Asana Aesthetics

V. Baby[1], Madhavi Boini[2], Saketh Talagadadeevi[3], Dharmika Thota[4], Venu Vennu[5]

[1]*Associate Professor, Dept. of CSE, VNR VJIET, Telangana, India*
[2, 3, 4, 5]*Student, Dept. of CSE, VNR VJIET, Telangana, India*

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Abstract - *We all know how impactful a good yoga session can be. The trend these days is that people are preferring online yoga sessions more and more after the pandemic. But technically, these sessions are not immersive like live yoga sessions. So, to cover the gap, we are trying to build a machine learning model which will assist the users while they practice yoga in the online mode. Our model will track the user's yoga footage and will analyze various aspects of the asana and it will give them some feedback regarding what changes can be made to perfect their pose.*

Key Words: **Machine Learning, Deep Learning, Computer Vision, Yoga Asana Detection, Pose Correction.**

1. INTRODUCTION

In conventional yoga, they say that the two instruments needed are the body and the mind. But in online yoga, an additional instrument is also essential, which is the computer. Ideally, the computer should have minimal impact on the learning process of the learners, and the yoga teachers should feel empowered in the online mode and not handicapped. If we must counter this shortcoming, then we need a robust mechanism of hardware and software which will not only enhance connectivity between student and the teacher, but also assist them enhance their learning experience. It would be even good if the computer has the capability to correct the learner from time to time by giving them feedback. This is where the role of machine learning and deep learning comes into the limelight. Either the real-time or pre-recorded footage is fed into a machine learning model, which will then extract the key features from the footage, then analyze them, classify them, and finally point out the similarities or the anomalies to the user so that they can make changes. For this, a variety of machine learning models are utilized, including support vector matrices (SVM), convolutional neural networks (CNN), and regression analysis. Also, other technologies like OpenCV can also be used to support the system. Now, let us see some of the pre-existing models that we perceived as part of our literature survey.

2. LITERATURE SURVEY

Sinha [1] proposed Deep learning-based techniques for identifying inappropriate yoga postures. With this approach, users get to choose the practice pose they want to perform and upload videos of themselves performing it. The user pose is given to models that are being trained to output any unusual angles between the user pose and the actual pose. By highlighting the yoga pose's shortcomings using the obtained outputs, the application can guide users on how to correct the pose. Prediction Accuracy is 99.58%. The key points are extracted using Multi-Layer Perceptron and Keras multi-person pose estimation.

Varsha [2] used KNN classifiers and "PoseNet". An individual can learn the best possible method to carry out the particular yoga pose they're trying to achieve by using such deep learning algorithms. Human pose estimation is used to analyze a person's yoga posture using computer vision algorithms and "Open Pose". The proposed system distinguishes between the actual and target positions and accurately corrects the user by providing real-time visual output and the necessary instructions to change the identified pose. Prediction Accuracy is 99.51%.

Santhosh [3] applied Deep learning algorithms to effectively detect and distinguish different yoga positions. The 85 videos make up the selected dataset each have 15 persons performing six yoga asanas. The user's keypoints are primarily retrieved using the Mediapipe library. A "LSTM '' and "CNN" combination has been used as a deep learning model to identify yoga asanas using real-time observed footage. The "CNN" layer detects the key points from which the features are obtained, and after that LSTM is used, which recognises when a series of frames occurs so that predictions may be generated. The poses are then categorized as being correct or improper. The system will provide text/speech feedback to the user if the correct pose is recognized. Prediction Accuracy is 99.53%.

Rutuja [4] employed a technique that begins by running the input images via "CNN" classifier that has been trained to detect humans. After recognizing yoga poses, the pose estimation network looks for trained key points. The image can then be displayed to the user by the computer using pointers that identify different parts of the user body. The OpenPose library is used in this case to extract the key points of the pose from the video frame. Yoga poses are detected and corrected using PostNet. Machine learning prediction is used by SVM classifiers to enhance ML algorithms' performance. In order to find similarities between the user's postures and the human skeleton poses, CNN compares the two poses. The prediction accuracy is 99%.

Abhishek [5] developed a pose recognition system, which assists and corrects users while performing Yoga. A dataset called "YOGI" was created, this comprised 10 yoga postures, each of which had between 400 and 900 images. Along with that, another dataset for Yoga Mudra detection was also developed. That dataset contains 5 mudras, with around 500 images for each mudra. Two different processes were carried out. First one was for detecting the skeleton structure while performing the yoga pose, and the other was for detecting the hand mudras. Later different angles between the joints extracted from the skeleton were measured and then the yoga pose was classified. A number of deep learning models were used in the process and among all the tested models, XGBoost with Random Search cross validation was the most accurate model, giving an accuracy of 99.2%.

Pranjal [6] used the Audiopipe Library. It is used to look over the postures of Surya Namaskar. Advanced software is used to detect the standing in real time. These Postures are classified into different groups of Surya Namaskar. The form is recognized by the classification divider as being one of the following: 'Ashtanga Namaskar', 'Dandasana, Bhujangasana', and 'Svanasana', as well as 'Pranamasana', 'Hasta Padasana', 'Hasta Uttanasana', 'Ashwa-Sanchalan Asana'. The correct yoga pose (Surya Namaskar) is identified using this model, which was created using deep learning-based approaches (CNN). The model has an accuracy score of 0.75 and a prediction accuracy of 98.68 percent.

Josvin [7] used transfer learning using the VGG16 architecture. To enhance the accuracy, he trained ImageNet weights in conjunction with a DNN classifier. Convolutional neural networks (CNN) and transfer learning, two deep learning approaches, have been employed to develop a system capable of detecting a yoga pose from an image or frame of a video. The model was trained using photos of 10 different asanas, and the prediction accuracy was assessed. With an accuracy rate of 82%, the prediction model supported by transfer learning displays encouraging results.

Satyam and Animesh [8] used the Tensorflow MoveNet Thunder model. The MoveNet Thunder model is an ultra-fast and accurate model that estimates the real-time pose and detects it, thereby allowing them to correct it. MoveNet is a model for identifying poses that uses 17 critical sites on the human body to distinguish poses. These key points are then converted to vectors and then "cosine rule" is used to estimate the error in the pose as compared to the ideal pose. The model showed a promising 85% prediction accuracy.

Utkarsh and Dr. Shikha [9] used MediaPipe to stream either live feed or recorded feed into OpenCV where 33 Key points in the human body were extracted. Later these Key points were passed through various classification-based Machine learning algorithms, and eventually, Logistic Regression Classifier produced the most optimized results with 94% Prediction accuracy.

Ajay [10] used a human joints localization model to locate all the important joints in the human body while examining the feed. Later a "CNN" model was used for classifying these joints into different asanas. Based on the classification, they displayed visual and textual feedback to the users, so as to make them aware of the shortcomings in the way they were performing yoga. This model gave a respectable 95% classification accuracy.

Deepak and Anurag [11] used an instantaneous human pose estimation library called OpenPose to distinguish different joint areas either in the live feed or in recorded feed. Once the joint extraction was done, the output was then fed into a "CNN" plus "Long Short-Term Memory" model, which classifies the pose into a specific asana and gives decisive feedback as well. The CNN plus LSTM model gave a good 98.58% Prediction Accuracy.

Shruti [12] used an instantaneous human pose estimation library called OpenPose to extract essential key points from either pre-recorded or real-time feed. Then they used an amalgamated model consisting of "CNN" classifier and "LSTM" model to classify the pose into a particular asana based on the closeness of the extracted key points of the current pose to those of the ideal pose/asana that the model was pre-trained with. This hybrid model produced a 99.38% prediction accuracy.

Ze Wu [13] suggested a full-body posture modeling and quantitative evaluation approach to identify and rate yoga poses. With the use of 11 IMUs fixed on the body, quaternion format data has been measured for human posture using a wearable device. As the first classifier for the classification of yoga poses, Back Propagation Artificial Neural Networks (BP-ANN) were selected. To assign postures to a category, flexible fuzzy partitioning was performed using FCM as the second classifier. They carried out both the identification of data frames and instances of posture. In the data frame recognition test, 30% of the data were randomly selected from the database to train the BP-ANN and FCM classifiers, and the remaining 70% of the data had a recognition accuracy of 89.34%.

Gochoo [14] proposed an innovative yoga posture detection based on Internet of Things (IoT) using "DCNN"s as well as wireless sensors with low-resolution infrared sensors. They achieved a breakthrough experimental outcome by using a low-resolution infrared sensor based WSN for the initial time to recognise up to 26 different yoga poses. The hardware for the suggested system is inexpensive and small. The suggested system is a cutting-edge posture recognition system that is device-free, portable, inexpensive, dependable, and accurate.

Usama's [15] objective is to identify yoga positions performed by people using Microsoft Kinect and to compare such poses to the actual data. They have established a model of real data that the postures have been discovered using for a certain set of poses. Their main challenge was detecting joint coordinates. Through the use of Kinect capture, the poses are detected. With over 97% accuracy, they were able to identify all angles in between different body segments in yoga postures.

Waseem [16] proposed a powerful classifier system that can identify yoga postures using an RGB camera. The recognition system first makes use of the Blaze Pose framework in order to pick out significant points from the input stream. In order to produce key points that are independent of frame and resolution, the obtained key points are subsequently converted using feature extraction techniques. A unique DL model of "CNN" plus "LSTM" is then used with the processed key points. Finally, they have achieved 98.65% prediction accuracy.

Carreira [17] developed the "Iterative Error Feedback" framework and is interested in using feedback to build predictors that have a natural ability to deal with complex, structured output spaces. By training stratified feature extractors over a shared area, they were able to develop a general model to represent a formidable structure in both input and output spaces. They did this by introducing top-down feedback, which predicts what is wrong with their current estimate and corrects it iteratively rather than trying to forecast the goal outputs directly as in feedforward processing.

3. CONCLUSIONS

The purpose of this review was to get a better understanding of the trends in Yoga Pose Detection technology. If we look back over the years, we can see how varied approaches were taken to carry out the process. This knowledge will help us understand the various options that lay in front of us, and then plan a project roadmap for this endeavor.

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