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# **Yoga Pose Detection Using Machine Learning**

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#### ABSTRACT-

Yoga is an ancient Indian practice that nurtures and enhances both physical and mental well-being. Practicing yoga without adequate guidance can result in subpar outcomes and even injuries, especially for those just starting out. While traditional in-person instruction provides immediate feedback, many individuals now turn to online platforms that lack this personalized support. Current solutions, such as fitness apps and wearable technology, often fall short, being either overly simplistic or dependent on costly hardware. The aim of this research is to utilize advancements in machine learning and computer vision to create a system that offers real-time feedback on yoga poses using common devices like smartphones or laptops. This system will help bridge the divide between professional instruction and virtual practice, allowing users to enhance their technique in a safe, effective, and convenient manner. However, challenges persist, such as accurately identifying complex and dynamic poses, dealing with variations in body shapes and postures, and ensuring real-time feedback. The proposed system seeks to overcome these challenges by leveraging robust pose detection methods and providing corrective suggestions to improve performance. This research marks a significant advancement in the fusion of technology with wellness, offering innovative solutions in the evolving field of mind-body fitness.

Keywords: Machine Learning, Yoga Pose Detection, Deep Learning, Computer Vision, Pose Estimation, CNN, Real-time Feedback, OpenPose, Media Pipe.

### **I.INTRODUCTION**

Yoga is a holistic discipline that promotes bodily, mental, and non secular nicely-being through practices like asanas (postures), pranayama (respiration sporting events), meditation, and ethical standards. The blessings of yoga span numerous fitness aspects, but precise execution of poses is important to fully free up these benefits.

When they are paired with models like CNNs, these technologies provide precise pose detection and immediate feedback and being taken into consideration for each. Our research on this project also seeks to connect traditional pose detection methods with contemporary yoga practices, streamlining the process to make it quicker and more efficient in real time uses. This look at aims to combine modern era with conventional yoga practices to beautify the general nicely-being of practitioners.

#### II. BACKGROUND

In this paper, a novel system is proposed which aim to assist yoga enthusiast for different yoga poses and validate it for correctness. Integrating computer vision techniques, the proposed system analyses the user's human pose then based on the domain knowledge of yoga, the user is guided to correct the pose. Precise recognition of yoga pose is a difficult task because of high computation and lack of availability of dataset. For the accurate detection of the yoga pose, different feature extraction and preprocessing methods are applied to the dataset which results in 97.4% accuracy just by using machine learning algorithms. To make the system efficient and low-cost, Human Pose Estimation technique based on computer vision is used.

#### **III. MOTIVATION**

The growing trend of home-based and virtual yoga classes has underscored the necessity for an accessible and dependable solution to ensure proper posture and alignment. Practicing yoga without adequate guidance can result in subpar outcomes and even injuries, especially for those just starting out. While traditional in-person instruction provides immediate feedback, many individuals now turn to online platforms that lack this personalized support. Current solutions, such as fitness apps and wearable technology, often fall short, being either overly simplistic or dependent on costly hardware. The aim of this research is to utilize advancements in machine learning and computer vision to create a system that offers real-time feedback on yoga poses using common devices like smartphones or laptops. To make the system efficient and low-cost, Human Pose Estimation technique based on computer vision is used.

The proposed system seeks to overcome these challenges by leveraging robust pose detection methods and providing corrective suggestions to improve performance. This research marks a significant advancement in the fusion of technology with wellness, offering innovative solutions in the evolving field of mind-body fitness.

#### **IV. FUNDAMENTAL CONCEPTS**

This research utilized pose estimation algorithms such as OpenPose to extract skeletal features from images and classify yoga poses using Support Vector Machines (SVMs). The study emphasized the need for accurate pose detection and real-time feedback in virtual yoga practice to reduce injuries and improve alignment. This paper focused on the use of deep learning algorithms for recognizing yoga poses in diverse environments. This extended pose estimation techniques to handle real-world scenarios, focusing on multi-person pose estimation. While not specific to yoga, their research introduced methods for accurate detection in complex environments, such as crowded settings or varying backgrounds. This work underscores the adaptability of pose estimation algorithms like MediaPipe for detecting poses in diverse conditions, which is relevant for robust yoga pose detection systems.

This system will help bridge the divide between professional instruction and virtual practice, allowing users to enhance their technique in a safe, effective, and convenient manner. However, challenges persist, such as accurately identifying complex and dynamic poses, dealing with variations in body shapes and postures, and ensuring real-time feedback.

Literature review of the research papers

1) Yoga Pose Detection Using Artificial Intelligence and Machine Learning (A.H. Nandhu Kishore, A. Sasireka, K. Vijay, 2024)

This research utilized pose estimation algorithms such as OpenPose to extract skeletal features from images and classify yoga poses using Support Vector Machines (SVMs). The study emphasized the need for accurate pose detection and real-time feedback in virtual yoga practice to reduce injuries and improve alignment Advantages: High accuracy in detecting common yoga poses. Limitations: Real-time feedback capabilities were not explored.

2) Yoga Pose Recognition Using Deep Learning" by Prosanta Kumar Chaka & Shikha Anirban (2024)

. This paper focused on the use of deep learning algorithms for recognizing yoga poses in diverse environments. The study implemented CNNs and leveraged datasets containing various yoga poses, ensuring model robustness across different angles, lighting, and backgrounds. Their findings emphasized the role of data augmentation in improving model generalization, a key factor for real-world applications of yoga pose detection Advantages: Demonstrated high robustness to varying lighting conditions and backgrounds.

Limitations: Did not address real-time feedback for corrective guidance.

Pose Estimation of Yoga Poses Using ML Techniques" by

3) Dayanand G. Savakar et al. (2022)

As investigated the use of pose estimation algorithms for detecting yoga poses. By extracting key body landmarks, their system analyzed skeletal data to identify poses with high accuracy. Their study compared the performance of various machine learning models, such as Support Vector Machines (SVMs) and CNNs, concluding that CNNs offered superior performance in terms of accuracy and scalability. Advantages:Used OpenPose for precise skeletal feature extraction.

Limitations: Limited to detecting a small set of yoga

4)Multi-View Yoga Asana Recognition Using Body Joints Information" by J. Seidenari et al. (2017)

1) Yoga Pose Detection Using Artificial Intelligence and Machine Learning (A.H. Nandhu Kishore, A. Sasireka, K. Vijay, 2024)

This research utilized pose estimation algorithms such as OpenPose to extract skeletal features from images and classify yoga poses using Support Vector Machines (SVMs). The study emphasized the need for accurate pose detection and real-time feedback in virtual yoga practice to reduce injuries and improve alignment

Advantages: High accuracy in detecting common yoga poses

Limitations: Real-time feedback capabilities were not explored.

It introduced a multi-view approach to yoga pose recognition using information from body joints. The study employed pose estimation to detect key landmarks and used their spatial relationships for pose classification. Their findings demonstrated the potential of multi-view systems in addressing challenges orientations, such as occlusion and varying improving offering insights for accuracy in real- time systems Advantages: Multi-view approach improved classification accuracy across complex poses. Limitations: Computationally multi-view processing expensive due to view processing.

5) Towards Accurate Multi-Person Pose Estimation in the Wild Papandreou et al. (2017)

This extended pose estimation techniques to handle real- world scenarios, focusing on multi-person pose estimation. While not specific to yoga, their research introduced methods for accurate detection in complex environments, such as crowded settings or varying backgrounds. This work underscores the adaptability of pose estimation algorithms like MediaPipe for detecting poses in diverse conditions, which is relevant for robust yoga pose detection systems.

Advantages: Multi-Person Pose Estimation

Limitations: Performance Degradation in Low-Quality Inputs

6) Yoga: Intuition, Preventive Medicine, and Treatment Collins (2024)

The discussed the broader applications of yoga in preventive medicine and well-being. Their study explored how machine learning and AI could play a role in enhancing the practice of yoga, particularly through automated systems for yoga pose detection. This work enhances the healthy benefits of correct posture and alignment, further motivating the need for real-time pose detection solutions

Advantages: Real-time feedback

Limitations: Lack of human touch

### V. EXISTING SYSTEMS

This research utilized pose estimation algorithms such as OpenPose to extract skeletal features from images and classify yoga poses using Support Vector Machines (SVMs). The study emphasized the need for accurate pose detection and real-time feedback in virtual yoga practice to reduce injuries and improve alignment. But, it had advantage that it had high accuracy in detecting common yoga poses. A major drawback was the real-time feedback capabilities were not explored.

The blessings of yoga span numerous fitness aspects, but precise execution of poses is important to fully free up these benefits. It introduced a multi-view approach to yoga pose recognition using information from body joints. The study employed pose estimation to detect key landmarks and used their spatial relationships for pose classification. Their findings demonstrated the potential of multi-view systems in addressing challenges orientations, such as occlusion and varying improving offering insights for accuracy in real-time systems. Multi- view approach improved classification accuracy across complex poses. Computationally multi-view processing expensive due to view processing.

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High accuracy in detecting common yoga poses. Real-time feedback capabilities were not explored.

## VI. PROBLEM STATEMENT

Designed for accessibility, it works with standard cameras on smartphones or laptops, which helps in eliminating the need for expensive sensors or smart mats. This paper introduces a novel system for real-time yoga posture detection and correction leveraging MediaPipe for computer vision. Utilizing a fusion of Convolutional Neural Network (CNN) and Long Short-Term Memory (LSTM), our deep learning architecture facilitates the recognition of yoga poses in live video streams. The CNN component is tasked with feature extraction from key body points, while the subsequent LSTM layer deciphers temporal dependencies within the sequence of frames for accurate pose predictions. Poses are classified as either correct or incorrect, and in the event of a correct pose, the system delivers pertinent feedback through text or speech modalities. Yoga Pose Detection using Machine Learning system is user-friendly, scalable, and aims to replicate the experience of a live instructor, enhancing the effectiveness, safety, and convenience of practicing yoga at home.



Fig 1: Integrated Representation of Existing Systems

## VII. PROPOSED SYSTEM

This proposed system is a more intelligent, automated platform for yoga pose detection, e-learning, and pose feedback using machine estimation techniques. Yoga Pose Detection using Machine Learning system can extract skeletal features from video streams or images, enabling most accurate classification and recognition of yoga poses like Tree Pose, Warrior Pose, and Downward Dog and many more poses. It provides real-time corrective feedback by comparing the detected poses to ideal templates, helping individuals to improve their posture and alignment while reducing the risk of injury and painful moments while performing yoga. Designed for accessibility, it works with standard cameras on smartphones or laptops, which helps in eliminating the need for expensive sensors or smart mats.



A diverse dataset of labeled yoga poses, which are enhanced through data augmentation techniques, ensures the model's effectiveness across various body types, angles, lighting conditions, and environments. Machine learning models such as Convolutional Neural Networks (CNNs) or Support Vector

Machines (SVMs) are trained to deliver high accuracy and low latency, ensuring real-time feedback and detection. Yoga Pose Detection using Machine Learning system is user-friendly, scalable, and aims to replicate the experience of a live instructor, enhancing the effectiveness, safety, and convenience of practicing yoga at home.

## VIII. METHODOLOGY

Data Collection and Dataset Preparation Yoga Pose Dataset Creation: Gather a collection of images and videos showcasing various yoga poses (like Tree Pose, Downward Dog, etc.). You can source these from publicly available yoga datasets or record them manually with the help of volunteers. It's important to ensure a variety of body types, angles, lighting conditions, and backgrounds to make the model adaptable to different environments and accurately detect poses. Each image or frame should be labeled with the corresponding yoga pose . e.g., "Tree Pose," "Warrior II," "Mountain Pose") to create a supervised learning dataset. Each image or video frame is converted into a set of coordinates that indicate the precise locations of these keypoints and landmarks. The identified keypoints create the feature set essential for pose detection. The relationships between these keypoints—such as the angles formed by joints and the distances between limbs—are vital for recognizing different yoga poses. Construct feature vectors from these keypoints to numerically represent the human body's posture in an organized format.

#### CONCLUSION

The development of a Yoga Pose Detection System using machine learning offers a practical solution for those who want to practice yoga safely and accurately without needing a live instructor. By utilizing advanced pose estimation algorithms and machine learning models, the system can identify key yoga poses in real time and provide personalized feedback to users. This helps improve posture and reduce the risk of injury. The Yoga Pose Detection System enables users to practice yoga more effectively and safely at home, potentially changing how people approach yoga and fitness routines in the digital age. Successfully implementing such a system can greatly enhance the experience of virtual fitness and wellness applications for users in real time.

## IX. RESULT DISCUSSION



Fig 3: Home Screen



Fig 4: Pose selection Interface



Fig 5: Augmented Dataset



Fig 6 : Illustrative Data Snippet





Fig 9: Final Detected Pose

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