Vol.15, Issue No 1, 2025

AI –YOGA TRAINER: INTELLIGENT POSTURE ANALYSIS & CORRECTION

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ABSTRACT

Yoga is beneficial for everyone of any age's physical and mental well-being. To avoid damaging the bones, muscles, and ligaments, it is extremely important to execute yoga poses correctly when practicing alone. As a result, providing feedback to the performance without a live instructor is possible by using artificial intelligence and machine learning in conjunction with picture processing. In addition to correcting users who perform the yoga posture improperly, the suggested system is designed to advise users on how to do it correctly on real-time and there is also a pose classification feature that can classify the yoga poses based on the images of the final yoga pose which is provided by the user. The feedback, which comes in text and audio formats, can assist the practitioner avoid injuries while also maximizing the advantages of doing the yoga posture. Various images from the internet were used to create the data set of various yoga poses. The data points are extracted from each webcam image with the aid of OpenCV and media pipelines. This is now fed into a deep learning model that employs convolutional neural networks (CNN), which finds pose errors and calculates the error percentage before providing the user with the necessary feedback in the selected output's text or audio format.

KEYWORDS: *Activity recognition, Human pose estimation, Media pipes, Real-time estimating human posture, Yoga.*

INTRODUCTION

The Indus-Sarasvati culture in ancient India is credited with creating the 5000-year-old practice of yoga. The definition of yoga is "deep association and union of mind and body." It is employed in all aspects of life to maintain mental and physical equilibrium through asana, meditation, and other methods. Due of the heightened stress levels associated with modern living, yoga has gained popularity globally these days. There are many different ways to study yoga, as well as resources available. Yoga can be learned on one's own with the aid of the Internet, books, recorded clips, and other resources, as well as in yoga centres and with private instructors. Many people prefer self-learning in fast-paced lifestyles because the tools described above may not always be available. However, when learning for yourself, as with any workout, the key to doing yoga postures correctly is to avoid bad posture, which is counterproductive and can even be harmful. This promotes doing yoga with a teacher nearby. With today's lifestyle, having a teacher or attending yoga sessions isn't always doable. An AI-based technology assists in identifying yoga positions and provides users with recommendations or comments. These guidelines assist users in enhancing their poses so that they are beneficial rather than harmful. The project's hurdles are that important spots must be identified without any gaps, and models must function correctly even when body components overlap. Experts should create the poses in the datasets used for this project.

LITERATURE REVIEW

Aman Upadhyay [1] This research reports an overall accuracy of 99.88% in the recognition of seven yoga asanas using the proposed Y_PN-MSSD model. This model's accuracy is derived from Mobile-Net SSD and Pose-Net posture evaluation. The human detection for each frame is managed by a Mobile-Net SSD layer, while feature point detection is handled by a Pose-Net layer. Three stages have been assigned to this model. The first step, known as data collection and preparation, involves gathering the yoga posters from the four users and compiling an open-source dataset containing seven different yoga postures. Ranjana S. Jadhav [2] kinematic description of the human body based on 17 mapped points and computer vision using OpenCV, a technique for detecting and correcting yoga posture was developed. The tf-position estimation technique was used to provide an accurate pose estimation. Debanjan Borthakur [3] The proposed model is to enhancing the general yoga

practitioner, the suggested paradigm opened doors for individual yoga practice, online instruction, and minimally invasive physical rehabilitation. Shahina Anwarul [4] The proposed system is divided into Three modules which make up the suggested system: alert creation, pose recognition using the suggested deep learning model, and pose detection using Media Pipe. The idea of hyperparameter tuning is used to maximize the intended model. Using a self-generated dataset of five postures, all experiments were carried out, and a 99.6% identification rate was attained, offering competent accuracy when combined with other state-of-the-art methods currently in use. Nagalakshmi Vallabhaneni [5] The findings of a thorough experimentation analysis show that the AAO HDL/YPE technique yields better results than current methods. Given is an artificial algae optimizer with hybrid deep learning-based model for estimating yoga posture (AAOHDL-YPE). Santosh Kumar Yadav [6] This research introduces Yog Net, a two-stream deep spatiotemporal neural network architecture based multi- person yoga expert system for 20 asanas. The first stream forms bounding boxes all over the subject after detecting the practitioner's pose using a key point detection technique. After extracting frame-wise postural features using time distributed convolutional neural networks (CNNs), regularized long short-term memory (LSTM) networks are applied by the model to provide temporal predictions. Pooja Gaikwad [7] In this study, the approaches employed are briefly discussed, and the tools and algorithms for position estimation, pose detection, and pose assessment are compared. It focuses on the researchers' accuracy, precision, and similarity of pose categorization results as well as the research's potential future directions. G. R. Sinha, Manish Raj et. Al [8] In this research paper, we used Kinect and AdaBoost classification with 94.78% accuracy using CNN and Stacked Autoencoder (SAE) method for Yoga discrimination system. Deep learning is an essential component of the study's technique for identifying inappropriate yoga poses and provide users with advice on how to correct them. Yoga poses go wrong. In the proposed system, users would You can choose and upload the poses you want to practice A recorded video of their yoga practice and research extract the angle of surveillance activity, Functions when scaling. In some cases, the key point is When rotated, the angle does not change. gives good results. In this system the angle with the floor is taken into account, but not between joints. Rotate the key point slightly, then change the angle. When to achieve these properties, we train a multi-layer perceptron. Accuracy on the test dataset is 0.9958. Hrishikesh Ghadge [9] The primary objective is to develop a yoga mentoring system that tracks and evaluates the user's moves and poses in order to identify any weaknesses in the yoga curriculum. After then, a display screen informs the user of their incorrect posture. Yoga is a health-promoting type of wokout that emphasizes mental, physical, and spiritual connections. On the other side, improper yoga practice can result in health problems like stiffness and sprains of the muscles. In this work, we propose to construct an Android or web-based yoga posture instruction system using an interactive transfer learning approach. Tapas Badal [10] This research develops deep learning-based methods to identify bad posture in yoga. Users using this method can upload recordings of themselves doing yoga poses and choose the desired pose to work on. The pose of the user is fed into training models, which then return the aberrant angles found between the stance of the user and the actual pose. By highlighting the areas where the yoga stance is incorrect, the system uses these outputs to give the user advice on how to correct it. The suggested solution required less computing complexity and attained an exceptional accuracy of 0.9958 when compared to various state-of-the-art methods.

A COMPARATIVE ANALYSIS OF VARIOUS MACHINE LEARNING ALGORITHMS

Table 1 Comparative Analysis

Year	Author	Algorithm/ Technology	Results	Future Scope
2023	Aman Upadhyay	1.Pose-Net CNN model	At an accuracy of 99.88%, the Y_PN-MSSD model is utilized to identify seven different yoga poses.	An audio-based alert. Enriched to detect more yoga postures.
2023	Ranjana S. Jadhav	1. CNN	99.88% accuracy was attained in identifying important human body locations.	Additional research should be done on concepts like batch normalization, dropout, and new activation functions.

2023	Shahina Anwarul	1. Hyperpara-meter Tuning	Dataset comprising 5 poses yielded a 99.6% recognition rate, comparable to other existing state-of-the-art approaches.	Implementing robust algorithms to ensure efficient data management, prioritizing security and privacy.
2022	Santosh Kumar Yadav	1. CNNs 2. LSTM	YogNet's accuracy was 77.29%, 89.29%, and 96.31%.	To extend the dataset with more yoga pose.
2022	G. R. Sinha	1. Multilayer perceptron 2. Recurrent neural network 3. LSTM 4. CNN 5. SVM	A testing dataset accuracy of 0.9958. The test accuracy obtained by SVM, CNN, and CNN + LSTM in the current research was 0.9319, 0.9858, and 0.9938, respectively. MLP achieved an accuracy of 0.9958 with updated features in the system, while having substantially less power than CNN and CNN+LSTM.	The proposed system is confined to 6 yoga poses, Moreover, real-time prediction and self-training on a mobile device are possible applications of this technology.
2021	Ajay Chaudhari	1. KNN 2. CNN	Video and image analysis can be used to examine the correctness of the yoga asana movements with 98.51% accuracy rate.	The proposed approach categorizes yoga asanas into five categories. The model's display is dictated by the nature of Open Pose's current evaluation, which may or may not operate well in circumstances involving overlap between people or body parts.
2021	Chhaihuoy Long	1. POSENET 2. CNN 3.Y_ PN-MSSD	A total of 99.88% accuracy is achieved in the recognition of seven yoga asanas using the suggested Y_PN-MSSD model. This model's accuracy is derived from Mobile-Net SSD and Pose-Net posture evaluation.	In the future, the yoga posture identification software can be trained on a larger variety of yoga positions. Furthermore, the proposed model will be expanded to identify other yoga positions. An audio notification can be incorporated.
2019	Abhishek Ranjane	1.CNN 2.LSTM	Yoga positions in a video are effectively detected by the system with 99.04% framewise accuracy and 99.38% accuracy after 45 frames have been polled. Real-time accuracy of 98.92% was attained by the system for a group of twelve individuals.	Future research can use other asanas and a larger dataset that includes both images and videos. For self-training and real-time forecasts, the system can also be put into practice on a portable device. The activity recognition in this work is demonstrated.

CONCLUSION

Yoga is an easy to perform exercise at home. But just following a video tutorial without a live instructor can be dangerous. Un-correct yoga poses can results in to various health problems like fractures, sprains, and muscle deformations thus, the need for Yoga Trainer with Al is necessary. The study proposes hybrid models, multi-stream networks, and deep learning architectures for high-accuracy yoga pose identification using Pose- Net, TensorFlow, or OpenCV. It collects yoga posture data from users and open-source datasets, preprocesses it with human body points, and uses deep learning techniques like CNNs, multi-streamnetworks, andhybrid models combining CNNs and LSTMs. The model's performance is evaluated using metrics like Matthews

accuracy, and precision. According to research, Yoga practice and technology are connected, with the goal of improving posture accuracy, user experience, and injury prevention through real-time feedback and correction mechanisms. The application for identifying yoga postures can be improved by incorporating some more yoga poses and a larger dataset and features like gesture recognition and progress tracking.

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