Pose Estimation In Physiotherapy Using Machine Learning

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ABSTRACT

Pose detection is an active research area in machine learning, with several real-world applications. Human pose estimation (HPE) is a method of identifying and classifying the joints of the human body. Basically, it's a way to capture a set of coordinates for each joint (arm, head, torso, etc.) known as key points that describe a person's pose. Connections between these points are called pairs. Connections formed between points must be significant. That is, not all points can form pairs. HPE's first goal is to form a skeletal representation of the human body and further process this for task-specific applications. Physical therapy treatments are usually long-term because it takes time to restore a person's movements.To regain movement, you need to do the same exercises every day for several months with the correct posture. Visits to a physiotherapist for each session can be very expensive and not everyone can afford it. must be confirmed. This project is an attempt to create a system that uses computer vision to guide, provide instant feedback, and act as a personal virtual trainer to help people exercise. A system that emphasizes form rather than repetition. In this project we will create an app for the patients and also create a web application for doctors. In web applications, doctors can create a set of exercises for patients and also monitor the exercise of patients. In this project mediapipe technique is used to improve the processing time in the frontend of both patient and doctor apps.

Keyword:*Machine Learning,Pose estimation in physiotherapy,Computer Science and Engineering, Machine Learning, Human Pose Detection, Physiotherapy, Media Pipe*

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1. INTRODUCTION

Patients who are unable to exercise due to accidents, injuries, or for any number of reasons receive physical therapy sessions, medicine that helps heal their injuries. The parameters of these exercises are adjusted in a controlled environment by performing them regularly. Guidance is provided verbally or physically by the therapist to the performer during the exercise or even before the exercise is performed.Regular exercise helps patients improve their potential and correct their mistakes. Physiotherapy treatments are lengthy, and it can take time for patients to recover from injuries. Therefore, the patient must perform the exercises correctly in the correct postural sequence in order to restore the ability to move the body. The hard part here is going to the hospital and getting treatment and guidance at the clinic. Use the app at the patient's site and track the patient's body movements with the phone's camera. Machine learning is used to track patient movement. The Physician Backend allows Physicians/Therapists to design courses for their patients and view reports from patients who have conducted sessions using the application. As patients perform their therapy sessions, the app tracks them and provides voice prompts if they are doing the wrong exercises. A report is also generated based on the session and sent to the doctor/therapist. There is also the ability for the therapist/doctor to follow the patient's session live.

2. LITERATURE SURVEY

[1]This solution leverages a two-stage detector-tracker ML pipeline that has proven effective in the MediaPipe Hands and MediaPipe Face Mesh solutions. Using a detector, the pipeline first identifies a region of interest (ROI) for the person/pose in the frame. The tracker then uses the ROI clipped frame as input to predict pose markers and segmentation masks within the ROI. Note that for video use cases, detectors are only invoked on demand. H. The first frame and when the tracker can no longer identify the presence of a pose in the previous frame. For other frames, the pipeline simply derives her ROI from the previous frame's pose landmarks.

[2] Deep convolutional architectures have proven to be very effective and are widely used in computer vision. With the advent of general-purpose graphics processing units (GPUs), there is a growing interest in harnessing the processing power of GPUs for deep learning algorithms. The vast amount of data on the internet has also made it possible to train deep neural networks efficiently.

[3]A view-based approach for representing and detecting human motion is presented. The basis of the representation is a temporary template (static vector image). where the vector value of each point is a function of the motion properties at the corresponding spatial location in the image sequence. Examine the visual power of a simple two-component version of the template using aerobic exercise as the test domain.

[4]Our approach uses low-cost wearable inertial sensors to track upper-body movements in real-time in 3D space. First create a human torso kinematic chain consisting of the torso and his two limbs. Joint variables are then calculated for the given rotation matrix of the body segment measured using the six inertial measurement units.

[5]Estimating human pose from video plays an important role in various applications such as body motion quantification, sign language recognition, and whole body gesture control. For example, it can form the basis of yoga, dance, and fitness applications. You can also overlay digital content and information on the physical world of augmented reality. MediaPipe Pose is a high-fidelity body pose tracking ML solution that derives 33 full-body 3D landmarks and background segmentation masks from RGB video images using BlazePose research, which also supports the ML Kit Pose Detection API. While current state-of-the-art approaches rely primarily on powerful desktop environments for inference, our method works in real-time on most modern mobile phones, desktops/laptops, Python and even the web. performance.

[6]The pipeline is implemented as a MediaPipe graph that takes pose landmark subgraphs from the pose landmarks module and renders them using a dedicated pose renderer subgraph. The pose landmark subgraph internally uses the pose recognition subgraph from the pose recognition module. This detector is inspired by his lightweight BlazeFace model used as a proxy for the people detector in MediaPipe Face Detection. We explicitly predict two additional virtual key points that tightly describe the center, rotation, and scale of the human body as a circle. Inspired by Leonardo's Vitruvian Man, it predicts the center of a person's waist, the radius of the circle circumscribing the whole person, and the slope of the line joining the center of the shoulder and waist.

3. CONCLUSIONS

Using technology in the physiotherapy sector can make a significant impact. This application will make it possible for patients to do physiotherapy exercises within their home by virtual assistance of doctors/physiotherapists. The implementation of the mediapipe line in this project helps to make the pose estimation and tracking of the patient's body movements much faster. Doctors designing therapy course for patients, patients doing these sessions at their comfortable time and place, patients getting tracked by the app and also getting live voice instructions for doing sessions, generating report of these sessions,report getting reviewed by Doctors/Therapists, Doctors/Therapists able to lively monitor the sessions of the patients and all theses features of the project can make physiotherapy courses much more easy flexible,accessible for patients. This application can make a drastic change in the field of physiotherapy.

4. REFERENCES

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