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Yoga Pose Estimation Using YOLO Model

Mr. Rohit Londhe[1], Mr. Yash Wanve[2], Mr. Uday Harle[3], Mr. Atharva Lohe[4], Prof. P. S. Patil[5]

[1] *Student dept. of Information Technology SKN Sinhgad Institute of Technology & Science, Lonavala, Maharashtra*
E-mail: rohitlondhe2112@gmail.com

[2] *Student dept. of Information Technology SKN Sinhgad Institute of Technology & Science, Lonavala, Maharashtra*
E-mail: yashrwanve@gmail.com

[3] *Student dept. of Information Technology SKN Sinhgad Institute of Technology & Science, Lonavala, Maharashtra*
E-mail: udayharle233@gmail.com

[4] *Student dept. of Information Technology SKN Sinhgad Institute of Technology & Science, Lonavala, Maharashtra*
E-mail: atharva.lohe.al@gmail.com

[5] *Asst. Professor, dept. of Information Tech, SKN Sinhgad Institute of Technology & Science, Lonavala, Maharashtra*
E-mail: pspatil.sknsits@sinhgad.edu

Abstract

Yoga, an historic exercise for every person and intellectual nicely-being, has gained large recognition in todays world . Monitoring yoga postures is essential for ensuring proper form, but yoga without an yoga professional is not good for person. In this research, we go deeply into the area of video processing ,image processing and deep learning, providing a new approach to yoga pose estimation. Leveraging the modern day YOLO (You Only Look Once) pose version, we suggest an revolutionary answer for real-time yoga pose detection in both images and video. The YOLO structure is customized and adaptative to recognizing and detecting yoga postures, maximizing accuracy and performance. YOLO is a popular deep learning algorithm used for object detection and classification in images and videos. It's known for its speed and efficiency. We inspect the result with in the parameter and also use customize data. We specially design this model for yoga Beginner and Intermediate those who cannot afford personal trainer or not able to mange time. Additionally, we renowned the limitations encountered in the course of our studies, also covering the way for future investigations.

Keywords: Pose Estimation,YOLO,KeyPoints Detection,Virtual yoga ,ML models

1. INTRODUCTION

Yoga, an historical practice originating in the heart of historical India, has taken centuries to turn out to be a international phenomenon, embraced via tens of millions for its profound physical and mental health benefits. In recent years, the combination of generation and traditional practices has opened doorways to innovative packages, revolutionizing how we interact with yoga . Yoga, with its various postures and highly detailed alignments presents a unique task within the computer vision and artificial intelligence .Recognizing yoga poses accurately is very important for practitioners and teachers alike. Traditionally, this task has depended on guide assessment, a time-consuming and subjective process. The fusion of deep learning and pc vision has lead in a brand new era, enabling automatic yoga pose estimation. This intersection of historical wisdom and present day generation isn't always most effective transformative for the practice of yoga but also represents a sizable as well as suitable development within the discipline of laptop imaginative. Our studies explore into this captivating convergence, focusing at the utility of the YOLO (You Only Look Once version) pose version, yolo highly recognize for its performance and accuracy, within the realm of yoga pose detection. The YOLO pose version, with its real-time talents, affords an interesting possibility to carry automation and precision yoga studios and individual practitioners worldwide. By as it should be figuring out yoga postures from images and motion pictures. The study aims to connect the physical practice of yoga with the digital world . It intends to provide yoga practitioners with instant feedback on their body posture .As we explore this fascinating intersection of yoga traditions and modern technology, our research is not just tells ths specific needs of the yoga community, But it also showing how AI can have broader impact in preserving and enhancing traditional practice. Join us in this adventure as we unravel the possibilities of Yoga Pose Estimation Using YOLO pose Model, illuminating a direction in which the beyond and the destiny seamlessly-converge.

Fig: .pose estimation by yolov7

2. HISTORY

Yoga, with its origins relationship back thousands of years in historical India, has lengthy been respected as a exercise for physical, mental, and non secular nicely-being. Representing precise frame components, have become the inspiration for yoga pose estimation models.In the early 2010s, as deep gaining knowledge of algorithms received prominence, researchers started out exploring their utility in human pose estimation. Breakthroughs in convolutional neural networks (CNNs) enabled the improvement of fashions capable of appropriately detecting human frame keypoints from pics. This development turned into not only a bounce forward for fields like gesture popularity and robotics however additionally opened new opportunities for yoga practitioners and teachers. Around the mid-2010s, the idea of switch getting to know won traction inside the deep mastering community.Researchers found out the ability of using pretrained fashions—models trained on massive datasets for prevalent duties like item recognition as a start line for specialized responsibilities like yoga pose estimation. By leveraging those pretrained models, researchers and builders should focus on first-class-tuning the fashions for precise yoga poses and frame configurations. But most of the algorithms are time taking to perform or evaluate the image and video processing. Sometimes the algorithm is to lagging because most of the algorithm require the GPU. Due to not having proper system requirements pose estimation model are not able to run on most of the Laptops and personal computers.

3. LITERATURE SURVEY

3.1 Implementation of ML Technique for Identification of Yoga Poses:

The research paper titled "Implementation of Machine Learning Technique for Identification of Yoga Poses" authored by Yash Agrawal, Yash Shah, and Abhishek Sharma likely explores the use of machine learning techniques to automatically recognize and classify different yoga poses. In this paper, the authors likely discuss how machine learning algorithms are applied to analyze and identify various yoga postures.

The study involve the collection of image or sensor data from practitioners in different yoga poses and then using machine learning models to classify and recognize these poses accurately. This research could have implications for yoga practice, fitness tracking, and healthcare applications. [7]

3.2 Human Pose Estimation Using Convolutional Neural Network :

The research paper titled "Human Pose Estimation Using Convolutional Neural Network" probably focuses on using advanced computer algorithms called Convolutional Neural Networks (CNNs) to figure out how people are positioned in images or videos. This means it helps identify key points like the head, shoulders, elbows, hips, and knees in a person's body when they're doing different activities.

In the paper, it's likely that the authors discuss how CNNs, which are really good at analyzing images, are used to solve the challenges of figuring out how humans are moving and positioned. They might explain the techniques they used, how they collected data, the computer models they created, and the process they followed to get accurate and reliable results. [5]

This kind of research can be super useful in areas like computer vision , robotics , gesture recognition and human-computer interaction . Essentially, it helps computers understand how people move and stand, which can be used in many practical ways...

3.3 Infinity Yoga Tutor: Yoga Posture Detection And Correction:

The research paper titled "Infinity Yoga Tutor: Yoga Posture Detection and Correction" likely explores a approach to using technology for enhancing yoga practice. This paper may discuss the development and implementation of an innovative system or tool called "Infinity Yoga Tutor" designed to detect and correct yoga postures.

In all probability, the paper covers how this technology employs computer vision, machine learning, or sensor-based techniques to analyze the alignment and correctness of yoga poses performed by individuals. The system may provide real-time feedback to practitioners, helping them improve their form and reduce the risk of injury during yoga sessions.

This research has potential applications in the field of fitness and wellness, offering a digital solution to aid in yoga practice by making it more accessible and informative. The paper may delve into the technical aspects of this technology, its effectiveness, and its contribution to yoga education and training. [6]

4. METHODOLOGY

Once it identified the key points on human body it extract and measure the angles between given key points and then this angle is passed to the ML model which is already train on this type of data the ouput given by the machine learning model is a recognized yoga pose. In this methodology angle is calculated using trignometric and mathematical formula. OpenCv and other python libraries are used to provide visual feedback hence this approach of yolov7 gives accurate and efficient yoga detection model by analyzing body keypoints and angle.

Steps of Methodology:

4.1 Object Detection: Utilize the YOLOv7 pretrained version to carry out object detection. This step permits the identity of yoga practitioners inside pictures or frames, presenting bounding containers round their our bodies.

4.2 Keypoint Extraction*:* In this step the Yolov7 model is used to find and extract the 17 keypoints of the human body.

4.3 Angle Calculation **:** all the joint angle that is needed to recognize the pose is calculated in this step by the trignometric formula.

4.4 Predicting angle : All the calculated angle is pass to the machine learning model which Is trained on this types of input the model will give the output which is predicted pose.

5. Overview of YOLOv7 Model

YOLOv7, stands for You Only Look Once model version 7 is modern object detection algorithms. Developed as part of tevolutionary series of YOLO fashions, YOLOv7 represents a massive bounce in actual-time computer vision tasks, promising unparalleled accuracy and performance in object detection. Unlike conventional Pose Estimation algorithms,Yolov7 pose is a high-level multi-person keypoint detector. It is much like the bottom-up method but heatmap free. It is an expansion of the single-frame pose detection model called YOLO-Pose. It combines the strengths of both top-down and bottom-up approaches. YOLOv7 Pose has been specifically trained using the COCO dataset, encompassing 17 key landmark configurations. It is applied in PyTorch making the code high-quality easy to personalize as in keeping with your want. The pre-trained keypoint detection model is yolov7-w6pose.Pth..

Key Features of YOLOv7:

5.1 Efficiency and Speed: YOLOv7 is made for real-time applications, It has high speed and accurate object detection even in high-resolution Images. Its streamlined structure allows for green processing without compromising on precision.

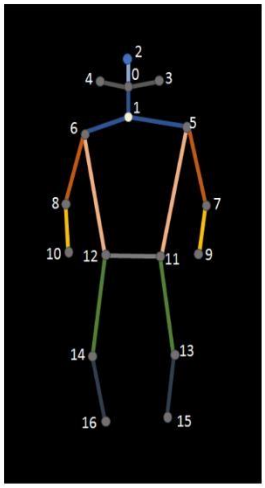
5.2 Advanced Backbone Network**:** The version is equipped with CSPDarknet53, a complicated backbone network famend for its ability to extract elaborate functions from photographs. This strong feature extractor performs a pivotal position within the version's advanced performance.

5.3 Scale Aware Predictions**:** YOLOv7 includes a couple of prediction scales, allowing it to come across items of numerous sizes inside an photo. This scale-conscious technique ensures that gadgets each big and small are as it should be diagnosed.

5.4 Dynamic Anchor Boxes: YOLOv7 dynamically adjusts anchor boxes at some point of training, optimizing the model's ability to predict bounding container dimensions appropriately. This adaptability allows the version to deal with numerous datasets correctly.

5.5 State-of-the-Art Training Techniques**:** The model consists of contemporary schooling methodologies, together with combined-precision training and gradient accumulation. These strategies contribute to the version's balance at some stage in the training process.

5.6 Open-Source Community Contribution: YOLOv7 is a fabricated from collaborative efforts within the open-source community, reflecting the collective know-how of researchers and developers committed to advancing laptop vision technology.



Key Points	Skeleton
• Nose – 0	[15,13]
• Head bottom – 1	[13,11]
• Head top – 2	[16,14]
• Left ear – 3	[14,12]
• Right ear – 4	[11,12]
• Left Shoulder – 5	[5,11]
• Right shoulder – 6	[6,12]
• Left Elbow – 7	[5,6]
• Right Elbow – 8	[5,7]
• Left Wrist – 9	[6,8]
• Right Wrist – 10	[7,9]
• Left Hip – 11	[8,10]
• Right Hip – 12	[1,2]
• Left Knee – 13	[0,1]
• Right Knee – 14	[0,2]
• Left Ankle – 15	[1,3]
• Right Ankle – 16	[2,4]
	[3,5]
	[4,6]

Fig-: .result of pose estimation on custom video

6. DISCUSSION

In this study,we use the YOLOv7 pose pre-trained model to perform yoga pose estimation By utilizing the pretrained model, we were able to accurately extract keypoints of the human body, important markers on the human body, which are critical for yoga pose recognition. Our analysis focused on calculating angles between these keypoints, enabling us to recognize and categorize various yoga poses.

Results: The pre-trained model that we used has successfully identified key body points, allowing for precise angle calculation. The maccuracy is crucial in yoga, where the differences in body positioning can determine the correctness of a pose.

Limitations: as we are using pre-trained model for finding keypoints so accury of model is good but No model is perfect, and occasional mistake might occur, particularly in complex poses or with occluded body parts.

Future Research Directions

***Real-Time Pose Estimation Optimization*:** Future research can be using this model on the real time webcam to enable realtime pose estimation. This could be crucial for applications where instant feedback is needed such as in live yoga classes or fitness apps.

Personalized Pose Correction and Feedback: Develop the model for pose correction and visual feedback.And also feedback on different body part like which body part should be in which position for a particular pose. user progress and adapt feedback accordingly,feedback can be visual or it can also audible.

8. REFERENCES

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7. CONCLUSION

Our research focused on figuring out yoga poses using model called YOLOv7 Pose. We used pictures and videos as a input to find the angles and identify different yoga positions. This isn't just about technology it's about making yoga easier for everyone.By using ready-made tools, we made our work better and faster. We can now recognize yoga poses accurately from pictures and videos. This could help beginners and anyone practicing yoga to do it right.Our study shows how technology and yoga can work together. This model can make fitness easier for people. In the future we can add the features where model can recognize poses in real-time and we could make a app or website for virtual yoga. Our research isn't just about computers it is about making the world healthier and more connected.