Volume 9, Issue 7, July – 2024 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL1267

Recognizing Yoga Pose using Deep Learning

Sangeetha S[1]
Student, Department of MCA
Jawaharlal Nehru New College of Engineering
Shimoga, India

Hemanth Kumar[2]
Associate Professor, Department of MCA
Jawaharlal Nehru New College of Engineering
Shimoga, India

Abstract:- Yoga posture identification is the method of identifying a particular person's yoga pose. It might be hard to get a private yoga teacher for every individual. This research uses images to find yoga posture using a deep learning technique called Yolov8. It is able to recognize the posture of yoga through webcam using yolov8 model. One need to train the collected set of data in accordance with the needs, the device is able to detect the various type of the yoga posture which has been trained earlier. This approach assists the peoples in doing yoga especially for beginners who cannot offer personal instructor.

Keywords:- *Deep Learning, YOLOv8.*

I. INTRODUCTION

The yoga is a gift to the world from India. Sage Maharshi Patanjali was the first person who invented the yoga. The word yoga is mentioned in the Rig-Veda. Yoga which helps to bring harmony between body and mind. Yoga practice is good for healthy living. Yoga is referred as a collection of exercises. Related to person's physical, mental and spiritual well-being originated in ancient India. Many people adopted yoga for their fitness purpose and also for good health. The reason being healthcare, it is highly essential to practice yoga perfectly, especially in the appropriate pose Many people starts to do yoga without proper instruction because they may receive wrong information or do not have an idea how to do yoga properly. The result of an incorrect posture may leads to muscle pain, ankle pain, joints pain may occur. Yoga should be done under the guidance of yoga trainer but practicing yoga under the supervision of yoga trainer is difficult for each and everyone. Recognizing a yoga posture accurately is significant task for yoga trainers but it takes more time. To learn yoga, nowadays people use their smart mobile but they not sure if they are performing the yogic posture in correct way or not. To overcome this, one can utilize a model of deep learning that facilitates yoga posture identification automatically and also shows the accuracy of that particular pose. In deep learning, YOLOv8 algorithm is used which aids to detect the yogic posture through the webcam and also detects the multiple objects in a single image. YOLOv8 is a fast and model of the deep learning it is utilized for several yoga pose detection. By analyzing images, the device is able to identify the posture of the individual which posture they are doing. There are many models in Machine Learning (ML) like Random Forest Classifier (RFC), convolutional neural network (CNN), k-nearest neighbors (KNN), YOLO and many more. In this work YOLOv8 is used for yoga posture detection. Because it identifies multiple person yoga pose in a single image. The algorithm include various steps like dataset collection, preprocessing the images by annotating all the images from dataset, train dataset using YOLOv8, test images using model and lastly yoga posture categorization is done.

II. LITERATURE SURVEY

Dr. Maya Bembde et al. in [1] presented that their device is able to identify yoga postures done by the people and also instruct the user. Preprocessing, extraction of features, and classification is carried out by using different Machine Learning(ML) algorithms. The algorithms are Ridge Classifier, Logistic Regression, Gradient Boosting Classifier and Random Forest Classifiers. Finally the system gives the best accuracy results using all the algorithms.

Work in [2] contains total six different yoga poses. This also includes voice command to the yoga poses that is performed from the user. They used Adaboost algorithm for Kinect through software developmet kit. This work gained the precision of 94.78%.

Work done by Fazil Rishan et al. in [3] describes that, to choose the optimal module for the system, a number of models were trained using keypoint data from Mask RCNN pose estimation modules and OpenPose. When tested using real-time feed, it is discovered that model trained with OpenPose keypoints performed the best overall with the least amount of delay.

The following work by Manisha Verma et al. in [4] explains the idea of a hierarchically refined pose categorization. The dataset is divide into three tiers that includes body positions, body position variants, and the titles of the real poses. They used modified DenseNet architecture. The accuracy of third level classifier is 79.35%.

The research paper presented by Mr. Rohit Londhe et al. in [5] explains about the detection of yogic posture using a YOLOv7 machine learning model. Angle is calculated using trigonometric and mathematical formula. OpenCv and other python libraries are utilized to provide visual feedback. All the calculated angles are passed to the model of the machine learning which is already trained. The trained model will give the result.

Work in [6] describes the yogic posture identification. The dataset is collected from the kaggle. Convolutional Neural Network (CNN) is utilized to train the dataset. CNN

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL1267

classifies the images using a variety of layers. Here they classify images by using flattering, fully connected neural network, softmax. In this project the system detect the kind of Yoga pose, also detects in real time.

The following work by Prof. Pragya Sinha et al. in [7] focuses on classification of yogic posture by employing Random Forest Classifier(RFC) technique of machine learning, this method chooses a portion of training data, makes decision trees for each subset. To train the data they used several modules like Open Pose for feature extraction, Keras, Tensor flow and NumPy will be used. Keras is utilized to create the model architecture and train the vast quantity of data. The total accuracy of RFC is 98% or higher.

Prof. Rupal More et al. in [8] used Python Imaging library for data preprocessing. The library provides various features they are formatting extensive file, creating thumbnails, changing format of image file, efficient internal representation, applying filters to images. To classify the data logistic regression model is used. OpenCV library and Mediapipe library is used for Feature extraction. The Logistic regression model provides the accuracy of 99.06%.

Work in [9] explores the detection of yoga posture and correction of yoga posture. The system used OpenCV, tf-pose estimation is utilized for pose estimation. For model TensorFlow and MoveNet is used. The system also facilitates the yoga practicing in live utilizing camera, it makes comparison with the previously trained dataset. If the posture is wrong the system provides the feedback for the user. MoveNet is utilized to detect the each person keypoints present in their body they achieved 99.88% of accuracy.

Work done by Rutuja Gajbhiye et al. in [10] used CNN of ML model. OpenCv, mediapipe, Operating system, array, and many more library are used. Convolutional Neural Network is utilized for picture classification. The captured pose and previously trained dataset is compared. Then the system decides which yogic posture has shown in the image.

Rutuja Jagtap et al. in [11] proposed the model for yoga posture identification, the system works on 8 yoga pose. They have designed a GUI-based desktop application using the Tkinter library. The input is preprocessed in the form of an image, the object is detected, and the core body from the people is identified using the media pipe and OpenCV library. For testing and training logistic regression models is used. The system gets an accuracy score of 100%.

Six variety of yoga postures is employed from S. Abarna et al. in [12], pose estimation method is employed in the feature extraction process, pre trained models are Openpose and CenterNet. For classification Recurrent Neural Network and 1D CNN used. After comaprision the result shows that OpenPose with 1D CNN provided good results.

The following work by Shrinivas Nagargoje et al. in [13] describes how to identify a yoga posture in real time. It has been successfully built to recognize yoga poses in live by CNN, Long Short Term Memory (LSTM) and OpenPose, in Python. During the time of yoga posture identification the framework will emit a buzzer sound if the posture is wrong.

Research paper done by Utkarsh Bahukhandi et al. in [14] utilized variety of ML methods, they are Logistic Regression(LR), RFC, k nearest neighbors and naive Bayes classifiers. The libraries that are utilized include Seaborn for data visualization, NumPy for numerical computation, OpenCV for computer vision tasks, Media Pipe for posture estimation, Pandas for dataset construction and data operations, and sklearn. In comparison to other classifiers, the LR classifier has the highest accuracy with 94%. While Naive Bayes has an 91% precision, the RFC has an accuracy with 89%.

Yash Agrawal et al. in [15] used a algorithm of TF-pose estimation which generates a human body's skeleton on the live basis. Variety of ML categorization models are utilized to test the dataset and attain accuracy with 83% by utilizing a Logistic Regression, Random Forest has 99% accuracy, SVM has 87% accuracy, Decision Tree has 97% accuracy, Naive Bayes has 74% accuracy, KNN has 98% accuracy and the best model is RFC with 99% accuracy.

III. PROPOSED METHODOLOGY

There are several models in machine learning like k-nearest neighbors (KNN), Random Forest Classifier (RFC), Convolutional Neural Network (CNN), k-nearest neighbors (KNN), YOLO and many more. In this work, YOLOv8 is used for yoga posture detection. It identifies multiple person yoga pose in a single image. YOLOv8 consists of three main parts that includes backbone, head, and neck. Backbone is utilized to take out the characteristics of specific object. Neck is utilized to process the image and merge the features extracted by the backbone. Neck contains Feature Pyramid Network (FPN), FPN combines low level and high level features. Head is the last part it is utilized to create the predictions based on feature extraction.

Fig 1 describes Machine Learning Model. Dataset is the collection of data. Training data is utilized to train the model of machine learning. Validation data is utilized to evaluate performance of ML model on unseen data at the time of training. Model training is the method of giving data to the algorithm such that it may learn and become more accurate at a specific job. A model is simply an algorithm that has gained knowledge on a specific task through training to identify patterns or make judgments based on data. Hyper parameter is a technique, it is utilized to automate the process of determining the optimal values for a machine learning models. Training evaluation results is the method of getting result metrics after training the machine learning model, the metrics gives the model's performance. Validation evaluation outcome are the metrics of performance, metrics obtained after testing the trained model on a validation set. This metrics shows that, how effectively the model applies to previously unobserved data.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL1267

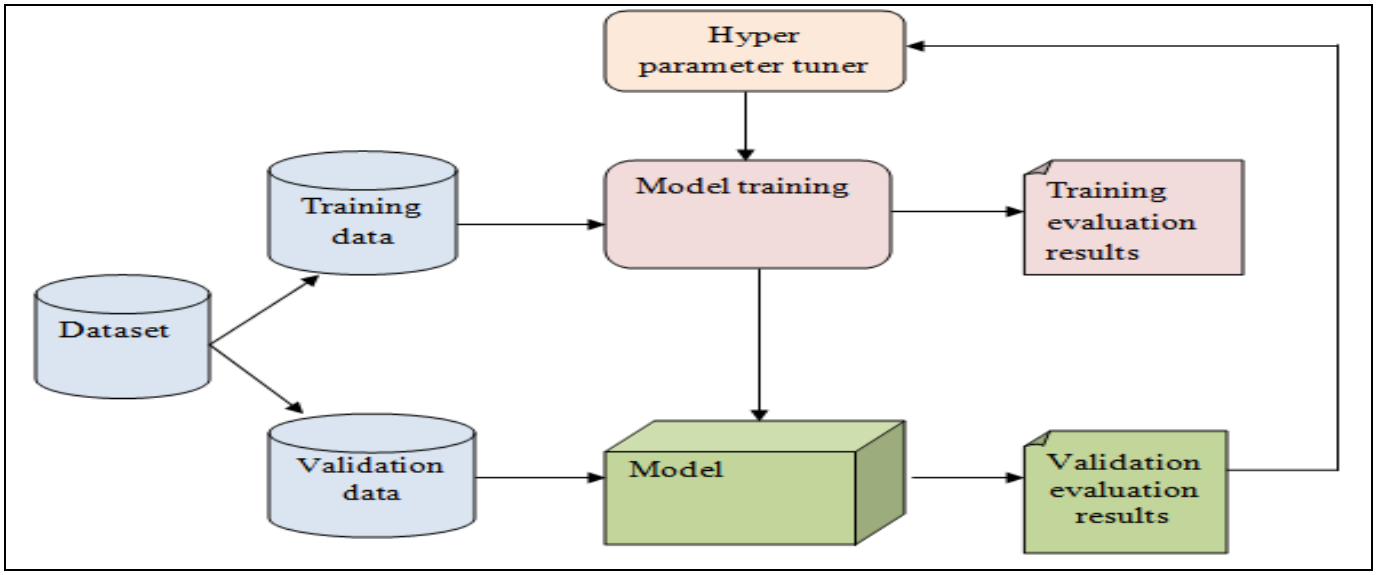

Fig 1 Machine Learning Model

➢ *Flow Chart of Proposed Method*

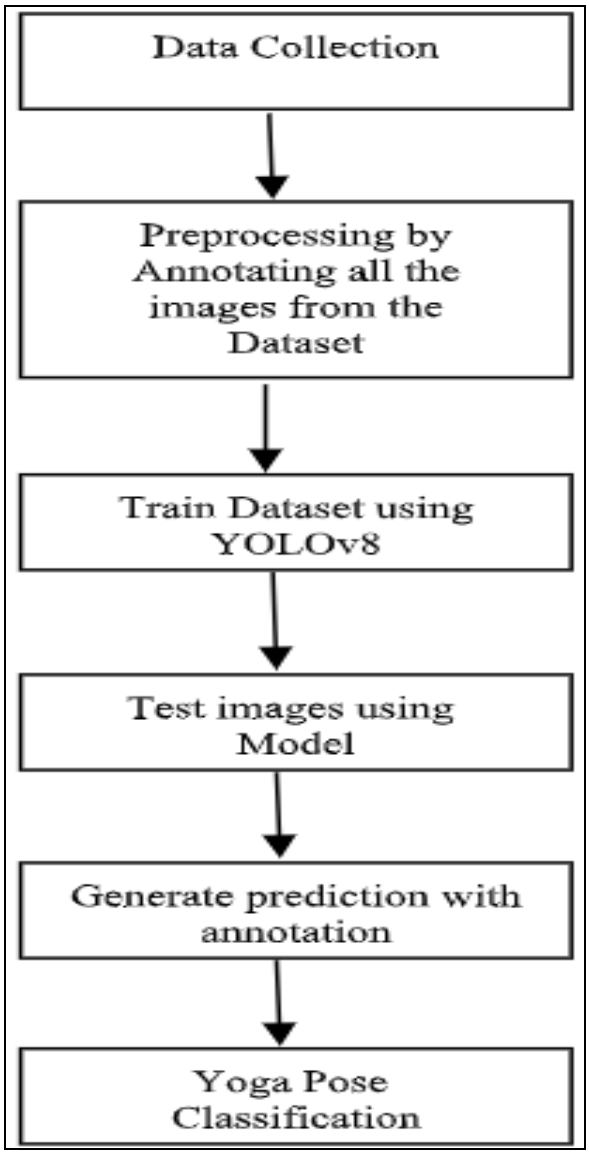

Fig 2 Flow Diagram for Proposed Method

- *Data Collection*

Data collection is the method of collection of images. In this work, images are gathered by the internet and real time images also collected. Around 200 images with variety of yoga poses are collected, total 11 different type of yoga posture are there in the work. They are dandasana, downdog, padmasana, plank, side plank, tadasana, trikonasana, utkatasana, virabhadrasana, virasana, vrksasana.

- *Preprocessing by Annotating all the Images from Dataset*

After dataset collection, next is to preprocess the image by removing noise, annotation needs to be done by utilizing a tool called labelImg. This tool helps to annotate all the images to provide training for the model. This is mainly used for image categorization. Annotation of images is completed by bounding box, drawing rectangle box around the object and labeling the image with particular name.

- *Train Dataset using YOLOv8*

To obtain the dataset trained, conversion of each image into YOLO format must be completed. YOLO format contain class Id, x center, y center, width and height. Each image should have corresponding .txt file with annotation. Configuring a file by creating .yaml file, that indicates path to the validation and training dataset. Training is finished by giving a command line. After training, validating the model on the validation dataset is carried out.

- *Test Images using Model*

After training, testing the images using YOLOv8 model needs to complete, then apply inference to fresh photos and display the outcomes.

- *Generate Prediction with Annotation*

Running interfaces using YOLOv8 on new images, result will be stored in the format that contains identified object and their annotation.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL1267

- *Yoga Pose Classification*

The last step is image classification. It identifies the type of yoga pose from the image or through the web camera. It identifies the image by bounding box to the trained pose. This is done under the computer vision.

IV. RESULT

Totally 11 yoga poses are considered including dandasana, downdog, padmasana, plank, sideplank, tadasana, trikonasana, utkatasana, virabhadrasana, virasana, vrksasana. The system displays the type of yoga posture range from zero to one. If the possibility is one or near to one then system detects the right yoga posture. If the possibility is zero or near to zero then system detects is a false. This technique helps the consumer to perform yoga pose correctly. Graphical user interface is designed for user. Results of the work are listed below:

In Fig 3, the system predicts the yoga pose as padmasana correctly with 98% accuracy.

Fig 3 Padmasana

In Fig 4, the system predicted the yoga posture dandasana correctly. It also detected the multiple person posture correctly with the accuracy of 100% and 99%. It supports persons who do yogic posture in group with a single web camera.

Fig 4 Dandasana

In Fig 5, the device predicted the yoga posture tadasana correctly. It detected the multiple person posture correctly with the accuracy of 98% and 99%.

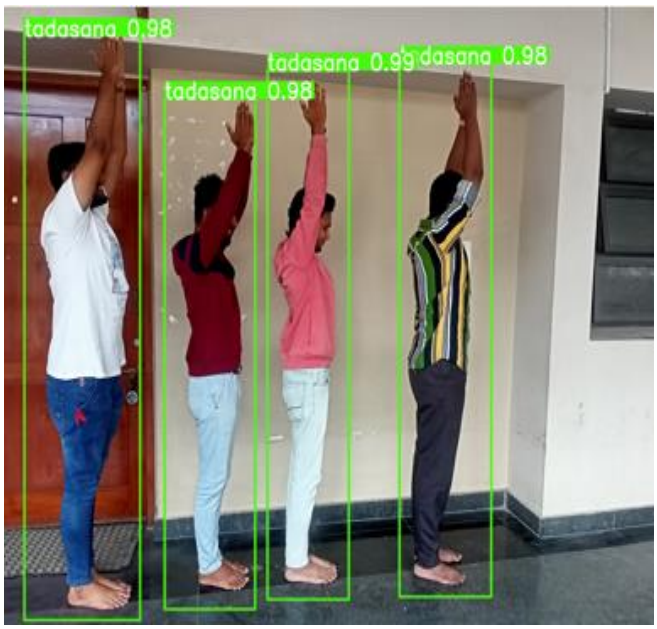

Fig 5 Tadasana

V. CONCLUSION

The current work explores the identification of yoga posture using a Deep learning model called YOLOv8. In this work, images are used as the input and system predicts the type of yoga posture as the output. It also predicts accuracy of particular yoga pose. The total accuracy of this work is 96%. This work displays that how yoga and technology work together. Important feature of this work is identification of multiple person yoga posture in a single image.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24JUL1267

REFERENCES

[1]. Dr. Maya Bembde, Swapnali Barude, Pradnya Shinde, Tejaswini Thorat, Deepak Thakar, " Yoga posture detection and correction system", International Journal of Advanced Research in Science, Communication and Technology (IJARSCT), Vol. 2, 817-823, 2022.

[2]. Edwin W. Trejo, Peijiang Yuan, "Recognition of Yoga Poses through an Interactive System with Kinect device", 2nd International Conference on Robotics and Automation Sciences, 12-17, 2018.

[3]. Fazil Rishan, Binali De Silva, Sasmini Alawathugoda, Shakeel Nijabdeen, Lakmal Rupasinghe, Chethana Liyanapathirana, "Infinity yoga tutor : yoga posture detection and correction system", IEEE Xplore, 2021.

[4]. Manisha Verma, Sudhakar Kumawat, Yuta Nakashima, Shanmuganathan Raman, "Yoga-82: A new dataset for fine-grained classification of human poses", IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW), 4472-4479, 2020.

[5]. Mr. Rohit Londhe, Mr. Yash Wanve, Mr. Uday Harle, Mr. Atharva Lohe, Prof. P. S. Patil, "Yoga pose estimation using yolo model", International Journal of Scientific Research in Engineering and Management (IJSREM)", Vol. 7, 2023.

[6]. Prof. Minal Zope, Aniruddh Ghewade, Swapnil Prasad, Omkar Patil, K.M. Chintguntla, "Yoga pose detection using deep learning", Vol. 10, 2023.

[7]. Prof. Pragya Sinha, Tejal Shetty, Aakash Pandey , Siddiqui Abdul Rahman, Agastya Sen, "Detection and Correction of Yoga Poses", Vol. 5, 2023.

[8]. Prof. Rupal More, Pallavi Late, Yukta Taral, Nilima Ahire, Bhagyashri Baviskar, "Live yoga pose classification using image processing and LR algorithm ",International Journal of Creative Research Thoughts (IJCRT), Vol. 11, 2023.

[9]. Ranjana Jadhav, Vaidehi Ligde, Rushikesh Malpani, Phinehas Mane, Soham Borkar, "Aasna: kinematic yoga posture detection and correction system using CNN", ITM Web of Conferences 56, 2023.

[10]. Rutuja Gajbhiye, Snehal Jarag, Pooja Gaikwad, Shweta Koparde, "AI human pose estimation: yoga pose detection and correction", International Journal of Innovative Science and Research Technology, Vol. 7, 1649-1658, 2022.

[11]. Rutuja Jagtap, Monali Zanzane, Rutuja Patil, "Yoga pose detection using machine learning", International Research Journal of Modernization in Engineering Technology and Science, Vol. 4, 1753-1756, 2022.

[12]. S. Abarna, V. Rathikarani, P. Dhanalakshmi, "Skeleton pose estimation features based classification of yoga asana using deep learning techniques", International Journal of Mechanical Engineering , Vol. 7, 2348 – 2355, 2022.

[13]. Shrinivas Nagargoje, Adesh Shinde, Pranav Tapdiya, Om Shinde, Prof. Anita Devkar, "Yoga pose detection", International Journal for Research in Applied Science & Engineering Technology (IJRASET), Vol. 11, 2023.

[14]. Utkarsh Bahukhandi, Dr. Shikha Gupta, "Yoga pose detection and classification using machine learning techniques", International Research Journal of Modernization in Engineering Technology and Science, Vol. 3, 186-191, 2021.

[15]. Yash Agrawal, Yash Shah, Abhishek Sharma, "Implementation of machine learning technique for identification of yoga poses", 9th IEEE International Conference on Communication Systems and Network Technologies, 2020.