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SURYANAMASKAR POSE CORRECTOR

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Abstract -In Surya namaskar self-learning is an integral part but incorrect posture while performing Surya namaskar can lead to serious harm to the muscles and ligaments of the body. Thus, to prevent this we present an intuitive approach based on machine learning techniques to correct the pose while performing Surya Namaskar The proposed system is aimed at providing concise feedback to the practitioner so they can perform Surya Namaskar poses correctly and assist them in identifying the incorrect poses and get proper feedback for improvement interevent injuries as well as increase their knowledge of a particular Surya Namaskar pose. A proposed deep learning model using convolutional neural networks (CNN) for Surya Namaskar pose identification and a human joints localization model followed by a process for identification of errors in the pose for developing the system. Using the proposed system, we will be able to achieve a classification accuracy of 95% for pose identification. After obtaining all the information about the user's pose, the system gives feedback to improve or correct the user's posture

***Key Words*: Surya namaskar, Surya namaskar Pose detection, Key point detection**

1. INTRODUCTION

The ancient Indian art of connecting mind and body, Suryanamaskar, is a great way to exercise which helps in maintaining mental clarity and calmness. Nowadays, yoga has gained worldwide attention because of increasing levels of stress in the modern way of life, and there are many ways or resources to learn yoga. The word yoga means a deep connection between the mind and body. Today there is substantial Medical and scientific evidence to show that the very fundamentals of the activity of our brain, our chemistry even our genetic content can be changed by practising different systems of yoga. Suryanamaskar, also known as a salute to the sun, is a yoga practice that combines eight different forms and 12 asanas(4 asanas get repeated) devoted to the Hindu Sun God, Surya. Suryanamaskar offers several health benefits such as strengthening muscles and helping to control blood sugar levels. However, when practising suryanamaskar, theperson must follow the proper guidelines to gain maximum benefit from following a particular suryanamaskar routine. Hence practitioner must invest their time in exercising by themselves along with regular training. These courses are given by an instructor. The importance of such a system comes into the picture when the practitioner is trying to learn suryanamaskar by themselves as they are not instructed by a professional, so they tend to make slow progress initially and can even hurt themselves during self-training because of incorrect practices. The practitioner has to follow certain steps and guidelines for taking maximum benefit from a particular pose and in a lot of cases failing to do so may lead to serious harm due to incorrect postures. If these incorrect practices are continued for a prolonged period it may lead to long-term pain in the joint. This became our prime motivation for developing a suryanamaskar self-training system for practitioners to exercise on their own with the help of a mobile or web-based application only so that proper instructions can be delivered to help them in a very convenient manner so that they can adjust their poses and learning about their incorrectness in real-time and there is also an

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computer-assisted training systems from the practitioner side to help them improve their knowledge and understanding about different types of suryanamaskar poses and protect them froman injury that might occur during learning phases.

1.2. Literature Survey

There have been multiple methods used to perform human pose estimation. For our case, we are going to focus on single-person pose estimation**.** The utilisation of the CNN and LSTM model on OpenPose information is profoundly successful and arranges all 6 yoga presents impeccably. SVM is a lot higher and less unpredictable when contrasted with neural networks and requires less preparation time [1]. In 2020, Abhishek Sharma, Pranjal Sharma, Darshan Pincha

, Pratik Jain proposes a paper: "Surya Namaskar: Real-Time advanced pose recognition and correction for smart healthcare".In this paper, they proposed that the use of the Hybrid CNN and LSTM model on OpenPose data is considered very effective and perfectly classifies all eight yoga postures of Surya Namaskar. It is also possible to use native CNN and SVMs but according to the result, SVM does not work with large datasets [2].In IEEE 2021, Ajay Chaudhari, Omkar Dalvi and Prof.Dayanand Ambawade published a paper: "Yog-Guru: Real-Time Yoga Pose Correction System using deep learning methods" In this project there is a system which consists of the pipeline for pose identification and then point localization on the human body and then followed by error identification process. Using deep learning techniques, the system can analyse the pose of the user from the front view and give feedback on their poses [3]. In 2022, Vivek Thoutam, Anugrah, Shrivastava, Vipul Mishra, and G.R.Sinh proposed that the Multilayer perceptron(MLP) is used for human pose classification, Angles between key points have been computed and passed as input for MLP.MLP power is much lower than CNN+LSTM the proposed approach maintains low computational complexity.

1.3 Motivation

Human pose estimation is a challenging problem in the discipline of computer vision. To automatically Detecting a person's pose in an image is a difficult task asit depends on several aspects such as scale and resolution of the image, illumination variation, background clutter, clothing variations, surroundings, and interaction of humans with the surroundings.

1.4 Project Scope

This system aims at helping people to perform Surya Namaskar correctly on their own and prevent injuries that can happen due to incorrect practices in Surya Namaskar. Using deep learning techniques, the system can see the user's pose from the front view and give feedback to them r improving their Surya Namaskar pose.

1.5 Assumptions and Dependencies

Before the implementation of the project can be done, some assumptions are needed to be made:

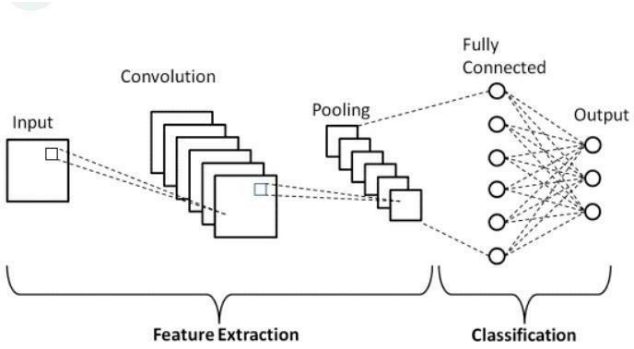
1. There shouldn't be any missing parts in the video.
2. The video captured should be clear.
3. The asanas should be visible.

1.6 Proposed System

The proposed system takes video sequence frames as input in real time. The output would be the predicted yoga pose along with possible feedback for angle and pose correction. The system consists of three main phases: Keypoints extraction, Pose prediction and Pose correction. Keypoints extraction phase does the job of detecting and extracting the location of important key points based on the user's position. The pose prediction phase defines the model architecture and classifies if the pose is correct or not. The final phase is pose correction where the user is further given feedback for the correction of the pose and is also shown the similarity percentage to the actual pose. Figure 1 shows the proposed system architecture with all the above phases.

2. MODEL TRAINING

CNN is a kind of neural organization which is broadly utilized in the PC vision space. It has ended up being exceptionally successful with the end goal that it has become the go-to strategy for most picture information. CNNs comprise at least one convolutional layer which is the main layer and are mindful for include extraction from the picture. CNNs perform include extraction utilizing convolutional channels on the information and examining a few pieces of the contribution at a given time before sending the yield to the ensuing layer. The convolutional layer, using convolutional channels, creates what is known as an element map. With the assistance of a pooling layer, the dimensionality is decreased, which decreases the preparation time and forestalls overfitting. The most well-known pooling layer utilized is max pooling, which takes the most extreme incentive in the pooling window. CNNs show an extraordinary guarantee in present characterization assignments, in this way making it an exceptionally attractive decision. They can be prepared on key points of joint areas of the human skeleton or can be prepared legitimately on the pictures. [4] utilized CNN to distinguish human postures from 2D human exercise pictures and accomplished a precision of 83%. Then again, [5] utilized CNN on OpenPose key points to arrange yoga presents and accomplished a precision of 78%. Even though the exactness isn't similar to the dataset alongside the CNN engineering and activities being ordered are extraordinary, [5] shows how utilizing CNNs on OpenPose key points merits investigating. On account of key points, CNN removes highlights from the 2D directions of the OpenPose key points utilizing the equivalent convolutional channel strategy clarified previously. In light of the channel size, the convolutional channel slides to the following arrangement of information. After the convolution, an initiation work Redressed Logistic Unit (ReLU) is commonly applied to add nonLogisticity in the CNN, as the genuine world information is generally nonLogistic and the convolution activity without anyone else isstraight. Tanh and sigmoid are other enactmentcapacities, yet ReLU is generally utilized due to itsbetter exhibition.



2.1 System Requirements

2.1.1 Technical Requirements

1. Frontend: Tkinter
2. Backend: Python
3. Model: CNN
4. Technology: OpenCV, MediaPipe, Logistics Regression

2.1.2 Hardware Requirements

1. i5 Processor
2. 1TB HDD
3. 8GB RAM
4. GPU 4GB

3. METHODOLOGY

The proposed system automatically extracts the user's posture from the webcam and monitors 17 major body points from the camera image of the user performing asanas to determine the pre-defined acceptable It is intended for comparison with a collection of similar yoga postures. The procedure consists of four stages.

They are:

- Pose extraction through Webcam
- Key-point extraction
- Application of ML Algorithm
- Error estimation and feedback

A. Pose extraction through Webcam

The initial step is to extract the pose from the webcam. Any traditional webcam is used to capture real-time video of the practitioner practising a yoga pose. This feed from the webcam is then used for key-point extraction.

B. Key-point extraction

A webcam collects real-time images while performing poses. From now on, we use media pipes to extract 17 body points from the stream as shown in the image. The extracted points are saved in a CSV file and compared to set point values in the training data based on the positions and angles between them. Fig. 1. 17-Key points identified by the model.

MediaPipe:
MediaPipe is an open-source cross-platform framework developed by Google that provides tools and building blocks for building real-time multimedia processing pipelines. It offers a wide range of capabilities for processing and analyzing multimedia data, including video, audio, and 3D data. MediaPipe focuses on providing a framework for constructing pipelines that can be used for various applications, such as augmented reality, gesture recognition, object detection and tracking, face detection, and more. It abstracts away the low-level details of multimedia processing and provides a high-level interface for developers to build applications quickly and efficiently. MediaPipe supports various platforms, including Android, iOS, desktop operating systems (Windows, macOS, Linux), and even web browsers. It provides language bindings for C++, Python, and Java, allowing developers to work with the framework using their preferred programming language. One of the key features of MediaPipe is its ability to leverage hardware acceleration, such as GPUs and specialized chips (e.g., Google's Edge TPU), to achieve real-time performance and efficiency in multimedia.

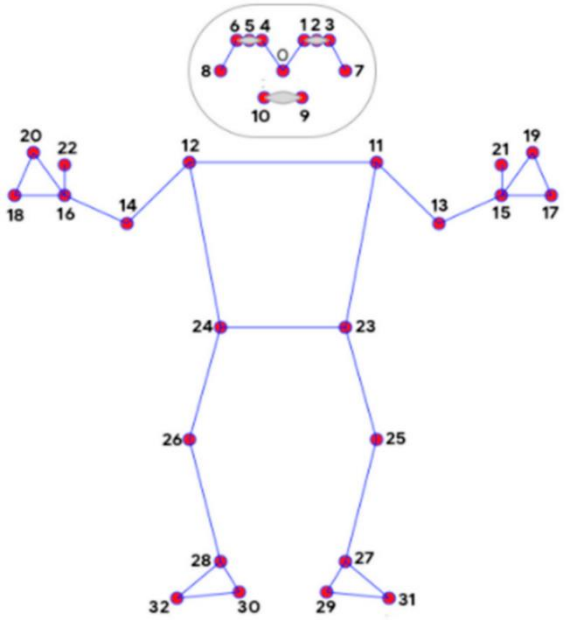


Fig. 1

No	Key point	No.	Key point	No.	Key point
0	Nose	6	Left elbow	12	Left knee
1	Neck	7	Left wrist	13	Left foot
2	Right shoulder	8	Right hip	14	Right eye
3	Right elbow	9	Right knee	15	Left eye
4	Right wrist	10	Right foot	16	Right ear
5	Left shoulder	11	Left hip	17	Left ear

C. Application of ML Algorithm

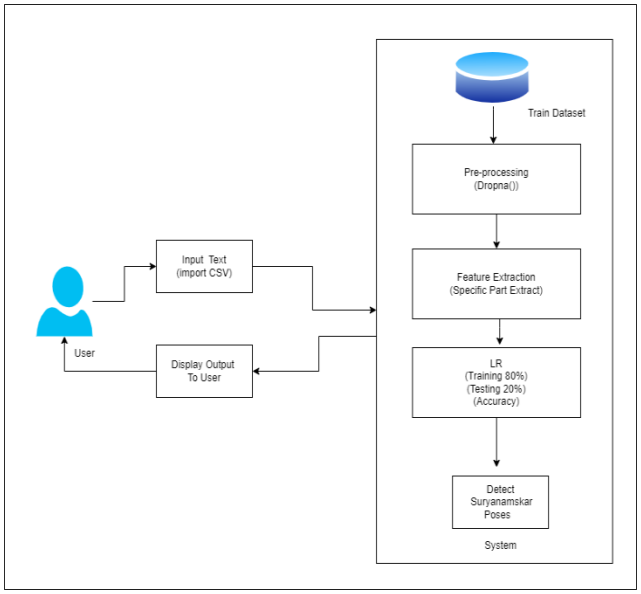
It uses ML techniques to predict errors and classification techniques to provide feedback. This is effectively done with the help of CNN. Convolutional Neural Networks (CNNs) perform well in computer vision problems such as image classification and object detection, especially for large data sets. The first step in identifying the wrong part of a particular pose is identifying the pose itself. This is done via a CNN classifier for different yoga poses by creating pose key points and skeletal annotations from a CSV file.

D. Error Estimation and Feedback

The model then compares key points derived from the User image to a predefined set of reference keys the point of building the ideal body for this asana. or Position of each key point If an adjacent key point is tested and an error occurs or if a mismatch is detected, a text message and A voice

The message is displayed to guide the user Make necessary adjustments to the current pose Fix the error.

4. SYSTEM DESIGN DIAGRAM



4. CONCLUSION

We propose that a Surya Namaskar self-learning system can not only popularize Surya Namaskar but also ensure that it is performed correctly. The use of hybrid CNN and Logistic regression models on Media Pipe data is considered very effective and perfectly classifies all postures of Surya Namaskar. It is also possible to use native CNNs and SVMs, but SVMs donot work with large datasets. This is less efficient than CNN + Logistic regression-based models. Therefore, this project will help people to perform the Surya Namaskar postures accurately and effectively without a mentor.

REFERENCES

[1] Anurag Sinha, "Yoga pose detection and classification using deep learning", International Journal of Scientific Research in Computer Science Engineering" Nov 2020 https://rb.gy/rxz38

[2] Abhishek Sharma, Pranjal Sharma Darshan Pincha, Prateek Jain "Surya Namaskar: Real-Time Advanced Yoga Pose Recognition And Correction for smart Healthcare," November 2020 https://rb.gy/oyhqq

[3] Ajay Chaudhari, Omkar Dalvi, Onkar Ramade Prof. Dayanand Ambawade "Yog-Guru: Real-Time Suryanamaskar Pose Correction System Using Deep Learning Methods" IEEE 2021 https://rb.gy/9k84p

[4] Vivek Thoutam, Anugrah Srivastava, Vipul Mishra, G.R.Sinha "Suryanamaskar Pose Estimation and feedback Generation using deep learning" https://rb.gy/pim95

[5] Dr Maya Bembde, Swapnali Barude, Pradnya Shinde, Tejaswini Thorat, Deepak Thakar, "Yoga Posture Detection and Correction System" July 2022

[6] Jothika Sunney "Real-Time Yoga Pose Detection using Machine Learning Algorithm", Aug 2022

[7] Varsha Bhosale, Pranjal Nandeshwar, Abhishek Bale, Janmesh Sankhe "Yoga Pose Detection and Correction using Posenet and KNN" April 2022

[8] Y. Agrawal, Y. Shah, and A. Sharma, "Implementation of Machine Learning Technique for Identification of Yoga Poses," IEEE 9th International Conference on Communication Systems and Network Technologies (CSNT). Apr. 2020

[9] Utkarsh Bahukhandi, Dr Shikha Gupta "Yoga pose detection and classification using ML techniques" Dec 2021

[10] Shivani Balakrishnan, Shriya S, Srajana, Vaishnavi N, Dr Kavitha C, "The Ai Yoga Trainer Using Artificial Intelligence And Machine Learning" Jan 2023