International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 07 | July - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

Yoga Pose Detection Using Machine Learning

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Abstract - A long-standing issue in computer vision, human pose estimate has presented a number of difficulties in the past. Many industries, including videosurveillance, biometrics, assisted living, at-home health monitoring, etc., benefit from human activity analysis. Today's fast-paced lifestyles often lead to people preferring individuals feel the need for a teacher to evaluate their technique even when they are able to work out at home. A self-instructional workout system can be made using human pose recognition to help people learn. and practise exercises appropriately on their own as these resources are not always readily available. This project discusses several machine learning and deep learning approaches to precisely categorise yoga positions on prerecorded movies as well as in real-time, laying the groundwork for developing such a system. The project also covers a variety of Describes various deep learning models used for posture classification in depth and describes pose estimation and keypoint detection techniques.

Keywords – Human pose estimation, yoga, openpose, machine learning, deep learning

1. INTRODUCTION

Ancient India is where yoga, a physical, mental, and spiritual practise, first appeared. The Sanskrit word "yuj," which meaning to connect or merge, is where the word "yoga" originates.

People who practise yoga consistently and more readily have better physical and emotional wellness. It offers a practical and accessible way to practise yoga and enables individuals to tailor their practise to suit their own needs and objectives.

The creation of the suggested system is the initial stage of the project scope. This entails creating the programme that will classify yoga positions instantly using deep learning, image processing, and LR algorithms.

With the use of posture, meditation, and a variety of alternate breathing practises, it is customary to bring harmony to each body and mind. It helps to calm the mind. Yoga has gained popularity all around the world as a result of the increased stress in the modern lifestyle. Yoga can be learned in a number of different methods. The majority of people prefer self-learning but struggle to identify the proper alignment of their yoga poses on their own.

and other negative emotions, making it the finest prescription for a healthy existence. The field of computer vision has difficulties when estimating human position. It is challenging to instantaneously identify a person's stance in a photograph since a person's position depends on a variety of factors, including the image's size and resolution, lighting, background clutter, clothing, surroundings, and how people interact with their environment. There are many different yoga asanas, therefore coming up with a pose estimate model that works for all of them is a difficult task. Overall, creatinga system for classifying yoga poses using machine learning and image processing can improve practitioners'access to, effectiveness of, and efficiency of their yoga practise.

The technique seeks to give practitioners immediate feedback on the accuracy of their poses, assisting them in adjusting their alignment and posture and enhancing the efficacy of their practise.

In order to enable practitioners to interact with the system and view feedback on their performance, the system intends to provide a user-friendly interface that is simple to use and comprehend.

2. Literature Survey

Paper [1]: Implementation of Machine Learning Technique for Identification of Yoga Poses
Abhishek Sharma, Yash Agrawal, and Yash ShahMany individuals all over the world now do yoga as a regular part of their lives. Because of this, y postures require scientific analysis. Pose identification algorithms have been shown to help people practise yoga more accurately by helping them recognise the postures. Due of the scarcity of datasets and the difficulty of real-time posture detection, posture recognition is a difficult undertaking. To solve this issue, a sizable dataset with at Yoga helps to alleviate stress, tension, depression, least 5500 photos of ten different yoga poses was compiled using the tf-pose estimation Algorithm, which sketches the human body's skeleton in real time.
Paper [2] : Recognition Of Yoga Poses Using EMG Signals From Lower Limb Muscles
In order to confirm that the lower muscle movements made during yoga practise are accurate, this research provides a posture identification system for the discipline. Ten subjects—five men and five women—were enrolled in the study. Five poses of yoga were used to get the data. In this research, the electromyography

limb muscles in both legs. Three machine learning methods for recognition were used. The analysis revealed that the Random Forest Decision Tree algorithm, when compared to other algorithms, has the highest accuracy in identifying yoga postures, with an accuracy rate of 87.43%.

Paper [3] : Real-Time Yoga Pose Detection using Machine Learning Algorithm

Yoga is an age-old practise that promotes both mental and physical wellbeing. Yoga encourages self-learning, yet bad posture can seriously harm your muscles and ligaments. Self-learning yoga techniques have become more significant during Covid-19, and many people now include yoga into their daily activities. A yoga position identification system based on machine learning and human pose assessment methods can help individuals perform yoga correctly on their own.

Paper [4] : Microsoft Kinect is used to recognize yoga poses by tracking human joint points in real time.
In this work, we have introduced a system that helps users practice yoga by monitoring the movement of various body parts and the accuracy of various yoga positions. Using Microsoft Kinect to identify numerous joint locations of the human body in real time, we have evaluated the correctness of specific yoga postures for a user. We computed various angles using those joint sites. Our proposed method might correctly recognize various.

Paper [5] : Real-time Yoga recognition using deep learning
In this paper, a method for applying deep learning algorithms to recognise various Yoga asanas has been provided. Using 15 people (ten men and five women) and an ordinary RGB webcam, a dataset of six yoga asanas—namely, Bhujangasana, Padmasana, Shavasana, Tadasana, Trikonasana, and Vrikshasana—was produced and made available to the public. Convolutional neural network (CNN) layer is used to extract features from keypoints of each frame obtained from OpenPose and is followed by LSTM to give temporal predictions in a hybrid deep learning model for yoga recognition on real-time videos.

3. DATASET

The dataset was developed in a way that makes it useful for model training and model testing. With the aid of web scraping, the dataset was gathered. Scripts for Web 4 scraping have been developed to scrape images as intended. To construct and acquire the dataset's collection of photos, a web scraper was developed.
As per the project's specifications, this has been divided into five folds. The collected dataset needs to be cleaned. Manual labour has been used to clean.

4. METHODOLOGY

Through the use of web scraping, a dataset of five poses was created. The data set is prepared for usage after being cleaned and processed. The photos are changed to the desired format after loading the data set. We counted the amount of landmarks on the human body using Mediapipe.These findings led to i.

H. To determine the established pose, landmark positions that have been created are used. used to train models.

The following classification methods were employedin the project.
The statistical technique of logistic regression, sometimes referred to as the logit model, is frequently utilised in ML applications as well as predictive analytics and modelling. The dependent variable in this analytical strategy might be categorical or finite, consisting of the options A or B (binomial regression) or a group of the possibilities A, B, C, or D (multinomial regression). By estimating probabilities with the aid of logistic regression equations, statistical software can be utilised to comprehend the relationship between a dependent variable and one or more independent variables.

• A random forest classifier is an ensemble of several different decision trees working together. In a random forest, every tree spits out a class.

A Gradient Boosting Classifier is a special kind of ensemble learning technique that combines numerous weak learners (low-accuracy predictions) to produce a strong learner (high-accuracy model). It works by requiring each model to consider the shortcomings of its predecessor.

• The ANN Classifier is a supervised machine learning method that counts on nearby similarities. predicts a new data point's class or continuous value based on its K closest neighbours.

•The Ridge Classifier uses a regression approach to solve the problem by converting the label data to a range of [-1, 1].
When dealing with multiclass data, multi-output regression is used. The target class is recognised to be the one with the greatest predicted value.

5. IMPLIMENTATION

The main objective of the research is to develop a system that can instantly distinguish a performer's yoga stance. The project can forecast in real time if the user is

carrying out the task correctly or not. Our aim is to provide precise stance detection and accurately forecast five frequent yoga positions. The positions of Downward Dog, Plank Tree, Goddess, and Warrior-2 are our main focus as a group of six people. Our project will aid users in their yoga study and assist them improve.

• without the involvement of or care for a third party, his or her way of life. Our project is really helpful since it ensures appropriate social distance, particularly during the pandemic. We have started comparing various classifiers for the classification of yoga poses. Ridge Some of these classifiers include KNN Classifier, Gradient Boosting Classifier, Random Forest

• Classifier, and Logistic Regression Classifier. The use of these classification techniques has helped to more accurately produce the best results. The dataset was gathered using

web scraping. The objective was to gather the photos in a way that would yield the best outcomes. The dataset was hand-cleaned for each of the five allocated positions.

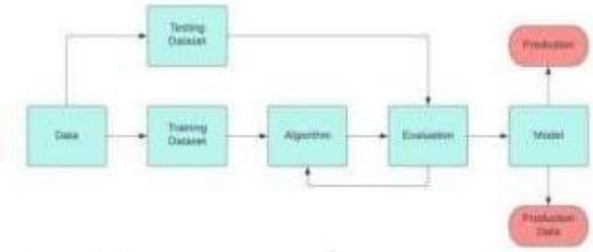

Fig. 4. It showcases the complete workflow of the project. It has the involvement of testing ang training dataset brief description.

A classification model has been created to accurately predict yoga positions. It has been suggested to evaluate the performance of the classification algorithms. For each approach we have used, it has been done with the aid of a confusion matrix. The project comprises a variety of aspects that have been divided into various modules and components. The creation of the project was facilitated by the integration of these elements at multiple stages.

• Creating the Dataset: As described in the section on datasets, we collected the data using web scraping. The dataset has been manually cleaned in order to improve it. The image is discarded if it isn't good enough. Image 7 is included in the dataset if it satisfies the requirements. A variety of techniques can be used to clean up datasets.

• Establishing Landmarks: Landmarks have been used to help implement the algorithms. The predetermined landmarks have been populated with the help of MediaPipe. If landmarks were found, they are recorded in the CSV file. Missing landmarks can be addressed through exception handling.

6. Result

The issue our endeavour set out to address and help our users with was slightly more totally remedied than had been the case with prior initiatives by various folks due to the precision and sensitivity we obtained. We examined many algorithmic models on our data in this case to see which was the best fit for the task and, in our case, provided an accuracy of approximately 98%.

Conclusion We began looking for a solution to help people correct their posture, as well as ways to create a learning environment that allows people to do so in the comfort of their own homes even if they do not have access to or cannot pay a personal trainer. And thanks to our diligence and good fortune, we were able to develop a platform that allows users to assess their own performance in the process and even make improvements. Our model gives you an accurate assessment of your posture in preparation for your reference offers a simple user interface to assist you in fixing problems and bettering yourself.

Fig.1 Detecting pose 1

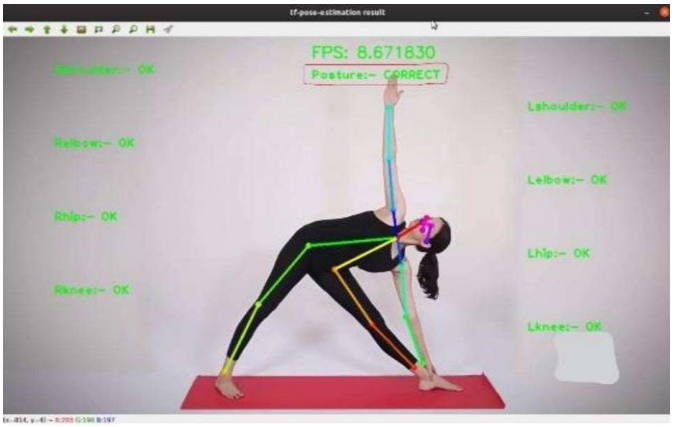

Fig.1 Detecting pose 2

7.CONCLUSION

Due to the rapid advancement of computer vision, new posture estimation methods and models will soon supplant the tried-and-true methods of today. In the future, we would absolutely be interested in applying better models and techniques to enhance the model. Additionally, it is intended to continue our work with a few more well-known yoga postures. We may also be able to improve the model we develop by incorporating new, improved, and complete datasets that are easier to use.

Additionally, UI components may be added to the project in order to establish a brand-new design language. The development of a native or online application will also aid in the dissemination of this concept.

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