Carpal Tunnel Syndrome. The study found that in order to alleviate certain symptoms of carpal tunnel syndrome, a yoga-based programme worked better than wrist splinting or no additional treatment at all.^[12]

❖ **Analysing Biometric Data to Promote Neurological Health:** The use of AI to the analysis of biometric data, including physiological responses, heart rate variability,

and brainwave patterns, can provide insights into the neurological effects of yoga practices. This section looks at how AI can improve our knowledge of the brain reactions that occur during yoga, which can lead to more focused therapies.

❖ **Neuroimaging and Cognitive Assessment:** Artificial Intelligence-driven analysis of neuroimaging data, such as fMRI and EEG scans, might yield important insights on the structural alterations and brain activity brought on by yoga. To examine the effects on memory, attention, and executive functioning, cognitive evaluations can be combined. This section explores how AI may be used to interpret intricate brain patterns and connect them to cognitive effects.

❖ **Predictive Neurological Outcome Modelling:** Predictive models that evaluate the long-term neurological effects of particular yoga practices can be created using AI algorithms. These models can direct the creation of tailored therapies for people with neurological illnesses by taking into account individual characteristics and medical histories. The section investigates the viability of employing AI to forecast and gradually maximise neurological advantages.

Potential Works to Improve Personalized Interventions

Personalized Yoga Programs for Neurological Disorders: AI's ability to analyse individual health data, including neurological markers and patient histories, can inform the creation of personalized yoga programs. This section explores the prospect of customizing yoga interventions to meet the specific needs and obstacles faced by individuals with neurological disorders.

Virtual Yoga Instructors and Rehabilitation: AI-powered virtual instructors can play a crucial role in guiding individuals with neurological disorders through rehabilitative yoga practices. The virtual instructors, equipped with AI algorithms, can adapt in real-time to the user's abilities and progress. This section explores how AI can contribute to neurorehabilitation through personalized virtual guidance.

Mindfulness and Emotional Well-being: AI's role in quantifying mindfulness and emotional states during yoga practices can be particularly relevant for individuals with neurological disorders, where emotional well-being is often intertwined with physical health. This section

discusses how AI can assist in monitoring and enhancing emotional well-being through yoga interventions. ^[13,14,15]

DIFFICULTIES AND ETHICAL CONSIDERATIONS

Difficulties in Combining Yoga and AI for Neurological Health

While the potential benefits are substantial, challenges in integrating AI and yoga for neurological health must be addressed. This section examines issues such as data privacy, algorithm bias, and the need for interdisciplinary collaboration to overcome these challenges.

Ethical Considerations in AI-enhanced Yoga Interventions

Ethical considerations are paramount when deploying AI in healthcare contexts, including yoga interventions for neurological disorders. This section explores the ethical implications of using AI in personalized interventions, emphasizing the importance of informed consent, transparency, and patient autonomy.

YOGA AND AI SYNERGY: TAILORED SOLUTIONS FOR NEUROLOGICAL WELLNESS

Yoga and artificial intelligence (AI) can be combined to create a transformative synergy in the field of neurological illness treatment. AI further optimises yoga, which has been shown to have therapeutic potential, to offer individualised and successful therapies. AI's main contribution to yoga practices is customisation to the unique requirements and circumstances of those suffering from neurological illnesses. AI examines large datasets of patient characteristics and outcomes using complex algorithms to find subtle correlations that guide the development of customised yoga regimens. Real-time tracking during yoga sessions is made possible by the integration of wearable sensors and AI-powered gadgets. Health care providers and users can receive real-time feedback from these devices, which monitor physiological data. This calls for an elevated degree of safety and strict attention to recommended exercises for people with neurological conditions. In order to ensure that people with diseases like Parkinson's disease retain good form and reduce their risk of damage during yoga sessions, AI algorithms also analyse movement patterns. Artificial intelligence (AI) is influencing virtual reality (VR) applications in addition to the physical world. AI improves the therapeutic benefits of yoga for neurological patients by building dynamic and immersive virtual environments. These VR experiences, which are driven by AI algorithms and change according to the patient's progress, offer a dynamic and captivating platform for

therapeutic activities. In summary, the combination of AI and yoga goes beyond conventional methods for treating neurological disorders. The therapeutic advantages of yoga practices are increased by AI's capacity to analyse, personalise, and adapt dynamically. This capability provides customised solutions that have the potential to improve neurological wellness.

VISION AND FUTURE PROSPECTS OF AI IN YOGA RESEARCH AND NEUROLOGY

The concept of "general AI," initially introduced by AI pioneers in the 1950s, is likely best relegated to the realm of science fiction in the foreseeable future. General Artificial Intelligence (AI) denotes machines possessing the ability to perceive, reason, and exhibit cognitive functions akin to humans. While AI applications introduce innovative tools to augment traditional clinical practices in triage, diagnosis, treatment decisions, and prognosis, clinicians and clinical methodologies are expected to remain central in the future. New algorithms have the potential to quickly and meaningfully assess whole genome or exome sequencing results, as well as identify early illness indicators in big population-based datasets. Artificial Intelligence (AI) algorithms are expected to be used in neurocutaneous syndromic diagnosis, syndromic diagnosis of uncommon genetic illnesses, and pathological diagnosis from biopsy specimens. Future AI methods might potentially help with therapeutic response prediction. Through the integration of patient-driven data from diverse sources such as research articles, patents, clinical trials, and patient records, rather than relying solely on the conventional trial-and-error approach, Artificial Intelligence (AI) has the capability to revolutionize the paradigm of drug discovery. The potential of artificial intelligence (AI) is being used to try and treat amyotrophic lateral sclerosis, a deadly and incurable disease.

Artificial Intelligence's limitations in yoga research and practice for neurological disorders

- ❖ Inadequate comprehension of the complex interplay between brain functions and the effects of yoga.
- ❖ Data standardisation is difficult because of the variety of yoga practices and unique neurological profiles.
- ❖ Insufficient multidisciplinary collaboration and expertise among researchers studying artificial intelligence, neurology, and yoga.
- ❖ Ethical issues with appropriate AI use, informed consent, and data privacy in yoga treatments for neurological illnesses.
- ❖ AI models are hard to generalise to different populations with different neurological disorders and different reactions to yoga practices.

CONCLUSION

Enhancing healthcare is one area where the application of AI provides a particularly difficult task to all countries. The combination of Yoga and Artificial Intelligence provides a compelling approach to address neurological disorders and advance our understanding of the mind-body connection. This synthesis of ancient wisdom and technological innovation could revolutionize therapeutic interventions. Navigating this uncharted territory calls for mindful steps, upholding ethical standards to ensure that AI enhances rather than detracts from the profound practices of Yoga. This journey explores the frontiers of neuroscience while preserving the essence of ancient contemplative traditions for the well-being of humanity.

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