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Real Time Yoga Pose Detection Desktop Application using Tkinter with Increased Accuracy and No. of Poses using openPose and LR Machine Learning Algorithm

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Abstract: This work presents a method for precisely identifying different Yoga Pose Assessments using deep learning algorithms. To aid in yoga self-learning, we provide a pose detection-based yoga pose assessment approach in this system. First, the system uses a PC camera and multi-part detection to identify a yoga stance. We also provide an enhanced algorithm for this system's score calculation that works with all positions. Our application's resilience is assessed using various yoga poses in various settings. For yoga detection in real-time movies, a hybrid machine learning model utilizing linear regression is put forth. In this model, features are extracted from each frame's important points derived from Open Pose.
Keyboards - Logistic Regression, Machine Learning, Real Time Yoga Pose detection, OpenPose,

I. INTRODUCTION

Humans are naturally susceptible to a variety of health issues, and musculoskeletal illnesses are a crucial area that has to be treated right away. Numerous people suffer from musculoskeletal diseases each year as a result of aging or accidents. You can enhance your physical well-being by practicing yoga. Exercise has numerous advantages, but if done improperly, it can result in a harmful way of life. Therefore, people who are doing tasks on their own need to be well instructed. A person can enhance their health and gain from many activities if they are guided in the correct direction. Strength, balance, and awareness are developed in the body and mind through yoga poses.

II. PROBLEM DEFINITION

Initially, the method recognizes a stance using a PC camera. Next, the difference between the user's pose and the instructor's pose with respect to the set body angles is computed. The process suggests that the part be fixed if it over the predetermined threshold. It is anticipated that this approach will enable people to practice yoga anywhere, including at home.

III. LITERATURE SURVEY

1) *Paper Title: Application of Machine Learning Methods for Yoga Pose Identification*

Authors: Yash Agrawal, Yash Shah, Abhishek Sharma

Abstract: Identifying postures is a complex task due to the scarcity of datasets and the challenge of real-time posture detection. To address this, a large dataset was compiled, comprising over 5,500 images across ten distinct yoga poses. A tf-pose estimation algorithm was employed to generate a skeleton model of the human body in real-time. The joint angles derived from this skeleton were used as features for training multiple machine learning models. 80% of the dataset was allocated for training, while 20% was reserved for testing. The Random Forest Classifier achieved the best results, with an accuracy rate of 90.04%.

2) *Paper Title: Yoga-82: A New Dataset for Fine-Grained Pose Classification*

Authors: Manisha Verma, Sudhakar Kumawat, Yuta Nakashima

Abstract: To address the complexities in human pose recognition, we introduce the idea of fine-grained hierarchical pose classification. This involves framing pose estimation as a classification problem, for which we created the Yoga-82 dataset. This dataset includes 82 different yoga poses, each with complex variations. Since precise labeling can be difficult, we offer a hierarchical labeling system based on the body configurations of each pose. The dataset is structured into three levels: general body positions, variations of those positions, and specific pose names. We evaluate the performance of state-of-the-art convolutional neural networks on this dataset and also propose several hierarchical variants of DenseNet to exploit the hierarchical labeling.

3) *Paper Title: Yoga Pose Recognition Using EMG Signals from Lower Limb Muscles*
Author: Pradchaya Anantamek
Abstract: This study presents a system that identifies yoga postures by analyzing electromyography (EMG) signals from lower limb muscles. The research involved ten participants, five males and five females, performing five different yoga poses. The system focuses on four lower limb muscles in both legs, using EMG signals to evaluate muscle movements. Three machine learning models were used for posture recognition, with the Random Forest Decision Tree model delivering the best performance, achieving an accuracy rate of 87.43%.

4) *Paper Title: Privacy-Preserving IoT-Based Yoga Posture Recognition Using Infrared Sensors and Deep*
Authors: Munkhjargal Gochoo, Tan-Hsu Tan
Abstract: This paper proposes a privacy-preserving yoga posture recognition system using low-resolution infrared sensors and deep convolutional neural networks (DCNN). The wireless sensor network (WSN) consists of three nodes, each equipped with 8×8 pixel thermal sensors, capturing data along the x, y, and z axes. The data collected from 18 volunteers performing 26 different yoga poses were converted into grayscale images. The models were validated using tenfold cross-validation, achieving F1-scores of 0.9989 for xyz posture images and 0.9854 for y-axis images. The average classification latency per image was 107 milliseconds, demonstrating the potential of the proposed system for privacy-preserving yoga training.

5) *Paper Title: Real-Time Yoga Pose Recognition Using Microsoft Kinect*
Authors: Muhammad Usama Islam, Hasan Mahmud
Abstract: In this study, we introduce a system that monitors human body movements to assess the accuracy of yoga poses in real-time. Microsoft Kinect was used to detect body joint points, and from these points, joint angles were calculated to evaluate pose accuracy. The system is capable of recognizing multiple yoga poses in real-time, helping users improve their practice.

6) *Paper Title: Yoga Pose Recognition via an Interactive System with Kinect Based on Confidence Value Authors: Edwin W. Trejo, Peijiang Yuan*
Abstract: This research proposes a low-cost solution for yoga pose recognition using Microsoft Kinect's body tracking and depth sensor capabilities. We developed an interactive system that perceives a few specific yoga postures, allowing users to learn and practice them. The system provides real-time feedback with pose correction instructions, guided by a yoga expert. The recognition algorithm uses the Adaboost algorithm to detect six yoga poses, achieving a maximum average confidence value of 92%.

IV. GAP ANAYLYSIS

1) *Paper 1: "Implementation of Machine Learning Technique for Identification of Yoga Poses"*
This study applies the tf-pose estimation algorithm with a large dataset comprising 5,500 images to detect poses. The angles from the generated skeletons are then processed by several machine learning models, achieving a 99.04% accuracy rate with the Random Forest classifier. In contrast, my project uses OpenPose for detecting keypoints and Logistic Regression for pose classification. My dataset could benefit from including a wider variety of poses and images, as well as exploring more sophisticated classifiers such as Random Forest or Convolutional Neural Networks (CNNs) for potentially higher accuracy.

2) *Paper 2: "Yoga-82: A New Dataset for Fine-grained Classification of Human Poses"*
This paper presents the Yoga-82 dataset, which features 82 distinct classes and incorporates a hierarchical classification system. It addresses issues related to pose diversity, occlusion, and varying viewpoints with a multi-level classification approach, aiding the recognition of more intricate poses. In contrast, my project does not include a hierarchical classification structure or utilize such a complex dataset. Incorporating a hierarchical labeling system and using a broader dataset with more diverse poses could significantly enhance my project's ability to recognize and process complex poses.

3) *Paper 3: "Recognition of Yoga Poses Using EMG Signals from Lower Limb Muscles"*
This research focuses on identifying yoga postures by analyzing Electromyography (EMG) signals from the lower limb muscles, emphasizing muscle movements rather than visual recognition. My project is centered on visual keypoint detection using OpenPose, without the inclusion of muscle activity data. Adding biofeedback mechanisms, such as EMG signals, could provide a deeper understanding of how poses are executed and offer an additional level of accuracy in correcting postures..

4) *Paper 4: "Novel IoT-Based Privacy-Preserving Yoga Posture Recognition System Using Low-Resolution Infrared Sensors and Deep Learning"*

This study introduces a privacy-conscious system for posture recognition using low-resolution infrared sensors, combined with a Deep Convolutional Neural Network (DCNN) for classification. My project, on the other hand, relies on an RGB camera input, which could raise privacy concerns. Furthermore, my system uses Logistic Regression for classification rather than deep learning models. Transitioning to a privacy-preserving system and incorporating deep learning models could enhance both the accuracy of pose detection and address privacy issues.

5) *Paper 5: "Yoga Posture Recognition by Detecting Human Joint Points in Real Time Using Microsoft Kinect"*

This paper employs Microsoft Kinect to detect body joint points in real-time, calculating joint angles to measure pose accuracy. The Kinect's depth sensors offer a level of precision in movement tracking that might surpass the standard camera setup used in my project. While my system relies on OpenPose and a regular camera feed for keypoint detection, incorporating depth sensors or Kinect could improve the accuracy of real-time tracking and pose identification.

6) *Paper 6: "Recognition of Yoga Poses through an Interactive System with Kinect Based on Confidence Value"*

This paper describes an interactive system utilizing Kinect for real-time pose recognition and corrections, achieving an average confidence score of 92%. The system uses the Adaboost algorithm for detecting poses. My project, in contrast, does not include real-time correction features and uses Logistic Regression rather than Adaboost. Implementing real-time correction feedback and leveraging more advanced algorithms like Adaboost could enhance the pose detection capabilities and overall functionality of my system.

V. CONCLUSION

Yoga Pose Detection system offers a valuable tool for users to receive real-time feedback on their yoga practice through the use of camera-based pose detection, leveraging OpenPose for keypoint extraction and Logistic Regression for pose classification. The system's user-friendly interface, built using Tkinter, provides essential features such as user authentication, pose accuracy measurement, and personalized feedback.

Future enhancements, such as adding more yoga poses, incorporating advanced AI models, expanding to mobile and web platforms, and integrating wearable devices, will significantly improve the system's functionality and usability. By implementing these features, the system can cater to a broader audience, provide more personalized and effective yoga practice guidance, and enhance the overall user experience.

With its scalable architecture, the system has the potential to become a comprehensive platform for yoga enthusiasts, offering not only pose detection but also health monitoring, progress tracking, and personalized yoga routines. These advancements would make the system an invaluable tool for improving wellness and fostering a deeper connection to yoga practice in the digital age.

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