International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 07, July 2026)

Real-Time Posture Detection and Fitness Coach

Yash Bobade[1], Aparajita Sinha[2], Sangameshwar Nila[3], Vaibhav Bagal[4]
[1,2,3,4]Dept. of Information Technology, G H Raisoni College of Engineering and Management Pune, India

***Abstract*-- In the last many times, it has come more and more important for overall health and injury forestallment to stay fit and have good pos-ture while working out. But a lot of people do exer cises wrong because they do n't have the right in structions or supervision. Bad posture while doing syllables, push- ups, lunges, and yoga acts can beget muscle strain, common injuries and make your work outs less effective. So, we need a smart system that can keep an eye on how peo-ple are exercising and give them feedback right away.The design called " Real- Time Posture Dis-covery and Fitness Trainer " wants to make an in-telligent system that uses com puter vision and ma-chine literacy to figure out how people are stand-ing while they work out and give them feedback right down. The system uses a Convolutional Neu-ral Network(CNN) model that was trained on a custom dataset of different yoga acts and fitness ex-ercises, similar as Pranamasana, Hastauttanasana, Hastapadasana, Ashwa Sancha lanasana, Dan-dasana, Squats, Push- ups, Lunges, and Planks, with both correct and wrong postures. The model uses frames from a webcam in real time to fig-ure out what kind of exercise it's and whether the posture is correct. The system shows the name of the exercise that was prognosticated, along with the confidence position, and gives druggies feed back to help them keep their form correct. The proposed system can help newcomers and people who are formerly fit by acting as a virtual fitness trainer that helps them ameliorate their exercise form and lower their threat of getting hurt. By combin ing deep literacy, computer vision, and real- time camera processing, the design helps make smart health monitoring systems better. The system can be bettered in the future by adding features like counting reiterations, suggesting ways to ameliorate posture, integrating with mobile apps, and giving substantiated fitness advice.**

***Index Terms*— Posture Detection, Deep Learning, CNN, Computer Vision, Real-Time System, Fitness Monitoring**

I. Introduction

With the rising trend of home drill sessions and online fit ness platforms, multitudinous people tend to perform their exercises without proper guidance or supervision from pro-fessional f itness trainers. This constantly results in infe-licitous posture dur ing exercises, leading to muscle strain, common injuries, and ineffective workouts.To address this issue, the Real- Time Posture Discovery and AI- predicated Fitness Coach design has been initiated to offer real- time and accurate posture analysis using computer vision and machine knowledge algorithms.

The growing trend of sedentary societies and infelicitous exercise ways has raised the need for intelligent fit ness monitoring systems. Although fitness centers pro vide pro-fessional supervision, multitudinous people tend to per form home drill sessions due to convenience and cost with recent advancements in com puter vision and deep knowledge, mor-tal disguise estimation has come possible with high delicacy using models like Me dia Pipe Pose and Move Net. These models are suitable of detecting pivotal points in the mortal body in real- time and can be used for fitness- related appli-cations.In recent times, there has been a significant rise in awareness regarding physical f itness and a healthy life. Peo-ple are doing exercises, yoga, and home exercises to remain healthy. But doing mate ercises with infelicitous posture can beget strain on muscles, joints, and overall health issues. beginners find it delicate to do exercises with proper posture as they ca n't calculate on professional trainers all the time.

Online vids and tutori als ca n't give substantiated feedback to the user.With the development of Artificial Intelligence(AI) and Computer Vision, it has come possible to anatomize mortal body movements through a camera. mortal disguise Estimation is a system that identifies pivotal points like shoul-ders, elbows, hips, and knees from images or vids. predicated on these pivotal points, the system can identify body posture and movements. Current deep knowledge models like Media Pipe and Move Net enable real- time discovery with high delicacy indeed on common laptops and mobile phones. The proposed design is a Real- Time Posture Discovery and AI-predicated Fitness Coach that tracks the user during exer-cise through a webcam. The system identifies pivotal points, computes common angles, com pares them with predefined correct posture values, and gives immediate feedback. It also tracks the number of repetitions and shows whether the pos-ture is correct or incorrect. This enables stoners to exercise safely without the need for a fitness trainer.

The primary ideal of the system is to give fitness back-ing that is accessible, affordable, and interactive. Un like common fitness apps that track exertion, this system assists the user laboriously and ensures that the user does n't get injured by correcting posture in real- time. The system can be applied to home exercises, gym backing, rehabilita tion exercises, and beginner fitness training.In contemporary so-ciety, it has come essential to keep oneself physically fit.

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 07, July 2026)

People have started doing exercises like yoga, weight train ing, stretching, and home exercises to remain healthy and avoid life conditions. still, one of the biggest issues that a beginner or an average fitness sucker faces is doing exercises with proper body posture. Doing exercises with im proper body posture can affect in muscle injuries, ligament injuries, common problems, and orthopedic issues. particular trainers help in posture correction, but constant monitor ing is pre-cious and not realizable. Online drill vids and fitness apps on mobile bias only show how to do exer cises and do n't cover the user's body movement.With the recent advance-ments in Artificial Intelligence(AI) and Computer Vision, it has come realizable to automatically anatomize mortal body movements using cameras. One of the most important tech-nologies in this area is mortal disguise Esti mation, which locates significant joints in the mortal body like head, shoul-ders, elbows, wrists, hips, knees, and ankles in an image or video frame. These joints are appertained to as pivotal points or mileposts. By examining the position of these mileposts, it becomes possible to determine the posture and movement of a person. modern deep knowledge algorithms like Media Pipe, Move Net, and other feathery neural networks make it possible to descry acts in real- time, indeed on low- cost attack like laptops and smartphones.

II. Related Work

Mortal posture discovery has been an active area of explo-ration in computer vision and machine literacy. Before-hand approaches reckoned on traditional image processing ways and hand machined features similar as edge discovery, color segmentation, and shape analysis. still, these styles demanded robustness and failed to generalize across different environments.With the advancement of machine literacy, ex-perimenters began using algorithms similar as Support Vec-tor Machines SVM) and Random Forest for bracket tasks. Although these styles bettered performance, they needed man ual point birth, which limited their effectiveness in com-plex scripts. Recent exploration focuses on deep literacy approaches, par ticularly CNNs, which automatically learn features from raw image data. CNN- grounded models have significantly bettered delicacy in tasks similar as object dis-covery, mortal exertion recognition, and posture bracket.

Some systems use disguise estimation ways similar as OpenPose and MediaPipe, which descry crucial body mile-stones and dissect common angles to determine posture. While effec tive, these approaches can be computationally precious and complex to apply. Several fitness operations and systems give posture monitoring, but numerous calcu-late onpre-trained datasets and warrant real- time feedback capabilities. also, some systems are limited to specific exer-cises and do n't generalize well through multiple postures. The proposed system addresses these limitations by using a custom dataset, applying preprocessing ways, and enforcing a CNN- grounded model for real- time posture discovery.

III. Methodology

III.1 System Overview

The proposed system follows a structured channel that pro cesses real- time videotape input to descry and classify mor-tal posture. The workflow begins with landing videotape frames through a webcam, followed by preprocessing way similar as resizing and normalization.

The reused frames are also passed through a CNN model, which excerpts features and classifies the posture into pre-defined orders. The proposed system follows a structured pipeline designed to process real-time video input and ac-curately classify human posture. The workflow begins with capturing live video through a webcam, where individual frames are extracted continuously. Each frame is then pre-processed to ensure consistency in input data.

III.2 System Architecture

The system is implemented with the help of layered architec-ture. The layers are depicted in (figure 1):

- *Presentation Layer*

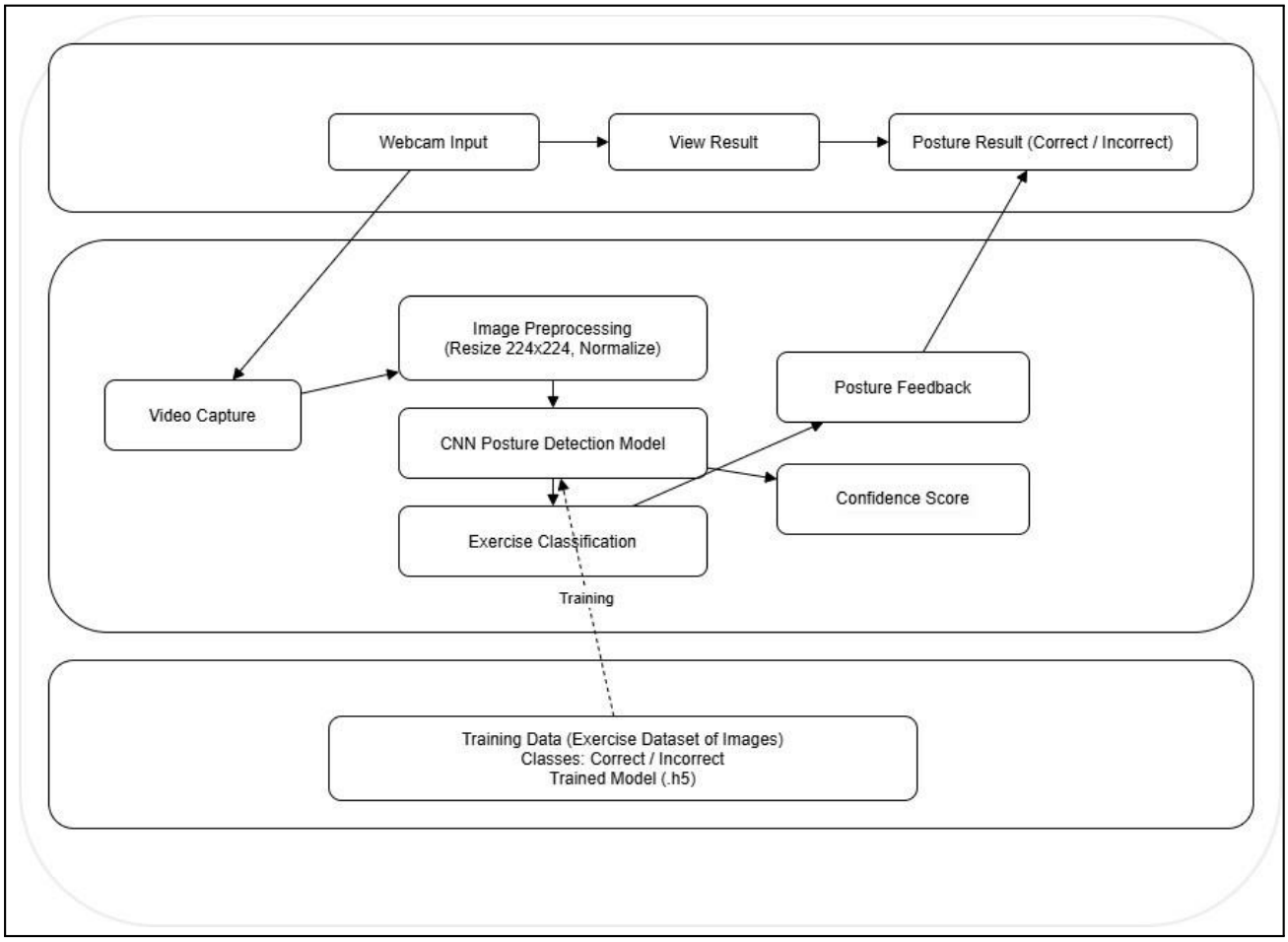
The system architecture is divided into three layers. The presentation layer handles user interaction by capturing video input and displaying results. The application layer performs image preprocessing, model prediction, and feed-back generation. The data layer stores the dataset and trained model, enabling efficient training and retrieval.

- *Application Layer*

This layer contains the core processing modules:

Image Preprocessing Module: Resizes images to a fixed di-mension (224×224), normalizes pixel values, and prepares data for model input.

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 07, July 2026)



Figure[1]: System Architecture Diagram

CNN Model Module: A deep learning model trained on exercise images. It extracts spatial features and classifies posture.

Prediction Module: Determines the exercise type and calculates confidence scores.

Feedback Module: Displays results and provides real-time guidance.

- *Data Layer*

This layer manages data storage and training: Custom dataset of exercise images Labeled classes (correct and incorrect posture) Trained model file (.h5 format)

III.3 Tools and Technologies

The proposed system utilizes a combination of ultramodern tools and technologies to achieve real- time posture discov-ery and feedback. The core perpetration is carried out using the Python programming language due to its simplicity and strong support for machine literacy libraries. The deep liter-acy model is developed using TensorFlow and Keras, which give effective fabrics for structure and training Convolutional Neural Networks(CNNs). OpenCV is used for landing real-time videotape from the webcam and performing image pre-processing operations similar as resizing and normalization.

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 07, July 2026)

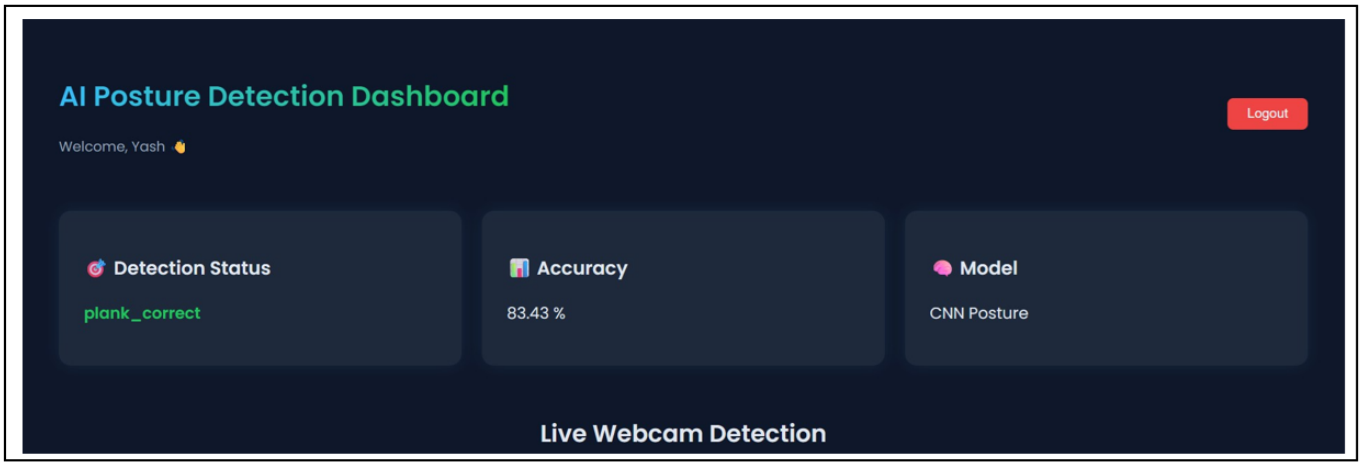
NumPy is employed for numerical calculations and handling array operations during model processing. The dataset is set and the model is trained using Google Colab, which provides GPU support for faster calculation. Visual Studio Code(VS Code) is used as the development terrain for enforcing and testing the real- time discovery system. also, data addition ways are applied to ameliorate model conception. These tech-nologies inclusively enable the system to perform accurate, effective, and real- time posture discovery.

III.4

III.4.1 Existing System

Being fitness monitoring systems primarily calculate on homemade supervision by coaches or pre-recorded educational vids.

In similar systems, druggies follow exercises without entering real- time feedback on their posture, which frequently leads to incorrect form and implicit injuries. Traditional approaches also include introductory fitness operations that give exercise instructions but warrant intelligent posture evaluation. Some advanced systems use disguise estimation ways like detectors or wearable bias, but these results can be precious and inconvenient for everyday druggies. also, numerous being AI- grounded systems depend onpre-trained datasets and don't acclimatize well to different surroundings or druggies.



Figure[2]: AI Posture Detection

They may also bear complex setups and high computational coffers, making them less accessible. The lack of robotization, real-time analysis, and stoner-friendly interfaces farther limits their effectiveness. Another limitation of existing systems is the lack of automation and real-time analysis. Most applications provide general instructions without evaluating user performance dynamically. These challenges highlight the need for a more intelligent and accessible solution.

III.4.2 Proposed System

The proposed system introduces an intelligent and automated approach to posture detection using deep learning techniques.

It processes live video input and analyzes user posture con-tinuously. The CNN model classifies different exercises and determines whether the posture is correct or incorrect.

The system is designed to be user-friendly and cost-effective, requiring only a webcam and basic computing resources. It provides real-time feedback along with confidence scores, enabling users to correct their posture instantly. The use of a custom dataset improves model accuracy and adaptability.

By eliminating the need for human supervision, the system acts as a virtual fitness coach that guides users during exercise. This approach enhances user experience and promotes safe and effective workouts.

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 07, July 2026)

IV. Results/Outcomes

1. The proposed system demonstrates strong performance in real-time posture detection and classification. The CNN model achieves high accuracy in identifying different exercises and distinguishing between correct and incorrect postures. The system provides immediate feedback, allowing users to adjust their posture during exercise.
2. The implementation shows robustness under varying lighting conditions and backgrounds. Data preprocessing and augmentation techniques contribute to improved model generalization. The system also maintains stable predictions through continuous frame anal-ysis.
3. Overall, the results indicate that the system is reliable, efficient, and suitable for real-world fitness applications. It provides a practical solution for posture correction and injury prevention.

V. Conclusion And Future Work

In conclusion, the proposed real-time posture detection and fitness coaching system successfully integrates deep learning and computer vision techniques to analyze human posture during exercise. The system provides accurate classifica-tion and real-time feedback, helping users perform exercises correctly and safely.

The project highlights the potential of artificial intelligence in transforming fitness and healthcare applications. By offering an accessible and automated solution, the system reduces dependency on human trainers and promotes effective workouts.

Future work may include the integration of repetition counting, voice-based feedback, and personalized workout recommendations. The development of a mobile application can further enhance usability and accessibility. Additionally, advanced techniques such as pose estimation and hybrid deep learning models can be explored to improve accuracy and performance.

REFERENCES

[1] D. M. Deeksha, R. Kumar, "Real-Time Yoga Posture De-tection and Correction using CNN-LSTM," *Proc. ICICNIS*, 2025.

[2] H. Chen, Y. Zhang, "Improved CNN-Based Exercise Posture Recognition," *Scientific Reports*, vol. 15, 2025.

[3] Z. Shan, L. Wang, "Deep Learning-Based Human Posture Recognition System," *Journal of AI Research*, vol. 12, pp. 101-115, 2024.

[4] P. Choudhary, S. Singh, "Yoga Pose Detection and Feed-back Generation: A Review," IEEE Access, vol. 12, pp. 45678-45690, 2024.

[5] A. Kumar, R. Gupta, "Human Posture Detection using MediaPipe and OpenCV," Proc. ICMLA, 2024.

[6] P. Verma, A. Mishra, "AI-Based Yoga Posture Detection System," IJERT, vol. 11, no. 5, 2023.

[7] H. Ram, S. Patel, "Yoga Pose Detection using Computer Vision Techniques," Proc. ICCCNT, 2023.

[8] V. Arya, N. Sharma, "Real-Time Posture Detection and Correction System," IEEE Conference, 2023.

[9] Google Research, "MediaPipe: A Framework for Build-ing Perception Pipelines," arXiv preprint arXiv:2106.10923, 2021.

[10] H. Jin, Y. Li, "SitPose: Real-Time Posture Detection System," arXiv preprint arXiv:2412.12216, 2024.

[11] C. Xie, J. Liu, "CNN-Based Posture Recognition in Sports," IEEE Transactions on AI, vol. 6, no. 3, pp. 210-220, 2025.

[12] M. Khamaisi, D. Cohen, "Digital Postural Assessment using AI," Healthcare Technology Letters, 2024.

[13] M. J. Meghana, R. Rao, "Comprehensive Analysis of Pose Estimation Techniques," IEEE Access, vol. 13, 2025.

[14] S. Gupta, A. Singh, "AI-Based Fitness Monitoring Sys-tem," IEEE Conference, 2021.

[15] T. Brown, "Deep Learning for Image Classification," Journal of ML Research, vol. 22, 2022.

[16] OpenCV Team, "OpenCV Documentation," OpenCV.org, 2023.

[17] TensorFlow Team, "TensorFlow: Large-Scale Machine Learning," Google Research, 2024.

[18] L. Perez, J. Wang, "The Effectiveness of Data Augmen-tation in Image Classification," arXiv, 2021.

[19] S. Hochreiter, J. Schmidhuber, "Deep Learning Tech-niques for Human Activity Recognition," Neural Computa-tion, 2022.

[20] X. Zhang, Y. Chen, "Real-Time Human Activity Recog-nition using CNN," IEEE Access, vol. 11, 2023.

[21] R. Singh, P. Mehta, "AI-Based Fitness Coaching Sys-tems: A Survey," IEEE Reviews in Biomedical Engineering, 2024.