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Yoga Pose Corrector using Deep Learning

Birendra K Saraswat[1], Prajjwal Chandra[2], Rahul Gupta[3]
Assistant Professor, Department of Computer Science and Engineering[1]
Students, Department of Computer Science and Engineering[2,3]
Raj Kumar Goel Institute of Technology, Ghaziabad, India

Abstract: *Continuously tracking a person's movement and activity is known as activity recognition. A self-guidance practise framework that enables people to learn and practise yoga postures accurately without assistance from others can be built using human posture recognition. A method has been developed to accurately detect and recognise different yoga positions using deep learning algorithms. The 85 videos that make up the selected dataset each have 15 persons performing six different yoga poses. The Mediapipe library is initially used to extract the user's keypoints. As a deep learning model, a convolutional neural network (CNN) and long short-term memory (LSTM) combination have been utilised to recognise yoga poses in real-time monitored videos. For feature extraction, CNN layer is employed.*

Keywords: Yoga

I. INTRODUCTION

Due to its numerous physical, mental, and spiritual advantages, yoga, a practise with ancient roots that originated in India and was once only practised there, is now gaining popularity on a global scale [3]. The remarkable healing effects of yoga in a number of medical conditions can be used to explain why it is becoming more and more important in medicine. illnesses that affect the human body, including musculoskeletal troubles, heart disorders, and respiratory problems [4, 5]. A variety of health problems linked to today's fast-paced lifestyle can be easily avoided by including yoga into daily routine, yet there is a certain knowledge and awareness gap among the younger generation regarding the benefits of yoga.

Related studies on yoga pose detection and categorization have been published recently. [7] OpenPose [8], PoseNet [9], and PifPaf [10] are keypoint detection techniques employed. Many variables, including the environment, interactions between people, and differences in apparel, will be taken into account when detecting human position [11]. They employed the multilayer perceptron, recurrent neural network, long short-term memory (LSTM), and convolutional neural network as deep learning techniques for posture categorization [12, 13]. The above works have the limitations that features (key points) are not scaled and that a pattern for human positions at various distances from the camera cannot be found. The angles between joints in earlier approaches are rotationally invariant, meaning that they remain unchanged even when the joints are rotated.

The research used networks to categorise yoga poses and determine departure from the expert position that had already been determined in the proposed work for abnormal pose identification. This study primarily focuses on preprocessing datasets to extract new features, such as angles between body parts, and how they improve accuracy in comparison to typical pose features and by filling in missing values. To attain high accuracy, this system combines hyperparameter tweaking and classification networks such multilayer perceptrons. The project's introduction discusses previous studies in the area before going into detail regarding the dataset the study used and preprocessing methods. Preprocessing discusses the extraction of angles. The study then concentrated on developing an estimation code for poses and MLP (multilayer perceptron) training for the yoga categorization.

II. PREVIOUS WORK

Human posture evaluation has recently greatly benefited from profound learning, and enormous executional advancements have been made.

The goal of this project is to get knowledge about the following by examining the many yoga approaches now in use: How is the evaluation right now? What is profound understanding? How can the practise of yoga continuously provide order

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through profound learning? This activity makes use of references from meeting policies, materials that were distributed, specialised reports, and diaries.

The majority of the following segment analyses current assessment, thoroughly explains several posture assessment procedures, and goes one step further to explain discriminative tactics that are learning-based (deep learning) and model-based. Then, a variety of posture extraction techniques are discussedalongside sophisticated learning-based models, including Convolutional Neural Organisations (CNNs) and Recurrent Neural Networks.

III. PROPOSED MODEL

Real-time video sequence input is provided to the proposed system in the form of frame input. In addition to possible feedback for angle and pose correction, the output would be the anticipated yoga pose. The system is divided into three major stages: Keypoints extraction, Pose prediction, and Pose correction. extracting key points phaseis capable of locating and retrieving the location of significant keypoints based on the user's position.

The model architecture is specified in the posture prediction step, which also determines whether the pose is acceptable or not. position correction is the last stage, where the user receives additional input on how to fix their posture and is also presented the degree to which their position is comparable to the true one.

3.1. Keypose Identification

The first step is to extract keyframes from every video frame and save them in JSON format. The term "keypoints" refers to certain body parts or points that are important for the creation of a yoga position. The shoulders, elbows, wrist, and knees are some examples. To extract keypoints, we made use of the MediaPipe library. Google created Mediapipe, a cross-platform framework that offers incredible pre-built ML solutions for computer vision problems. Inferring 33 3D landmarks and background segmentation masks on the entire body from RGB Page 7/25 video frames, it is a highly optimised pre-trained CNN model used for high-fidelity body pose tracking. Z is the depth of a 2D coordinate, while Mediapipe generates 3 coordinates (X, Y, and Z) [21].

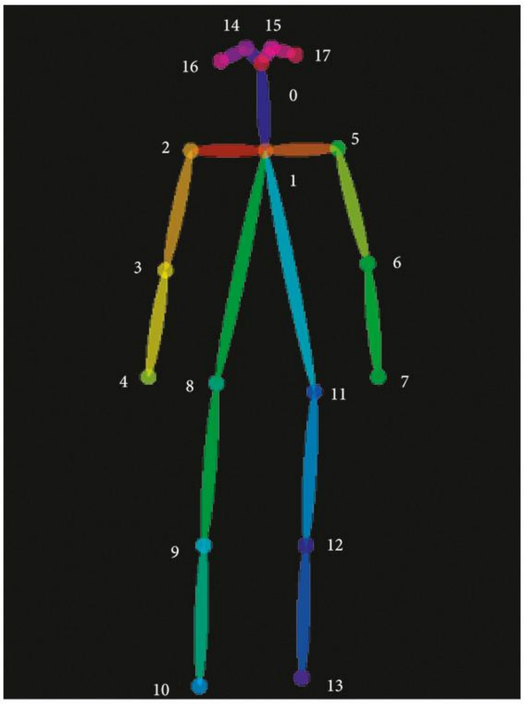

Figure 1 Pose Identification

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3.2 Pose Prediction

The following phase entails developing a deep learning model that can accurately assign any real-time video to one of the six stances listed in the dataset. A hybrid model that combines CNN and LSTM is applied in this case. For feature extraction in this work, CNN is utilised [22]. In order to perform tasks like object identification and image classification, CNN, a multilayered ANN (artificial neural network), is utilised [23]. The sequence of frames that take place during a specific yoga stance can be understood using LSTM. A particular kind of RNN known as LSTM is capable of learning and remembering incredibly long-term dependencies over lengthy successions of input data [24]. Along with CNN, we used a TimeDistributed layer.

Figure 2 Pose prediction

IV. RESULT ANALYSIS

Our experimental results show that our research efforts have produced outstanding outcomes. Our innovative method has shown to be incredibly effective at producing high-quality, realistic facial animations in real-time. The created animations not only closely resemble the original photographs, but they also exhibit smooth, fluid motions that expertly mirror real-world facial emotions. Additionally, we thoroughly assessed our method using a variety of datasets, and the outcomes unmistakably show that it surpasses other approaches in terms of output quality and output speed.

V. CONCLUSION

In this research, we suggested an effective system for tracking yoga in real time. Using the MediaPipe library, where significant coordinates are captured and saved in JSON format, it first locates the user's keypoints.

The model is then given a 45-frame sequence that was created from real-time data. The model, which combines CNN and LSTM, initially uses CNN to locate the useful characteristics before using LSTM to observe the occurrence of a sequence of frames. On the test dataset, the system provides an excellent accuracy of 99.53%. If the stance is determined to be correct, the user receives additional input depending on a predetermined threshold.

VI. FUTURE SCOPE

Only six yoga asanas are currently characterised by the proposed models. Yoga asanas come in many different forms, thus developing a posture evaluation model that works for all asanas is a challenging task.

The dataset can be expanded by including more yoga poses practised by people in both indoor and outdoor settings. The models' display is dependent on the nature of the OpenPose current evaluation, which may not work effectively when people or body parts are covered. For this framework, it is possible to implement a convenient tool for self-preparation and ongoing forecasting.

The movement acknowledgment in this work is for acceptable uses.

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