

# PosePerfect - Yoga Pose Detection using Machine Learning

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**Abstract:** The global popularity of yoga has witnessed significant growth in recent years, primarily due to its well-documented benefits for physical health, mental well-being, and spiritual development. As a result, an increasing number of individuals are adopting yoga as part of their daily routine. However, a considerable portion of these practitioners engage in yoga without the supervision or guidance of a qualified instructor. While yoga offers numerous advantages when practiced correctly, incorrect execution of poses (asanas) can lead to serious health complications, including muscular injuries, nerve damage, and, in extreme cases, conditions such as strokes. To mitigate such risks and promote safe yoga practice, this research explores an intelligent system capable of detecting and evaluating yoga poses using machine learning techniques. The proposed system leverages computer vision and pose estimation algorithms to analyze the practitioner's body posture and determine whether it conforms to standard, expert-defined yoga poses. By providing real-time feedback and corrections, the system serves as a virtual instructor, helping users to align their poses accurately and avoid potentially harmful deviations. This paper presents the architecture and implementation of the yoga pose detection model, including data collection, preprocessing, model training, and evaluation metrics. The model utilizes keypoint detection frameworks such as MediaPipe and OpenPose, integrated with classification algorithms to identify and assess various yoga postures. Experimental results demonstrate the model's effectiveness in recognizing poses with high accuracy, establishing its potential for real-world application in yoga training apps and wellness platforms. Ultimately, this study aims to bridge the gap between the widespread practice of yoga and the accessibility of expert supervision by introducing a scalable, AI-driven solution that promotes safe and effective yoga practice.

**Keywords:** Yoga Pose Detection, Machine Learning, Pose Estimation, Real-Time Feedback

## I. INTRODUCTION

Human pose estimation is a challenging problem in the discipline of computer vision. It deals with localization of human joints in an image or video to form a skeletal representation. To automatically detect a person's pose in an image is a difficult task as it depends on a number of aspects such as scale and resolution of the image, illumination variation, background clutter, clothing variations, surroundings, and interaction of humans with the surroundings. An application of pose estimation which has attracted many researchers in this field is exercise and fitness. One form of exercise with intricate postures is yoga which is an age-old exercise that started in India but is now famous worldwide because of its many spiritual, physical and mental benefits. The problem with yoga however is that, just like any other exercise, it is of utmost importance to practice it correctly as any incorrect posture during a yoga session can be unproductive and possibly detrimental.

This leads to the necessity of having an instructor to supervise the session and correct the individual's posture. Since not all users have access or resources to an instructor, an artificial intelligence based application might be used to identify yoga poses and provide personalized feedback to help individuals improve their form.

In recent years, human pose estimation has benefited greatly from deep learning and huge gains in performance have been achieved. Deep learning approaches provide a more straightforward way of mapping the structure instead of

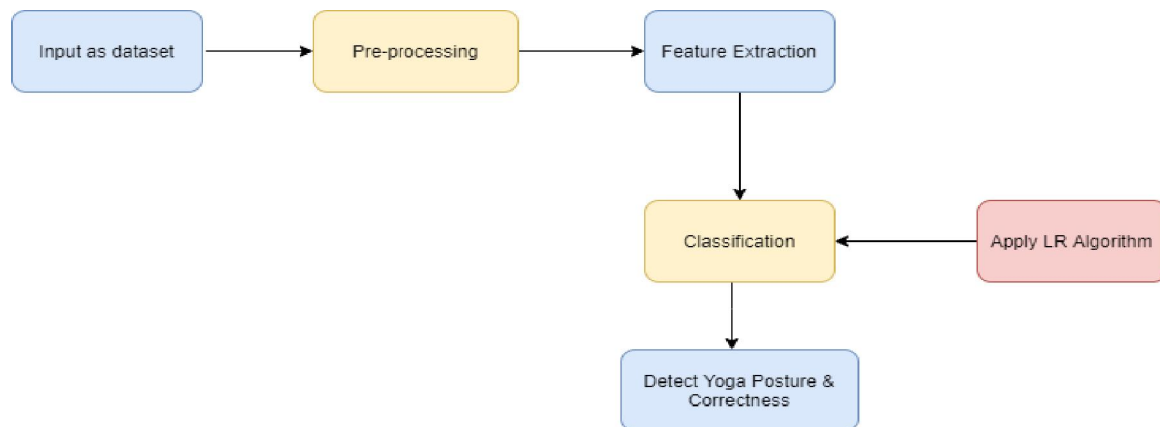


having to deal with the dependencies between structures manually. used deep learning to identify 5 exercise poses: pull up, Swiss ball hamstring curl, push up, cycling and walking. However, using this method for yoga poses is a relatively newer application. This project focuses on exploring the different approaches for yoga pose classification and seeks to attain insight into the following: What is pose estimation? What is deep learning? How can deep learning be applied to yoga pose classification in real-time? This project uses references from conference proceedings, published papers, technical reports and journals.

## II. LITERATURE SURVEY

The importance of core strength in yoga is well emphasized by V. Akuhota and S. F. Nedler (2004), highlighting its role in achieving stability and accuracy in yoga postures. In the domain of technology, R. Szeliski's Computer Vision: Algorithms and Applications (2010) serves as a foundational reference, offering insights into computer vision techniques relevant to pose estimation. The work presented by INCET (2023) demonstrates the practical implementation of real-time yoga pose detection using OpenCV and MediaPipe, showcasing the integration of modern tools in yoga applications. P. Ganesh (2019) simplifies human pose estimation techniques, making them accessible for fitness and yoga use cases. Similarly, the study titled Yoga Trainer for Beginners via Machine Learning (JAC-ECC, 2021) introduces a machine learning-based assistant designed to help beginners maintain correct yoga postures. Advancing this concept, the iYogacare project (2023) presents a smart healthcare application that provides real-time pose recognition and correction feedback during yoga practice. Supporting these implementations, Learning OpenCV by G. Bradski and A. Kaehler (2008) offers practical knowledge about the OpenCV library, which is essential in vision-based yoga systems. Lastly, the research by Z. Cao, T. Simon, S.-E. Wei, and Y. Sheikh (2017) introduces Part Affinity Fields, forming the core of OpenPose—an effective technique for detecting and analyzing multiple yoga poses in real-time environments.

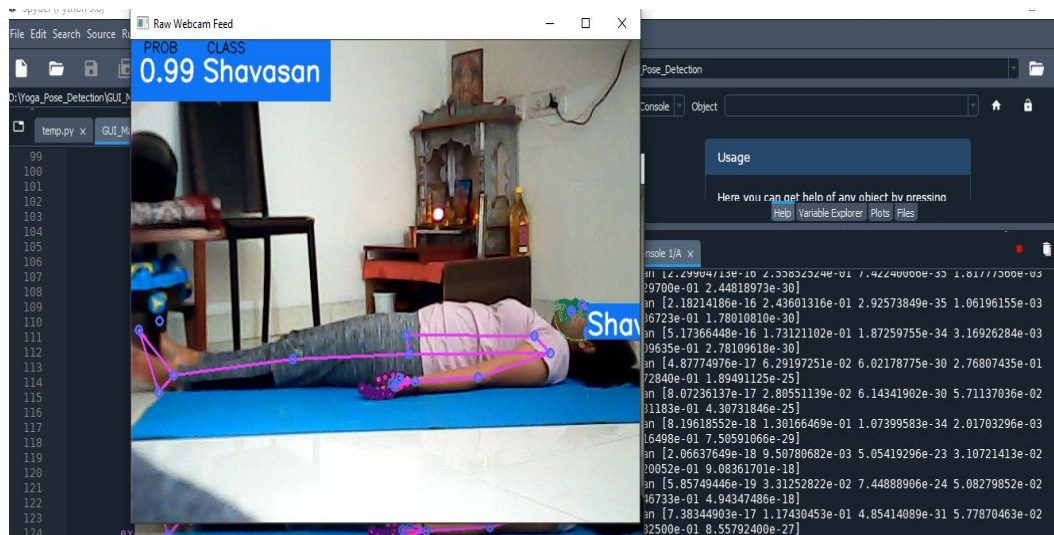
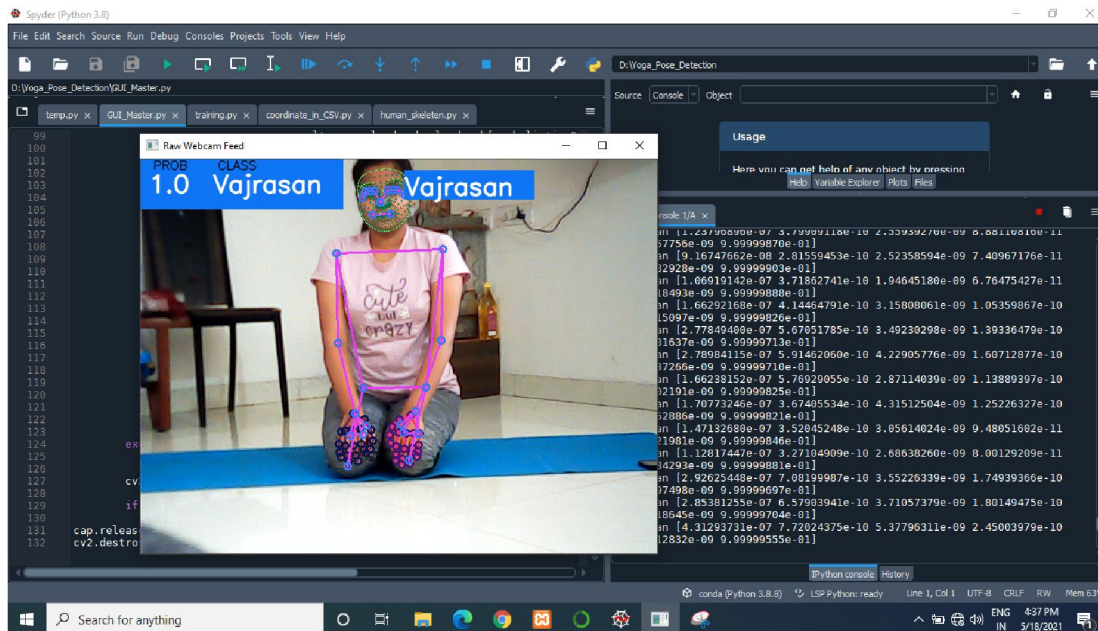
## III. SYSTEM ARCHITECTURE



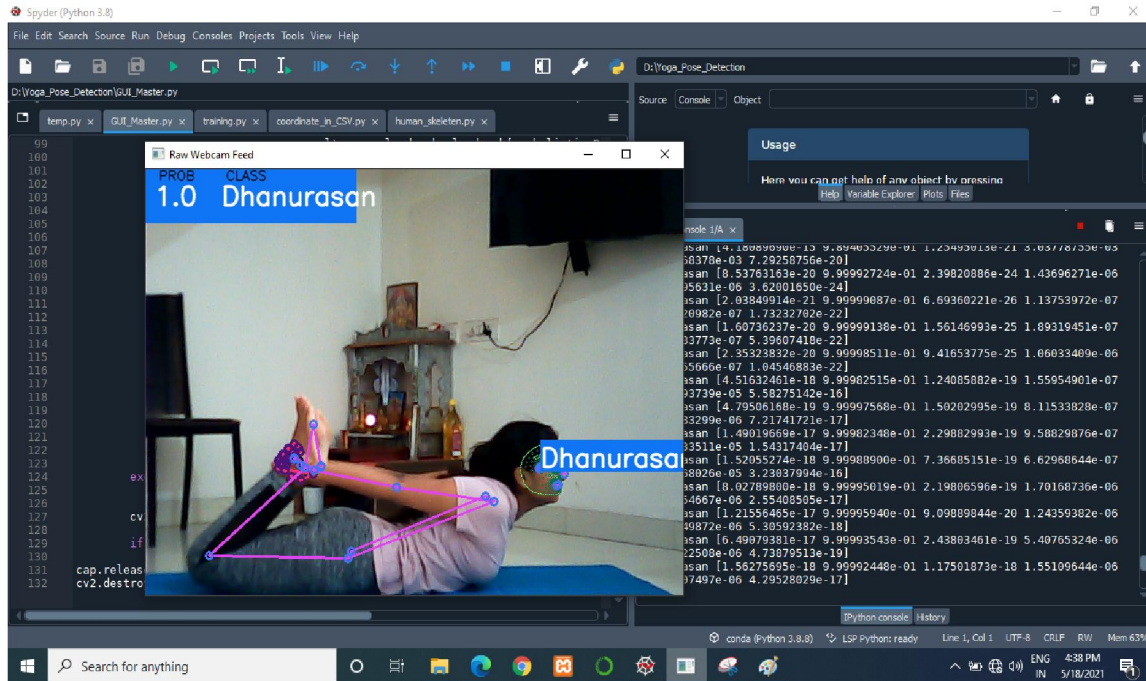
The yoga pose detection system begins with the collection of a dataset comprising images or videos of various yoga postures for training and testing purposes. The data undergoes pre-processing to enhance quality and consistency, involving tasks such as resizing, normalization, and noise reduction. In the feature extraction phase, key body points and angles are identified, which serve as critical indicators for differentiating between correct and incorrect poses. These extracted features are then classified using machine learning algorithms trained on labeled data to evaluate posture accuracy. Linear Regression is applied to assess the alignment of body parts, quantifying any discrepancies to suggest corrections. Finally, the system determines the correctness of the performed pose and provides real-time feedback, guiding users toward improved posture alignment.



## IV. IMPLEMENTATION







## V. CONCLUSION & FUTURE WORK

PosePerfect is a smart and scalable solution that helps people practice yoga safely by using machine learning and pose estimation. It checks if the user is doing the yoga poses correctly and gives feedback to improve posture, which helps prevent injuries and improves performance. In the future, adding 3D pose estimation will make it easier to understand body movements in depth, especially for difficult poses. Also, adding voice-guided feedback will make the experience more user-friendly and hands-free, allowing users to follow instructions without looking at the screen. These improvements will make PosePerfect more accurate, easier to use, and a more complete virtual yoga assistant for users of all levels.

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