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Using Machine Learning "AI Software" for Real-Time Posture Correction in Yoga

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Abstract

This paper explores the application of machine learning (ML) algorithms in real-time posture correction for yoga practitioners and yogachrya. In 21century these tools help in rise of at-home fitness solutions and virtual yoga classes, maintaining correct posture. A yoga teacher can check the yoga poses but can't be make correction 100 % in the asana but now ML-powered systems using computer vision such as (Mediapipe, PoseNet, MoveNet, and OpenPose) and sensor-based data analysis help resolve the all issue. This research investigates is totally technological based and aware the society about the new AI technology for the improvement of yoga practice. In yoga competition judges check the alignment and stability of the students and players but now after this technology judgment become quick and accurate. In the results of a study, it's also proved that accuracy of the Mediapipe architecture has the better accuracy other apps.

Keywords: Yoga, AI Technology, Machine Learning, Sensor, Virtual Yoga

Introduction

Now a day's yoga is not an old day technique because AI generation modernize the technique to find out the accuracy in Yoga (asana). Yoga give us to achieve physical, mental, and spiritual well-being. A wrong posture can lead to injuries or reduced benefits of asana. If the technology is built to help the people than this work always appreciated by the society. Computer technique is very old but this time it became the necessity of time which help us in so many projects. "It is the impact of computers and computer-powered technologies on healthcare hospitals and institution, AI technology is extensively established in Yoga, Zumba, martial arts, and other hobbies. Its also worked additionality to standard medical procedures. which are commonly recognized as strategies to improve one's health" [1]. Yoga is a set of practices related to a person's physical, mental, and spiritual and emotional well-being that was the part of ancient India. "Artificial intelligence technologies, Traditionally, alignment is corrected by a trained instructor. So many trend people used this software in yoga. However, with the growing trend of self-practice and digital yoga classes, the absence of real-time feedback creates a critical gap. The integration of machine learning and computer vision such as (Mediapipe, PoseNet, MoveNet, and OpenPose) offers a novel approach to posture detection and check out the correction level.[2] "Thes all studies helps to find the feasibility and accuracy of above mentioned systems. The World Health Organisation (WHO) acknowledges yoga as an effective tool for promoting physical activity and preventing diseases and can make fit all the society members [3]. WHO is the top organization which work for citizens health? Its also aware about the new disease and also give grant to poor people to have food and take free medicine. WHO is the human back bone on this earth? Every people can't expanse money on medicine so WHO guided the people how to they can live long to adopt the healthful living. "Additionally, it is widely recommended for reducing anxiety, alleviating mood disorders and enhancing quality of life [4]. Yoga helps people physical and mentally. In the evidence of so many researches its proved yoga help in stress management, sleep quality improvement, anxiety and depression reduction. Yoga also help in promotion of self-care and awareness [5]. International yoga day given a new world level platform to yoga. Now "Yoga's globally popular event. Now everyone practices yoga for its benefits like physical and mental

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health, including improvements in blood pressure regulation [6]. “Bhattacharyya. Meta-analyses further underscore the positive impact of yoga on immune function, stress reduction and quality of life[7].

Background and Literature Review

According to the D Mohan et. al. The study also compared the estimation accuracy of all architectures and concluded that the MediaPipe architecture provides the best estimation accuracy. [8]

Chen et al.[9], in their paper titled “PoseNet: A Convolutional Network for Real-Time 6-DOF Camera Re-localization”, demonstrate a monocular, six-degrees-of-freedom delocalization system that is reliable and works in real-time. Graph optimization is not required, however, as additional engineering would be needed. Their system uses CNN to infer the six poses from a camera shot of a single RGB. In this system software required the accuracy of images and the lenses capturing power. Its also required the motion detection with speed and need to capture all the movement with high level accuracy.

Islam et al.[10], in their paper “Adversarial PoseNet: A Structure-aware Convolutional Network for Human Pose Estimation”, implemented a joint occlusion method for a human body, which overlapped frequently and led to incorrect pose predictions when used for human pose estimation in monocular images. These conditions may result in pose predictions that are biologically improbable. Human vision, on the other hand, may anticipate postures by taking advantage of the geometric limitations of joint interconnectivity.

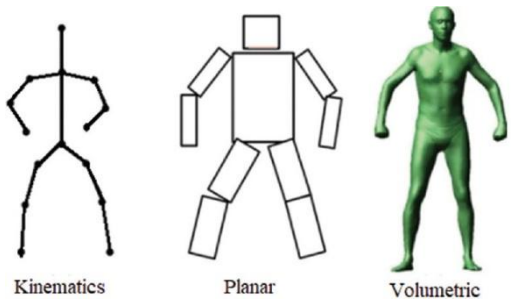
Alex et al.[11], in their paper on simple and lightweight human pose estimation, demonstrated using benchmark datasets that the majority of existing methods often aim for higher scores by utilizing complicated architecture or computationally expensive models, while neglecting the deployment costs in actual use. They examine the issue of straightforward and lightweight human posture estimation in this study.

Chen et al.[12], in their paper on continuous trade-off optimization between fast and accurate deep face detectors, demonstrated that DNNs, i.e., deep neural networks, are more effective at detecting faces than shallow or hand-crafted models, but their intricate designs have more computational overheads and slower inference rates. They researched five simple methods in this context to find the best balance between speed and accuracy in face recognition.

Zhang et al.[13], in their paper “Yoga Pose Classification Using Deep Learning”, proposed a persistent issue in machine vision that has presented numerous difficulties in the past. Many industries, including surveillance cameras, forensics, assisted living, at-home monitoring systems, etc., can benefit from human activity analysis. People typically enjoy exercising at home these days because of our fast-paced lives, but many also experience the need for an instructor to assess their workout form and guide them.

3. Methodology

Data for model training includes annotated images and videos of yoga practitioners performing various asanas. The main Key points of the study (joints, limbs) are labeled manually or through semi-automated tools.



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Media pipe :- Provides efficient real-time detection of body landmarks and is frequently combined with classification algorithms for yoga pose recognition. All the software work on the mathematical formula to calculate the point to point motion and accuracy. The Blazepose model within Mediapipe extracts 3D landmark features x, y, z coordinates.

Pose Net & Move Net : These models generate skeletal representations by detecting keypoints just like joints in real time. MoveNet, in particular, achieves exceptional accuracy (up to 99.88%) and speed, making it suitable for live feedback applications.

OpenPose Used for feature extraction and joint localization, supporting both spatial and temporal analysis of movement patterns, especially when combined with temporal neural networks.

These all system work on the three main points to check Accuracy.

- Joint detection precision one point to other.
- Deviation from ideal pose (in degrees) and level
- User-reported feedback and ease of correction

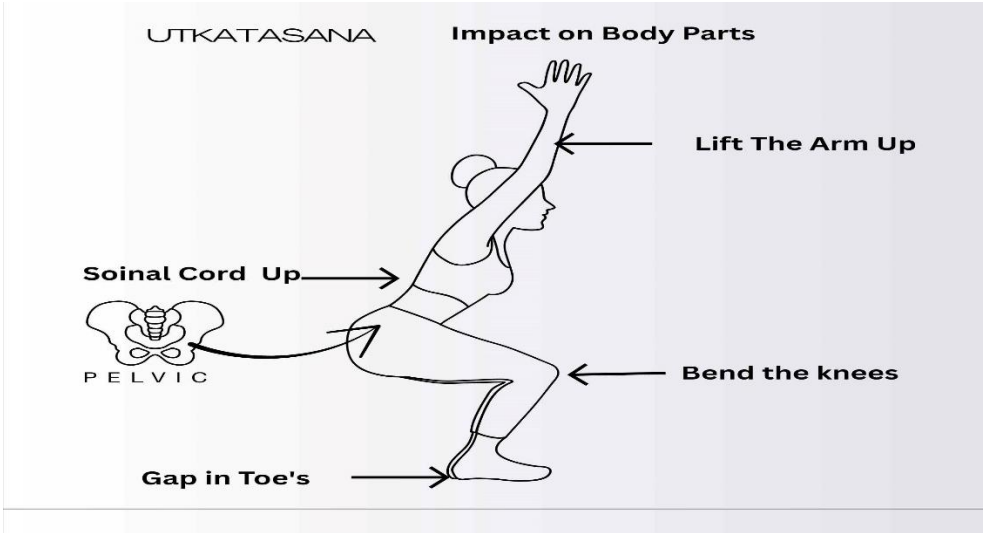
Results

- **Input:** Real-time video stream via webcam or smartphone camera

Real Image APP Design

Train a Pose Classification model using pose detection and tensor flow to find out the results.

(1)Obtain the key-points from training data (so many images from each pose)
(2)Train a pose classification model that takes the key point coordinates from CSV-file as input, and outputs the predicted labels.
(3)Using Key-points of the data for correction suggestion



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This AI medal explained the angle of the body and correct the posture of the body.

With the help of these software researcher can find out the results of all the postures and predict the accurate results for the correction of poses. These apps give a new height to all the yogacharya and Institutes.

Discussion

Teacher and the Yogacharya detect the pose and same time he can correct the posture. The Tests will find the accuracy,and Real-time feedback helped to improve pose alignment in under 30 seconds.In this software some challenges included like some time its not able to read the joints, and performance on advanced poses like Headstand or Crow Pose.

Its Minimized the risk of wrong yoga poses and help to stop the ligaments and muscles injury.

In few cases, A person can perform asana without trainer because its help to make the body posture accurate.

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