

Preventing the players health using Device free method as Full body Interactive Game Controller through OpenCV and MediaPipe

K.Karthikeyan¹, Dr.V.P.Sumathi²

UG Scholar¹, Associate Professor²

^{1,2}Department of Computer Science and Engineering, Kumaraguru College of Technology, Coimbatore, India^{1,2}

karthikeyan1.20cs@kct.ac.in¹,sumathi.vp.cse@kct.ac.in²

Abstract

Nowadays , children were exposed to multiple games for long time which leads to several health complication. In order to manage those challenges, many game application requires gestures and motions of the human body to play the game which minimize the health deterioration of the children with increased accuracy. Especially significant advancement has been made in game application through device free method on using various pose of the player for controlling the game in recent years without any devices to recognize it. However those application were focused only to the specific poses even those advancement could not able to give complete health benefit. In order to provide complete health benefits to the children playing games, entire body poses has to be gathered for the game controlling using device free methods. In this paper, a new deep learning model is designed for full body pose detection has been designed towards real time tracking of the children on utilizing their body posture and body landmarks to control game operations through opencv and MediaPipe. MediaPipe pose detection model on processing the acquired videos without devices. Video were processed using openCV and MediaPipe. MediaPipe perform machine learning task like pose estimation which is able to extract the human movement like arm gestures, leg lifts , squats and jumps on relative difference between body parts as feature points. These feature points are classified to provide input for game controlling . Particular specific movements such as arm and leg extension provides effective controlling operations. Finally key mapping for different games enhances game play through full body interaction. The controller supports single and multi-player setups, offering a unique and immersive gaming experience through body movement-based inputs. Experimental analysis of the proposed model proves that pose detection based fully body game controllers represents immense potential in generating interest in the applications. Furthermore, the full-body engagement aspect of these games could also play a role in promoting physical activity as a regular habit.

Keyword: Fully Body Game Controller, Gestures, Pose Detection, MediaPipe, OpenCV, Device Free methods

1. Introduction

Children were exposed to multiple games for long time which leads to several health complication. In order to manage those challenges, many game developers uses the gestures and motions of the human body through external devices such as sensor like accelerometers and gyroscopes to detect the human movements to play the game which minimize the health deterioration of the children with increased accuracy. Pose estimation plays an important role in the world of interactive games. Recent advancements in this field have greatly improved the gaming experience. Particularly, the cost associated with motion capture technology tends to be high.

Nowadays , significant advancement has been made in game application through device free method on using various pose of the player for controlling the game in recent years without any devices to recognize it. However those application were focused using openpose and microsoft Kinect as machine learning task like pose detection to the specific poses even those advancement could not able to give complete health benefit. In order to provide complete health benefits to the children playing games, entire body poses has to be gathered for the game controlling using device free methods and deep learning models.

In this paper, a OpenCV and MediaPipe is employed for full body pose detection on processing live streaming video of the children to extract the pose of different body posture and its body landmarks to control game operations. MediaPipe pose detection model process the live streaming video without external devices. MediaPipe

perform machine learning task like pose estimation which is able to extract the human movement like arm gestures, leg lifts , squats and jumps on relative difference between body parts as feature points.

Feature point classification provide input for game controlling . Particular specific movements such as arm and leg extension provides effective controlling of the game. Experimental analysis of the proposed model proves that pose detection based fully body game controllers represents immense potential in generating interest in the applications. Furthermore, the full-body engagement aspect of these games could also play a role in promoting physical activity as a regular habit.

Rest of the paper is organized as follows, section 2 provides related work while section 3 presents the proposed model. Section 4 provides experimental and performance analysis. Finally section 5 concludes the article.

2. Related works

In this section, device based methods and device free method employed for pose detection on human movement has been illustrated below

2.1. Microsoft Kinect

Microsoft Kinect is device free method uses camera for video acquisition and those video employed for human movement recognition using position estimation capabilities which extract the Keypoints of human movements as postures and those feature classified into different control to game operations.

2.2. OpenPose

OpenPose is device free method used for human movement recognition using position estimation capabilities which extract the Keypoints of human movements by estimating and connecting the main joints of the person in the video using straight line in real time and those feature points extracted considered as Keypoints. Finally Keypoints is classified into different control for game operations

3. Proposed model

In this section, proposed Opencv and MediaPipe is designed as device free method for human movement recognition to game controller.

3.1. Webcam

Webcamera is placed above the screen. Screen which is used to present the game visuals and camera is used to captures the player poses from their entire body. Each poses has been indicated with landmarks to present the movement and its associated control. Figure 1 represents the Keypoints of the full body of the player .

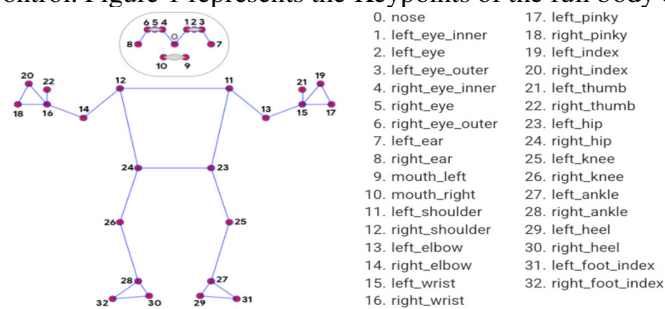


Figure 1: Keypoints of the full body

3.2. Open CV and MediaPipe based Pose Detection

In this part, capture video is processed using OpenCV and MediaPipe pose estimation model. It extract the human movement like arm gestures, leg lifts , squats and jumps on relative difference between body parts as feature points. These feature points were generated as CSV configuration file. Finally CSV configuration file is interfaced

with keyboard to provide input for game controlling . Particular specific movements such as arm and leg extension provides effective controlling operations.

Algorithm: Pose Estimation

Input : Live Streaming Video

Output: Game Controller

MediaPipe()

Extract ()

It extract the human movement like arm gestures, leg lifts , squats and jumps

Feature points= landmarks points { arm gestures, leg lifts , squats and jumps}

Compute()

Difference in Motion patterns to specified control ()

Provides the relative difference between body parts

Gather (feature point)

Control the game operation

4. Experimental Analysis

Experimental analysis of the proposed model(openCV and MediaPipe) is carried out against existing device free methods such as Kinect and Openpose in the python enviroment. CSV file generated to each model to control game is evaluated using accuracy and IoU measure. Figure 2 represents the accuracy evaluation of the device free methods on pose estimation among the various human movement of the full body.

Table 1: Performance Analysis

Methods	Human Body Movements	Accuracy	IoU
Opencv MediaPipe	Arm Movement	94.7	0.07
	Eye Movement	93.8	0.07
	Leg movement	92.8	0.07
	Hip Movement	93.5	0.07
Kinect	Arm Movement	88.7	0.05
	Eye Movement	84.8	0.05
	Leg movement	83.8	0.05
	Hip Movement	84.7	0.05
Openpose	Arm Movement	86.7	0.03
	Eye Movement	82.1	0.03
	Leg movement	81.4	0.03
	Hip Movement	82.2	0.03

Table 1 represents the accuracy evaluation and IoU of the device free methods on pose estimation among the various human movement of the full body. Human Movement estimation efficiency is calculated on basis of IoU. IoU is measure of overlap among the keypoints of the pose.

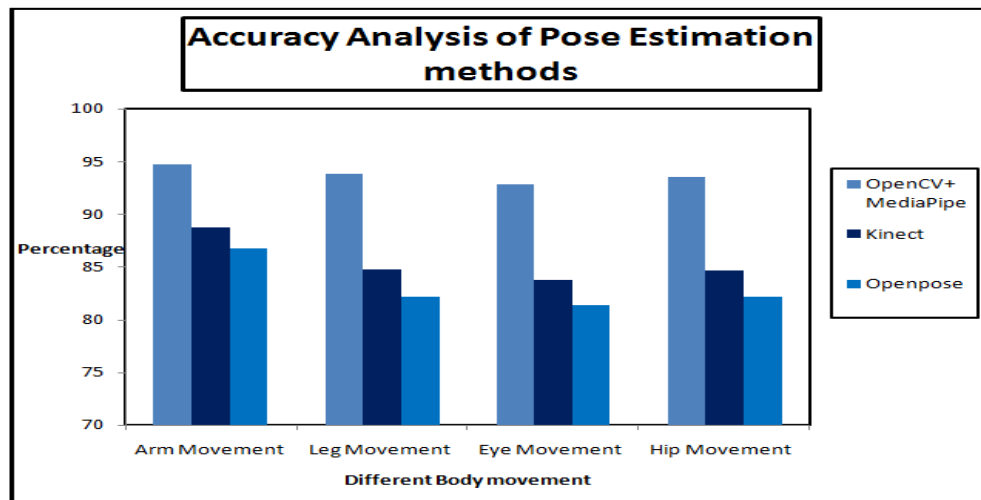


Figure 2: Accuracy Analysis of pose estimation methods

Finally model produces better results on all movement of the body for controlling various games in the multiple environments.

Conclusion

In this article , device free methods towards full body human movement estimation using openCV and Mediapipe has been used for game controller. OpenCV and mediapipe based pose detection approach is machine learning model which provides better performance comparison compared to existing model. Especially proposed model provides increased accuracy to various full body movements as compared with existing models.

References

1. T.-Q. Wang, Y. You, K. Osawa, M. Shimodozono, E. Tanaka, A Remote Rehabilitation and Evaluation System Based on Azure Kinect. *Journal of Robotics and Mechatronics*. 34, 1371-1382 (2022)
2. Z. Cao, G. Hidalgo, T. Simon, S.-E. Wei, Y. Sheikh, OpenPose: Realtime Multi-Person 2D Pose Estimation using Part Affinity Fields. *IEEE Transactions on Pattern Analysis and Machine Intelligence*. 43, 172-186 (2019)
3. P. Mahajan, S. Gupta, D.K. Bhanushalii, Body Pose Estimation using Deep Learning. *International Journal for Research in Applied Science & Engineering Technology*. 11, 1419-1424 (2023)
4. L.N.B. Jyotsna, N. Jagadeesh, G. V. K. Reddy, S.J. Pradeesh, N.H. Raj, REAL TIME GAME PLAY USING HEAD POSE ESTIMATION. *Juni Khyat Journal*. 12, 554-561 (2022)
5. J.-W. Kim, J.-Y. Choi, E.-J. Ha, J.-H. Choi, Human Pose Estimation Using MediaPipe Pose and Optimization Method Based on a Humanoid Model. *Applied Sciences*. 13, 2700 (2023)