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Exploring the Foundations of Yoga Philosophy and Its Relevance in Contemporary Society: A Deep Learning-Based Analysis

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ABSTRACT

The confluence of traditional Indian knowledge systems with modern practices, especially in the field of yoga, is an intriguing conversation that has an international appeal. This study explores the many facets of Indian knowledge bases and their ongoing development, concentrating on the continued applicability and modernization of yoga. This study aims to shed light on the complex web that unites tradition and innovation through a thorough investigation of historical foundations, philosophical foundations, scientific discoveries, sociocultural ramifications, and commercialization dynamics. We suggest a method for the effective identification and recognition of different yoga poses using deep learning technologies. The Media Pipe library is used to extract the essential points of users from the selected dataset, which consists of 85 films with 15 individuals performing 6 yoga poses. Using real-time observed movies, a deep learning model that combines Convolutional Neural Network (CNN) and Long Short-Term Memory (LSTM) has been used to recognize yoga poses. In particular, the CNN layer extracts features from the important places, and the LSTM layer that follows recognizes the presence of a frame sequence so that predictions can be made. The stances are categorized as either right or wrong in the following; if a correct pose is found, the system will give the user the appropriate response via speech or text.

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1. INTRODUCTION

One of the most important and intricate ideas in yogic philosophy is the idea of dharma, which functions as a framework for understanding cosmic order and societal responsibility as well as a personal ethical guide [1]. Dharma, which comes from the Sanskrit root "dhr," which means "to maintain" or "to preserve," includes obligation, morality, natural law, and the values that uphold equilibrium in both personal and universe existance. In the context of yoga, dharma establishes the moral framework required for genuine transformation and serves as the ethical basis for all religious practices. Dharmic ethics in yoga offers an integrative approach that acknowledges the connection between human virtue and cosmic harmony, in contrast to Western ethical frameworks that frequently concentrate largely on individual moral thinking or social norms [2]. This viewpoint recognizes that moral decisions made by individuals have effects that go well beyond their own lives and have an impact on reality as a whole. Thus, the yogic interpretation of dharma offers a distinctive perspective for analyzing current ethical, social justice, and sustainable development issues.

In yoga, dharma has practical applications in everyday life in addition to intellectual speculation. The traditional writings portray dharma as a living manual for negotiating the intricacies of human life while upholding both individual integrity and universal principles, rather than as an abstract concept [3]. Because of its practical focus, dharmic ethics are especially pertinent to current conversations about ethical behavior, healthy living, and personal growth.

This paper explores the many facets of dharma in yogic philosophy, looking at its function as a social reform principle as well as a personal moral framework [4]. The study shows how dharmic principles provide useful tools for tackling current ethical issues while preserving ties to the wisdom of old spiritual practices through an examination of classical works and modern uses.

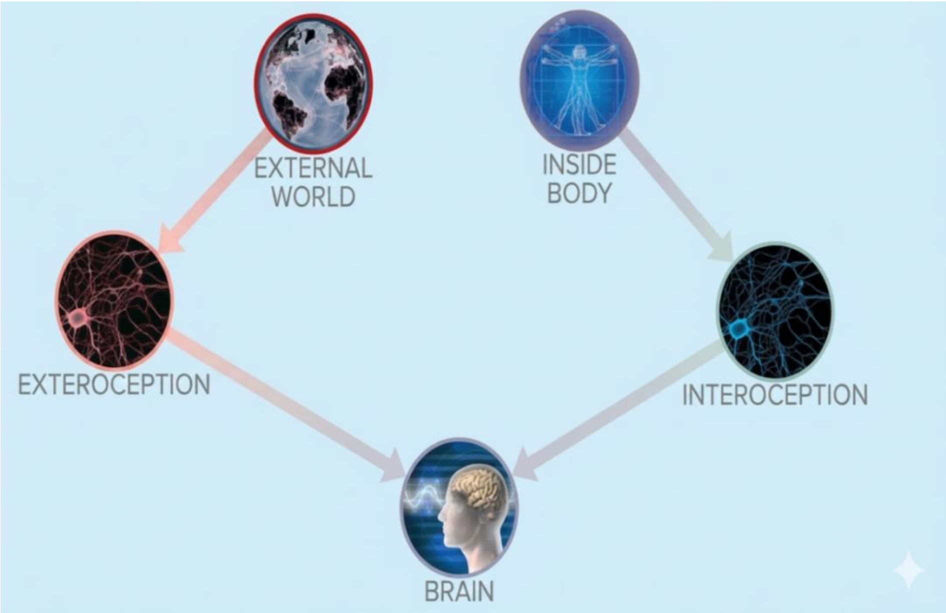

Figure 1. Exteroceptive and interoceptive senses

The fundamental roles of both interoception and exteroception are shown in Figure 1 [5]. Yoga's application in pain management is related to its interaction with sensory perception. The brain receives data from surroundings through the sense organs, which are perceptual pathways. Sensory nerve fibers in the human body transmit data for the central nervous system. This information is typically separated into two categories: internal senses (interoception) such as the need for food, sleep, and bladder and bowel evacuations, and external perceptions ("exteroception"), such as the detection of pressure, pain, and temperature changes. The two senses of expulsion and tactile perception are not mutually incompatible in traditional yoga systems.

2. LITERATURE REVIEW

This study examines the impact of strolling and office yoga on the frequency and severity of musculoskeletal complaints (MSC) among employees as well as normal activation, which includes vigor and alertness [6]. 459 office workers from five firms were randomly allocated to either the office-yoga treatment group, the pedometer intervention group, or a waiting control group using a three-month longitudinal randomized controlled study design. Individuals in the intervention categories were directed to perform the recommended activity at work in short daily sessions. The office-yoga club members were given video instructions on how to do the poses. Every week, self-reported MSC and engagement were evaluated. Small impacts of office-yoga ($d=-0.28$) and walking ($d=-0.34$) in lowering the incidence of MSC were found by Bayesian structural equation modeling, along with a program-based efficacy of walking over office-yoga in lowering the severity of MSC.

The Bhagavad Gita [7], Katha Upanishad, Charak Samhita, And Yoga Sutras serve as the foundation for this narrative review, which incorporates information from both contemporary neuroscience and traditional Indian mind-body wisdom systems, including Ayurveda, Yoga, and spiritual literature. Keywords like "social media dependency," "Neurobiological" mechanisms," Ayurveda, "Indian Knowledge Systems," and "Yoga and awareness" were used to search databases including PubMed, Google Scholar, Scopus, and JSTOR. PRISMA-based assessment of the research was carried out during the years 1994–2024. The included peer-reviewed studies were conceptually divided into three categories: Ayurvedic approaches, mind-body therapies (such as yoga and meditation), and scientifically supported processes of SMA.

The study explores the connection between individual responsibility (svadharma) and global dharma (standard dharma) [8], looking at how these ideas offer direction for moral judgment and social responsibility. In order to show how these teachings establish an extensive structure for ethical living, special attention is paid to the incorporation of dharmic concepts with the ethical constraints (yamas) and observances (niyamas) described in classical yoga. In order to address current ethical dilemmas, social justice concerns, and environmental problems, the article examines how dharmic principles are being applied. The study comes to the conclusion that dharma in yoga offers a complex ethical framework that goes beyond individual morality to include cosmic harmony and collective well-being, offering insightful information for modern methods of social change and personal growth.

This study aims to integrate the understanding of yoga with the ever-evolving power of deep learning. In this project [9], we use Mediapipe and deep learning to observe yoga pose estimation combined with breathing control and focus instruction for ten different postures. The suggested method uses model matching and landmark extraction to forecast pose and instructions. Keypoints on the pose are obtained by establishing the Mediapipe standard pose model. In order to accomplish the pose estimation, a hybrid model utilizing ANN and current state-of-the-art models is developed. During the model's execution, an optimal accuracy of approximately 93.43% was attained. The model's greatest accuracy was approximately 90.9% when it was later implemented on Raspberry Pi-4 equipment.

3. METHODOLOGY

This book examines the Vedantic underpinnings of yoga philosophy using a thorough philosophical technique that combines textual analysis [10], comparative philosophies, and theological interpretation.

3.1 Primary Source Analysis

To discover important ideas and their consequences for comprehending yoga practice, a systematic analysis of classical Vedantic texts was carried out [11]. Among the primary sources are:

- Upanishads: Key Upanishads were examined to determine fundamental ideas about reality, awareness, and spiritual awakening.
- Vedanta Sutras [12]: The philosophical foundation of Badarayana's methodical arrangement of Vedantic concepts was studied.
- Classical Commentaries: To comprehend various interpretations of Vedantic principles, major commentaries by Shankara, Ramanuja, and Madhva were examined.
- Yoga writings: The relationship between Vedantic philosophy and traditional yoga writings, such as the Yoga Sutras, Bhagavad Gita, and Hatha Yoga books, was investigated.

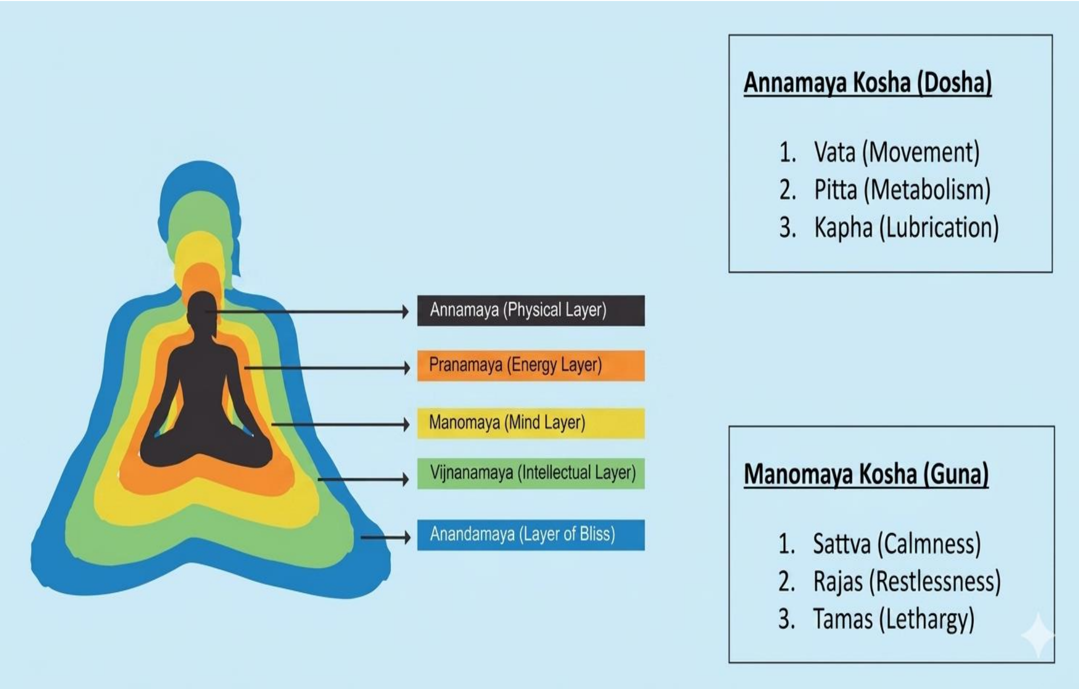

Figure 2. Proposed Panchakosha Model Illustrating the Correlation between Dosha and Guna

This conceptual analysis also emphasized the significance of relaxation and symptomatic relief as a necessary precondition for obtaining mental clarity to identify the Proposed Panchakosha Model Illustrating the Correlation between Dosha and Guna in Figure 2 [13]. A number of these studies provide light on the therapeutic alliance, the characteristics of a successful therapist, and the execution of a group yoga teaching program. Notably, a double-blinded RCT, an instance series, and a case-control study of patients with depressive and anxiety condition, and mental health and psychoneurotic conditions, correspondingly, show that yogic counseling may be helpful in lowering CMD manifestations [14].

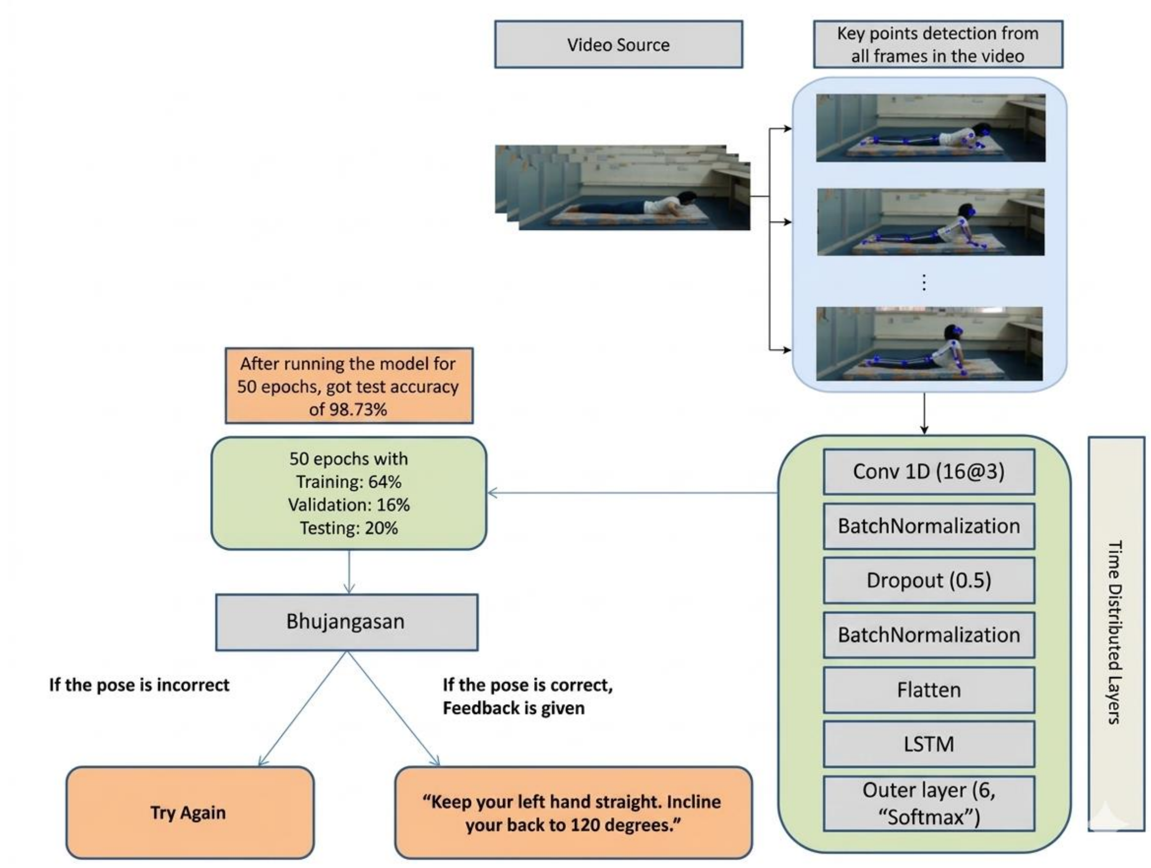

Figure 3. Proposed System Architecture for Deep Learning-Based Yoga Pose Recognition

The suggested system design and the Architecture for Deep Learning-Based Yoga Pose Recognition are shown in Figure 3. Real-time video series frames are entered into the suggested system. The expected yoga pose and the associated input regarding angle and pose modification would be the output. Point extraction, posture prediction, and pose correction are the three primary stages of the system. The goal of the parameter extraction phase is to use the user's position to identify and extract the position of significant keypoints [15]. The model architecture is defined during the posture prediction step, which also determines whether or not the pose is right. The last stage is pose correction, in which the user receives further input for adjusting the pose and is shown the percentage of similarity with the actual pose.

4. IMPLEMENTATION AND EXPERIMENTAL RESULTS

Polling is used to predict a yoga stance for a series of 45 frames, with the final prediction being the mode of all the forecasts.

4.1. Model Accuracy and Model Loss

The model achieved 92.49% training accuracy and 95.70% validation accuracy after 50 epochs of operation. The model quality and modeling loss are represented graphically in Figure 4 (a) (b) [16].

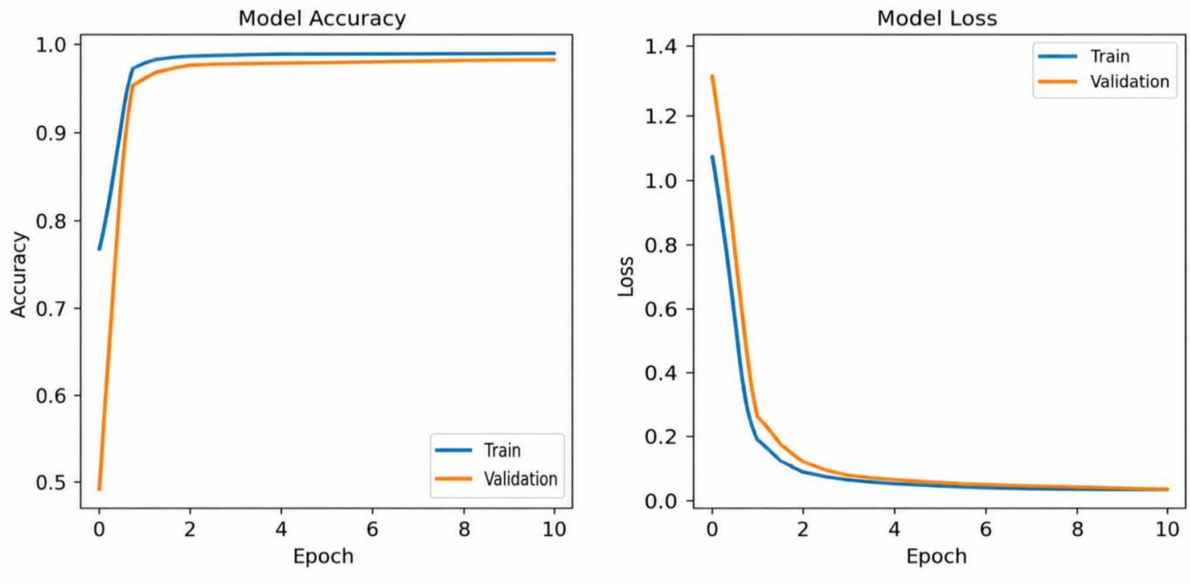

Figure 4. (a) Model Exactness (b) Model Injury

4.2. Confusion Matrix

Recall, precision, particularity, sensitiveness, and other analytics are calculated using a confusion matrix, which is regarded as a crucial performance metric. In order to recap prediction outcomes, it is also applied to classification issues. Additionally, it has four primary values: false positive, false adverse, true favourable and true minus.

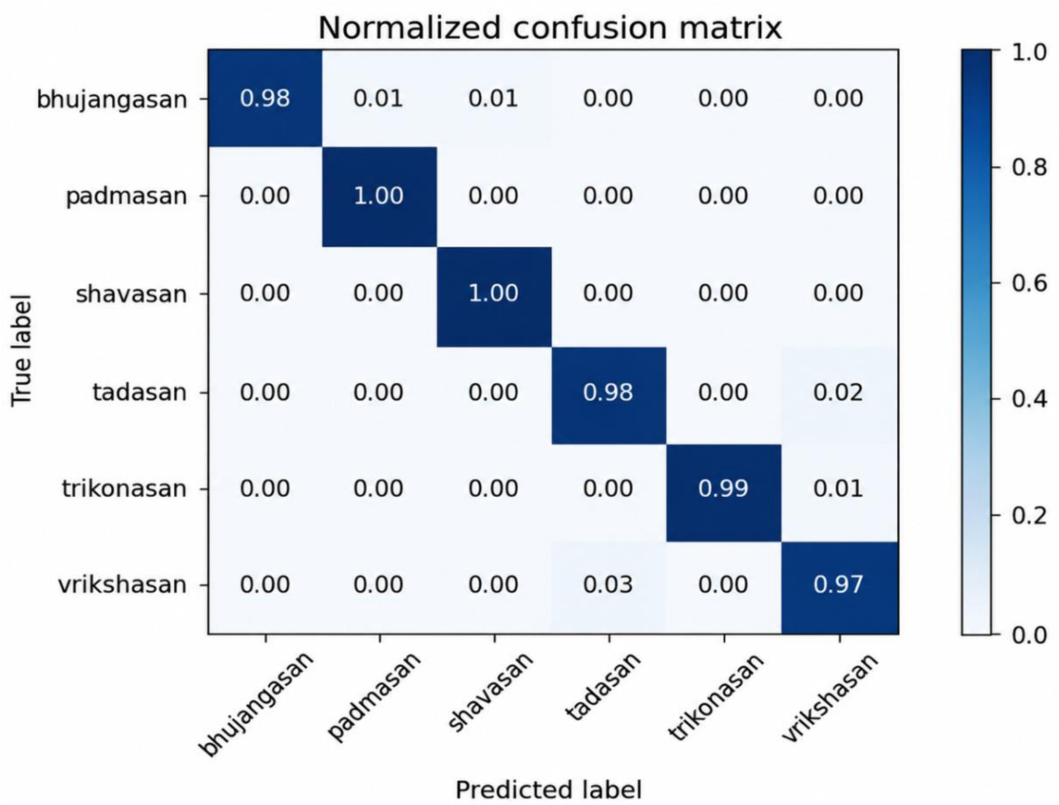

Figure 5. Confusion Matrix

The confusion matrix between the anticipated and actual yoga poses is shown in Figure 5, and the test accuracy was 99.53%. The relationship between the actual and anticipated values is stronger when the blue color on the diagonal is darker. The matrix shows a strong correlation, which correlates to a reasonably accurate model because the majority of the diagonals are near 1.

4.3. Precision

One criterion used to assess a model's performance is precision. In practical terms, it is described as the percentage of samples that are accurately identified as positive in relation to all samples that are positive [17]. The model yielded a precision of 0.9866. Equation (1) provides its algebraic formula:

$$Precision = TP * TP + FP \tag{1}$$

where TP are the true positives and FP the false positives.

4.4. Recall

Another parameter used to assess a model's effectiveness is recall. Given every specimen that is anticipated to be positive, it is defined as the percentage of samples that are accurately identified as positive. The model yields a recall of 0.9769. Equation (2) provides its scientific formula:

$$Recall = TP * TP + FN \tag{2}$$

where FN represents false negatives and TP represents true positives.

4.5. Receiver Operating Characteristic (ROC) Curve

Additionally, we use the ROC curve, a graphic representation that plots the false positive rate against the true positive rate to show a model's effectiveness. When the area under the ROC curve goes to 1, a model is considered optimal.

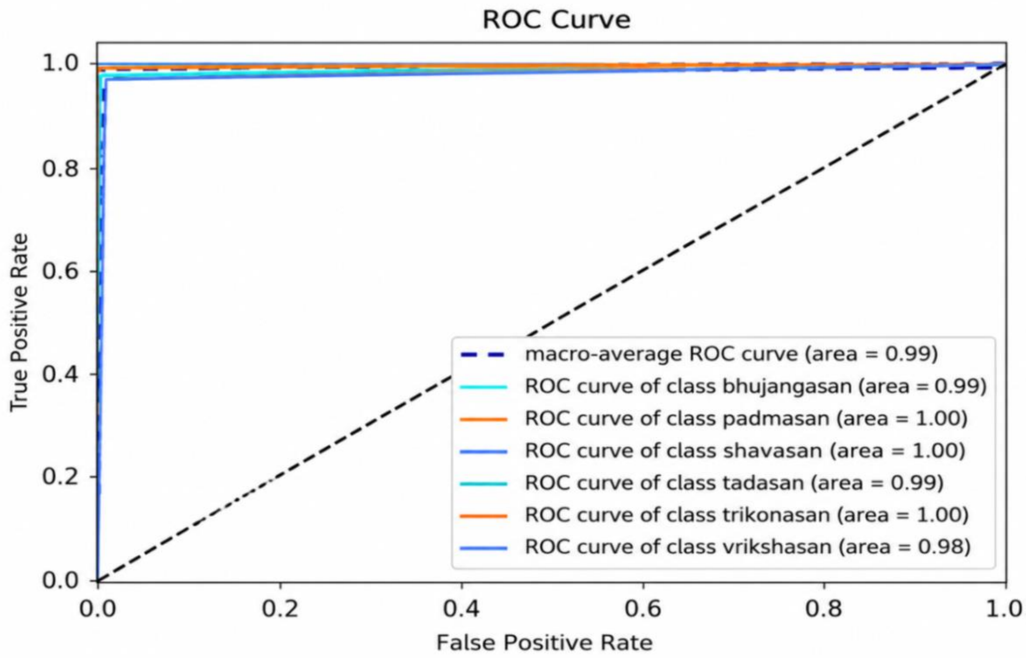

Figure 6. ROC Curve

The ROC curve for each of the asanas we employed in our tests is shown in Figure 6. The area under the curve that was produced is 0.96, which is a very high value.

4.6 CNN Layer Count's Effect on Model Performance

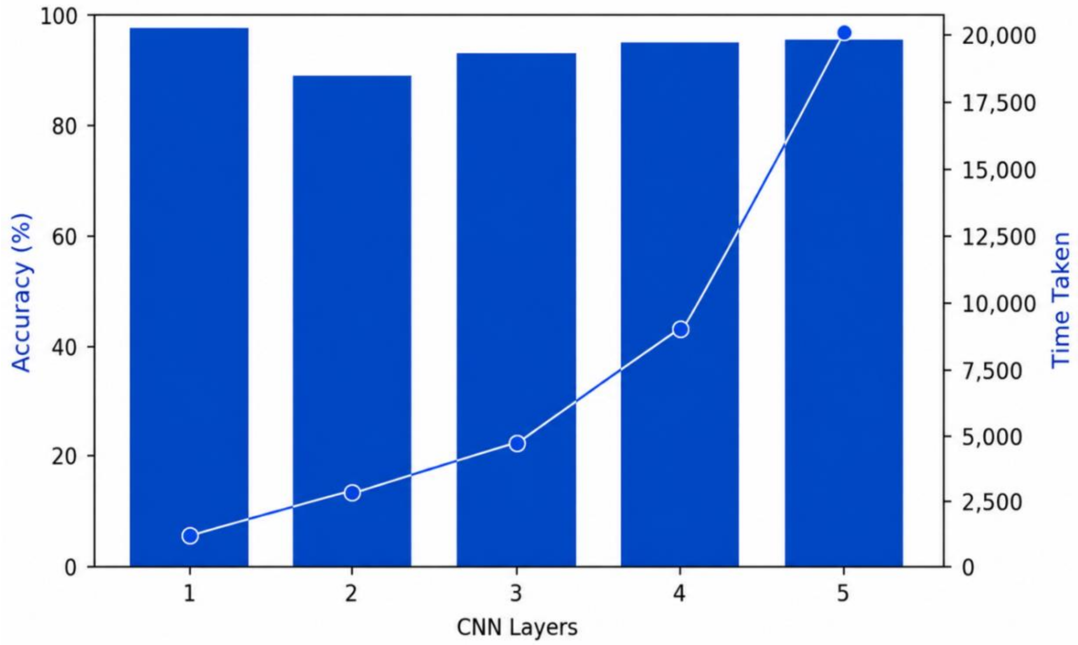

Figure 7. Accuracy in Relation to Different CNN Layer Counts

A CNN model's classification accuracy can be greatly impacted by how many hidden layers it has. Although more layers are typically associated with higher overall precision, this is not always the case and frequently depends on the task's intricacy. Adding more layers can significantly improve a very large and complex network that is subject to overfitting and, consequently, lower precision obtained on the test data in the absence of a sufficiently big training set. However, as the line graphs in Figure 7 shows, adding more layers might also result in a longer execution period. Using just one convolutional layer produced the greatest results for this specific model.

4.7 Effect of CNN Filter Count on Model Efficiency

Figure 8 illustrates a high association between the number of CNN filters utilized and the corresponding accuracy. A certain collection of features must be extracted from the input data by each filter layer. An increasing number of filters are needed to accurately extract different combinations of key characteristics from the received data as trends get more complex. In particular, the accuracy has a value of 100% for at least 8 CNN filters.

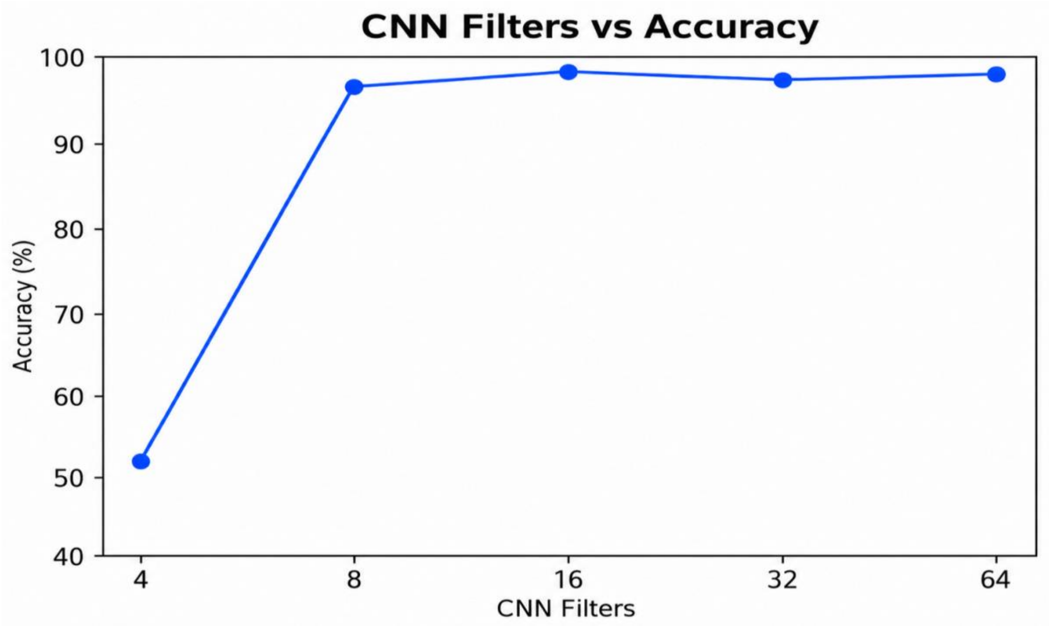

Figure 8. Accuracy in Relation to Different CNN Filter Counts

4.8 Learning Rate's Effect on Model Quality

The learning rate refers to the extent of adjustment allowed in the model in response to the error observed every time the model weights are altered. Since none of the extremes is ideal, choosing the ideal learning speed can be challenging. A slower learning rate can lead to a very slow training process; even though it might assist create an accurate model. In a similar vein, a very high value can save learning time considerably, but precision may come at an even higher cost.

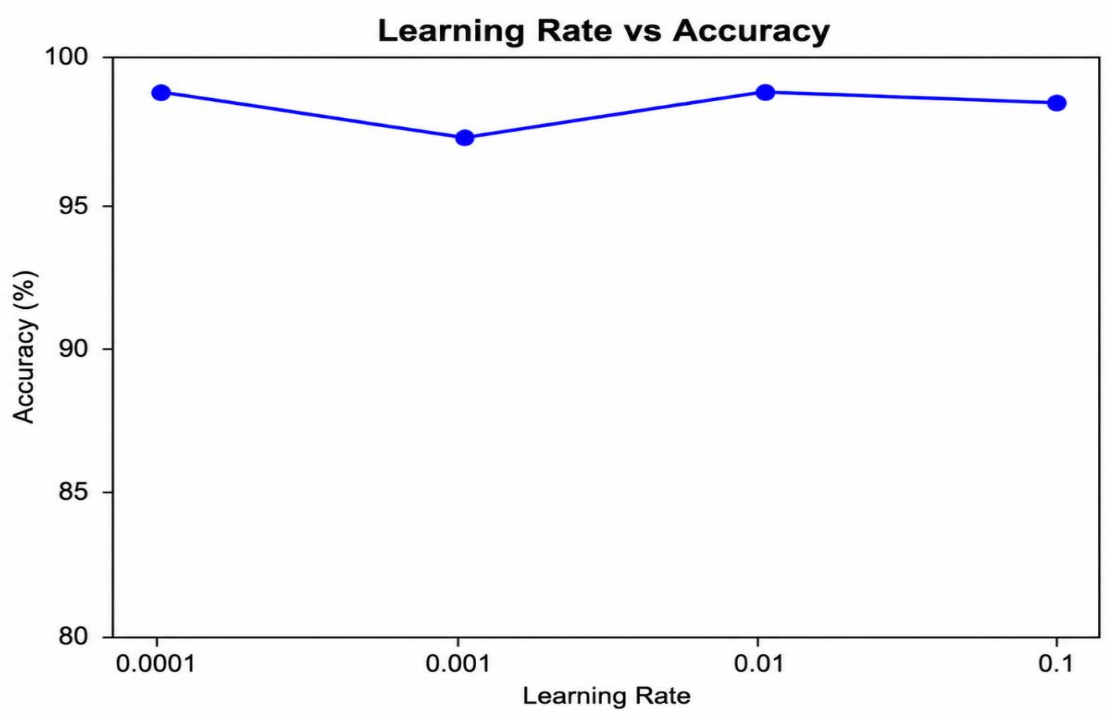

Figure 9. Learning Rate's Effect on Accuracy

The accuracy dependence on learning rate is seen in Figure 9. In particular, the precision is at least 97%, while the learning rate ranges from 0.0010 to 0.1.

5. CONCLUSIONS AND FUTURE WORK

Yoga's many elements—postures (asanas), breathing exercises (pranayama), meditation, and moral precepts (yamas and niyamas)—all contribute to overall wellness. Together, these aspects improve mental clarity, mental equilibrium, and physical health. Regular yoga practice has been shown to increase emotional regulation, decrease stress and anxiety levels, and enhance cognitive abilities.

On the test dataset, the method achieves an outstanding accuracy of 99.53%. The user receives additional feedback based on a predetermined threshold if the stance is deemed correct. In particular, the threshold is chosen to guarantee that the user's position and angles are precise while also preventing the system from being overly rigorous. Lastly, the user sees the similarity percentage in relation to the standard posture.

In order to determine whether it is feasible to further increase the accuracy, it would be worthwhile to attempt variations and combinations of the suggested set of models described in this work. Additionally, the high degree of accuracy attained in sentiment recognition might be confirmed by testing the current classifiers on larger data sets. It is crucial to include more numerical characteristics than those found in the set utilized for this work, additionally to increasing the dataset's volume. Furthermore, a number of combination strategies can be used to address the shortcomings of individual models, resulting in more accurate outcomes.

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