



Angle Heuristics Approach to determine angle of poses based on AI

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Abstract : In recent years, yoga has become part of life for many people across the world. Due to this there is the need of scientific analysis of y postures. It has been observed that pose detection techniques can be used to identify the postures and also to assist the people to perform yoga more accurately. Recognition of posture is a challenging task due to the lack availability of dataset and also to detect posture on real-time bases. To overcome this problem a large dataset has been created which contain different yoga pose and used a tf-pos estimation Algorithm which draws a skeleton of a human body on the real-time bases. Angles of the joints in the human body are extracted using the tf-pose skeleton and used them as a feature to implement various machine learning models. 80% of the dataset has been used for training purpose and 20% of the dataset has been used for testing. This dataset is tested on different Machine learning classification models and achieves an accuracy of 99.04% by using a Random Forest Classifier.

Keywords - Artificial Intelligence, Deep Learning, Human Pose Estimation, Machine Learning, Open pose, Python, Yoga

I. INTRODUCTION

Yoga is one in all the most effective exercises that we tend to all waste our lifestyle Yoga-Tracker classifies numerous Yoga poses and not simply static footage however additionally real time yoga poses performed before of the camera. It tracks however long you hold a yoga cause and keeps a journal that motivates you in your journey. It educates users of varied poses and it's advantages beside correct steering on a way to perform them. It boasts of compatibility over all devices, Web, golem and IOS. Yoga cause estimation from video or a period feed plays an important role in numerous fields like full-body gesture management, quantifying physical exertion, and signing recognition. Angle Heuristics may be a technique that is employed to seek out the angle between the poses that ar performed before of internet camera.

1.1 how it works?

G. Ning, P. Liu, X. Fan and C. Zhan [9] to coach the model with detection of various yoga poses we tend to initial of all install all the specified libraries and modules like mathematics, OpenCV, matplotlib, TensorFlow, media pipe and NumPy. By mistreatment these modules and library we tend to ar playacting our project and trained our system to discover the yoga cause by giving it an information that is image and moreover as real time video. Media Pipe provides a strong resolution capable of predicting cardinal 3D landmarks on a personality's body in period with high accuracy even on central processing unit. It utilizes a ballroom dancing machine learning pipeline, by employing a detector it initial localizes the person inside the frame and so uses the cause landmarks detector to predict the landmarks inside the region of interest. For the videos, the detector is employed just for the terribly initial frame and so the ROI springs from the previous frame's cause landmarks employing a pursuit technique. Also, once the huntsman loses track of the determine body cause presence

during a frame, the detector is invoked once more for consecutive frame that reduces the computation and latency.

1.2 which techniques used?

Gao Z, Zhang H, Liu AA et al (2016) [10] Yoga is originated in ancient Asian country and it's a bunch exercise related to mental, physical and religious strength. Yoga and sports are attracting peoples from such a big number of years however from the last decade, an outsized range of individuals are adopting yoga as a part of their life. This can be thanks to the health advantages. It's necessary to try to do this exercise in right manner specially in right posture. It's been ascertained that someday thanks to lack of help or information folks don't recognize the right technique to try to do yoga and begin doing yoga with none steering, therefore they injure them-self throughout self-training thanks to improper posture. Yoga ought to be done underneath the steering of a trainer however it's additionally not reasonable for all the peoples. These days folks use their mobile phones to be told {how to the manner to a way to} do yoga causes and begin doing that however whereas doing that they don't even recognize that the yoga pose they're doing is within the right way or not. To beat these limitations, several works are done. PC vision and information science techniques are accustomed build AI package that works as a trainer. This package tells concerning the benefits of that cause. It additionally tells concerning the accuracy of the performance. Mistreatment this package one will do yoga while not the steering of a trainer. To use machine learning and Deep learning modules an outsized range of image dataset has been created.

II. LITERATURE SURVEY

U. Rafi [1] To avoid this drawback the pose rule has been used. This rule creates a skeleton of a person's body and provides the required info concerning the joint within the physique. Victimisation this one will realize the coordinates of the joints and use that as a feature to notice the posture of a body. Paula Pullen, William Seffens used visual Gesture Builder feature of Kinect detector that went to capture yoga postures with high accuracy. Edwin W. Trejo, Peijiang Yuan has additionally used Microsoft Kinect v2 which supplies additional accuracy and preciseness except for an additional complicated model, it needs additional machine time. The Kinect camera may be a device that works on three things (depth, colour, and body tracking). Victimisation all the options of the Kinect device they develop a PC Interaction system for coaching purpose a commercial boost rule has been used to acknowledge half dozen common yoga poses. Several authors have worked on completely different applications of Kinect device and came to a conclusion that it works well for depth, color and body pursuit.

S. Patil. [2], describes that Human posture recognition has created large advancements within the past years. It's evolved from 2D to 3D create estimation and from single person to multi person create estimation. Uses create estimation to create a machine learning application that helps notice shoplifters whereas uses one RGB camera to capture 3D poses of multiple individuals in period of time. ANN is associative analogous to the human brain wherever the units in an ANN represent the neurons within the human brain, and weights represent the strength of affiliation between neurons. Deep learning provides associative end-to-end design that permits automatic learning of key info from pictures. One standard deep learning model that has been widely used for create.

S. Haque [3], describes that the planned models at once characterize simply half dozen yoga asanas. There square measure numerous yoga asanas, and afterwards creating a posture assessment model which will be effective for all the asanas may be a testing issue. The dataset is extended by adding additional yoga presents performed by individuals in indoor setting likewise as out-of-doors. The exhibition of the models depends upon the character of OpenPose gift assessment which can not perform well in instances cowl|of canopy} between people or cover between body elements. A convenient contrivance for self-preparing and constant forecasts is dead for this framework. This work exhibits movement acknowledgment for cheap applications. A technique medical services so forth Multi individual posture assessment may be a wholly completely different issue in itself and encompasses a deal of degree for analysis.

L. Sigal [4] Researches are done on yoga create detection and correction. Some researchers have used a Kinect device to create a personality's posture. This device wants to capture the pictures however the vital half is that this device contains associate built-in infrared optical maser projector, a multiarray mike associated an RGB camera want to capture the color and depth pictures. This device additionally encompasses a tool that produces a personality's body skeleton in 3D house which supplies the data concerning the coordinates of the joint of the body. This methodology is nice however the most disadvantage of this methodology is that the Kinect device is dear and not easy.

D. Mehta, O. Sotnychenko, F. Mueller and W. Xu [5], Human create estimation algorithms is wide organized in 2 ways that. Algorithms prototyping estimation of human creates as a geometrical calculation square measure classified as generative strategies whereas algorithms modelling human pose estimation as a picture process drawback square measure classified as discriminative strategies One vital learning-based methodology is deep learning that is made upon Artificial Neural Networks (ANNs).

W. Gong, X. Zhang, J. Gonzàlez, A. Sobral, T. Bouwmans, C. Tu, and H. Zahzah [6], The subject is in the nature of the vulnerable and wide range health diseases of which musculoskeletal disorders may be a crucial arena and needs urgent attention. Once a year an outsize range of individuals are affected from various sorts of musculoskeletal disorders due to accidents or aging problem [1]. Human pose estimation may be a challenging problem within the discipline of computer vision. It deals with localization of human joints in a picture or video to make a skeletal representation.

M. Islam, H. Mahmud, F. Ashraf, I. Hossain and M. Hasan [7], Nowadays, yoga is that the part of existence during a number of the people. The human pose estimation is that the deep rooted trouble in computer vision. That has exposed in many challenges inside the beyond. They have many fields to capture the posture like video surveillance, biometric, webcam, sort of the equipment, etc. The pose detection techniques have observed and it'll be used to identify the posture and thus the accuracy of the yoga posture in machine learning techniques.

A. Singh, A. Gupta, and J. Raheja [8], To classify the yoga asana for Sun salutations set of postures in four machine learning models and pose estimation algorithm for a person's body is used for skeleton drawing in the real-time. Sun salutations set of posture are often collected the important time and used for the estimation of a pose algorithm for the accuracy result of yoga poses. We have used for various parameters. The find the results of classify of four machine learning technique during a sun salutation set of posture. Find the accuracy of knowledge in machine learning technique.

G. Ning, P. Liu, X. Fan and C. Zhan [9], This paper to classify the sun salutation yoga poses and which machine learning technique get the currency results of the pose. We have collected the info in one male participant. Their age, weight, height is often regarded. To detect the yoga pose supported the angle draw out from the skeleton joint of the estimation of a pose algorithm.

Gao Z, Zhang H, Liu AA et al [10], Angles of the joints in the human body are extracted using the tf-pose skeleton and used them as a feature to implement various machine learning models. 80% of the dataset has been used for training purpose and 20% of the dataset has been used for testing. This dataset is tested on different Machine learning classification models and achieves an accuracy of 99.04% by using a Random Forest Classifier.

Diane Richmond, Kathleen Castro, Vaibhavi Rathod, Thais Medeiros da Costa Dias, Nelson Marinho de Lima Filho, Judith Meer, and Smita Rao [11], Yoga is originated in ancient India and it is a group exercise associated with mental, physical and spiritual strength. Yoga and sports have been attracting peoples from so many years but from the last decade, a large number of people are adopting yoga as part of their life. This is due to the health benefits. It is important to do this exercise in right way specially in right posture.

Yash Agrawal, Yash Shah, Abhishek Sharma [12], Yoga should be done under the guidance of a trainer but it is also not affordable for all the peoples. Nowadays people use their mobile phones to learn how to do yoga poses and start doing that but while doing that they don't even know that the yoga pose they are doing is in the right way or not. This dataset is tested on different Machine learning classification models and achieves an accuracy of 99.04% by using a Random Forest Classifier.

III. METHODOLOGY

3.1 OPENPOSE

A. Singh, A. Gupta, and J. Raheja [8] Open create could be a multi-person period key purpose detection that brought a revolution within the field of create estimation. it absolutely was fictitious in Carnegie Andrew W. Mellon University (CMU) by the sensory activity Computing workplace. It uses CNN primarily based design to spot facial, hand and foot key points of a personality's body from single pictures. Open create helps establish physical structure joints victimisation AN RGB camera. Open create key points embody eyes, ears, neck, nose, elbows, shoulders, knees, wrists, ankles and hips. It presents the results obtained by process inputs from a camera in period or pre-recorded videos or static pictures as eighteen easy key points. thanks to this, it finds its use during a type of applications starting from sports, police investigation, activity detection to yoga create recognition. The work planned in uses Open create for initial key purpose identification followed by CNN for classification of yoga poses. However, they win AN accuracy of solely seventy eight that may be because of the restricted dataset they used or design and hyperparameter calibration of their CNN model. the primary stage in Open create is sleuthing key points of each person within the image that is followed by assignment elements to every distinct individual. Open create network starts with extraction of options from the image victimisation the initial layers. These options square measure then passed to 2 convolutional layer branches that run in parallel. A prediction of eighteen confidence maps, that represents specific elements of the physical structure, is formed by the primary branch. On the opposite hand, thirty eight half Affinity Fields (PAF) that denote the association degree between elements is foretold by the second branch. additional stages square measure wont to create refinement to the predictions made up of the previous branch. Bipartite YOGA create CLASSIFICATION victimisation DEEP LEARNING ten graphs square measure shaped between completely different elements victimisation half confidence maps. The links that square measure weaker in these graphs square measure removed victimisation the PAF values. With these steps, human skeletons square measure calculable for each person within the frame or image.

3.2 POSENET

D. Mehta, O. Sotnychenko, F. Mueller and W. Xu, "XNect [5] create internet is another deep learning framework the same as Open create that is employed for identification of human poses in pictures or video sequences by characteristic joint locations during a physical structure. These joint locations or key points square measure indexed by "Part ID" that could be a confidence score whose price lies within the vary of zero.0 and 1.0 with 1.0 being the best. The create internet model's performance varies counting on the device and output stride. The create internet model is invariant to the scale of the image, so it will predict create positions within the scale of the particular image no matter whether or not the image has been downscaled. In create internet, the softmax layer is replaced by a sequence of totally connected layers. the primary element within the design is AN encoder that is chargeable for generating the cryptography vector v , a 1024-dimensional vector that's AN encoded illustration of the options of the input image. The second element is that the localizer that generates vector u that denotes localization options. The last element could be a regressor that consists of 2 connected layers that square measure wont to regress the ultimate create.

3.3 PIFPAF

L. Sigal. create estimation [4] PifPaf could be a new methodology supported the bottom-up approach for second multi-person human create estimation. It uses a locality Intensity Field (PIF) for part localization and a locality Association Field (PAF) for association of body elements to make full human poses. The model beats alternative strategies in terms of a lower resolution and higher performance in overcrowded places primarily because of the following: (a) fine data encoded during a newer composite field PAF, (b) the choice of astronomer loss that integrates AN opinion of uncertainty. The model design rests upon a totally convolutional box-free style. The input image is of size (H, W) . it's the RGB channels that is shown by 'x3'. The encoder is predicated on neural networks, and it generates the PIF field with seventeen x five channels and PAF field with 19×7 channels. '//2' represents AN operation with strides of two. The PIF and PAF fields square measure born-again by the decoder into create coordinates that have seventeen joints every. each joint could be a second.

IV. DATASET COLLECTION

W. Gong, X. Zhang, J. González, A. Sobral, T. Bouwmans, C. Tu, and H. Zahzah, [6] Currently, finding a precise and effective yoga-pose dataset on the web is a challenge in itself. YOGI dataset is a mixture of both standing poses and sitting poses, it makes use of the whole body in depicting any yoga pose. The poses have a variety of different hand and leg folds which make it difficult for posture detection algorithm to work efficiently. Realizing the above problem, YOGI dataset consist of 10yoga poses which were captured using burst

feature of the DSLR camera. The images were taken with high precision and accuracy. There are 10 yoga poses, each class containing around 400 to 900 images. The complied Colour Image dataset consists of 5459 images. Yoga-pose of four classes are shown in Fig.1



Fig. 1 Images of Yoga Dataset

Collecting data manually of a huge volume requires a lot of effort, attention and precision. Listed below is the procedure. A closed room was used to avoid any use of direct sunlight to get images without any reflection or glare. M. Islam, H. Mahmud, F. Ashraf, I. Hossain and M. Hasan [7] The camera was mounted and adjusted on a tripod with an appropriate frame centering the person performing the yoga poses, and the distance was maintained around 4 to 5m between the camera and the person. The background was kept plain white to enhance and distinguish the yoga poses done by the person.

Images of every pose were clicked from multiple directions and angle with the motion to capture every form of the pose, This helped to create a mixed real-time dataset. Images of each pose were clicked in continuous mode ,25 images in a single go.

V. ALGORITHM

The algorithm for the proposed system is as follows:

- Step 1. Import all necessary packages (math, NumPy, Matplotlib, OpenCV, mediapipe and time)
- Step 2. Initialize the pose detection model.
- Step 3. Specify the path of the dataset.
- Step 4. Loop through each file in the dataset folder and map labels for that particular file.
- Step 5. Perform Pose Detection using installed libraries.
- Step 6: Landmark on the dataset and creating a 3D image.
- Step 7: Create a Pose Detection Function.
- Step 8: Pose Classification with angle Heuristics.
- Step 9: Create a function to calculate angle between landmarks.
- Step 10: Create a function for pose 19 classifications.
- Step 11: Make detection using test data.

VI. PARTIAL RESULTS

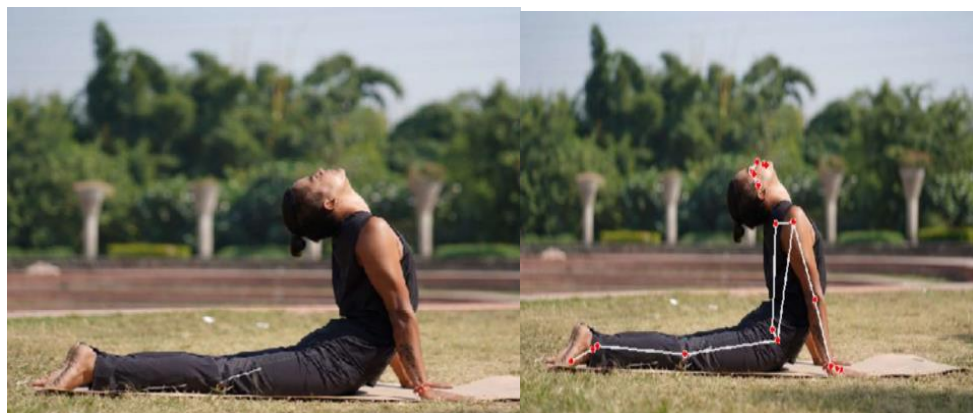


Fig. 2 Image without landmark

Fig. 4 Image with landmark

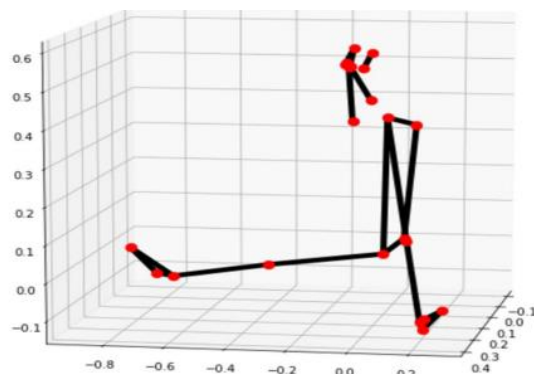


Fig. 4 3-D image of above images

J. Palanimeera , K. Ponmozhi [13] MediaPipe provides a robust solution capable of predicting thirty-three 3D landmarks on a human body in real-time with high accuracy even on CPU. It utilizes a two-step machine learning pipeline, by using a detector it first localizes the person within the frame and then uses the pose landmarks detector to predict the landmarks within the region of interest. For the videos, the detector is used only for the very first frame and then the ROI is derived from the previous frame's pose landmarks using a tracking method. Also, when the tracker loses track of the identify body pose presence in a frame, the detector is invoked again for the next frame which reduces the computation and latency.

CONCLUSION

In this paper, a system is suggested that classify ten yoga poses and the dataset upholds on six classification models of machine learning. The yoga pose is detected based on the angles extracted from the Skeleton joints of TF pose estimation algorithm. 94.28% accuracy altogether was attained of all machine learning models. The data pre-processing and model training was done on Jupiter notebook. Future ideas also include expansion of YOGA dataset on more yoga poses and implement deep learning modules for better performance. In addition to that an text guidance system will also be included.

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