

Pose Trainer: “An Exercise Guide and Assessment in Physiotherapy”

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Abstract: This report is written on project based on assessment of physiotherapy exercises. Due to lack of physical exercises and movement, after some time people in many profession and in general many people in certain age group would require exercises assessment whether they are doing the exercise correctly or not, then from here our project comes in the picture where it will assist them by letting them know that they are performing it correctly or not. The project uses modern technician to estimate the geometry of person performing exercise in the video uploaded by the user of the project. The open pose model extract the points from the uploaded video and tells the user with which accuracy he or she has performed the exercise. The system can detect the most common exercise and can function on any windows system with GPU.

1] INTRODUCTION:

Patients who face difficulty in performing exercises due to some accidents or any injuries or due to many different reasons they go through physiotherapy sessions which is a medical science that helps them to cure their injuries. The parameters of these exercises are adapted in a controlled environment by performing on regular basics. While performing the exercises or even before performing the exercises some directive is given to the person who is performing the exercise by the therapist either orally or physically guiding. By performing the exercises regularly the patients can improve their potential and correct the errors. Physiotherapy treatments are long running and may take time to make the patient recover from their injuries. Thus the patient should carry out the exercises correctly with correct order of posture to recover the movement ability of the body. The difficulty here is visiting the hospital and getting the in-clinic treatment and guidance. The reason why the patient and therapist get minimal session is because the availability and accessibility of sessions. On the contrary, going for a private therapy sessions is not affordable for every person because they will charge the patient with huge amounts on the bills. Because of such reasons some patients would try to do it on their own at their homes and by doing so they can make the conditions more worse for themselves. Motion recognition research which is based on machine learning has developed the technology by building the cost efficient, accurate and which is stable action recognition

system from video clip(video data) in controlled environment. In this paper, the proposed system act as a personal virtual trainer that would guide, provide instant feedback and helps them to do exercise by themselves.

1.1) Project Objective:

The objective of project are as follows:

- ☐ To help the patient to do the exercise correctly.
- ☐ To avoid the injury to the patient by doing wrong posture.
- ☐ CNN models are studied for pose detection.
- ☐ To explore the various existing system and validate the proposed result.
- ☐ The approach is developed for dynamic pose detection by already trained OpenPose network.
- ☐ It provides current pose correction with help of virtual assistance.

2] LITERATURE SURVEY:

Automatic Squat Posture Classification Using Inertial Sensors: A Deep Learning Approach [1]. Traditional machine learning is use to compare deep learning squat posture. Supplementary, sensor installation is done on the best site. 39 healthy subject were selected and Five (IMUs) inertial measurement units which are mounted on left thigh, right thigh, left calf, right calf, and lumber area so that they can collect data accelerometer and gyroscope. Each subject was asked to do six reps of correct squat and six reps of wrong squats which is standard among the beginner exercisers. The result comparison is done through deep learning and traditional machine learning. One inertial measurement units, or a combination of two or five inertial measurement units, were operated to get each result.

Pose Trainer: Using Pose Estimation to Correct Exercise Posture [2]. User exercise pose is identified using new app, Stance Trainer that give individualized detailed recommendations to improve the user form. Modern pose

estimation technology which evaluate the vector geometry of pose that will deliver useful feedback by the exercise.

Neural Networks for Physical Exercise From Correction [3]. Hips to low ,hips to high and proper are 3 category in which convolution neural network classify images. The real-time posture correction input is given by neural network which works through smart-phone app. Various environmental situations are choosen to assess the performance of system and solution is provided by convolutional neural network. The trained network is in the mobile network.

Deep learning and neural network based computer vision approaches[4]. Deep neural network is used for video analysis of human pose detection. There are 3 ways to value the research. An overview is provided on the topic of current research. Many more ways are up forward for research by video analysis, it's the region in which photos has been more in focus by vision community of computer. Significant advancement on human pose detection is done by 2 models.

3] Proposed System:

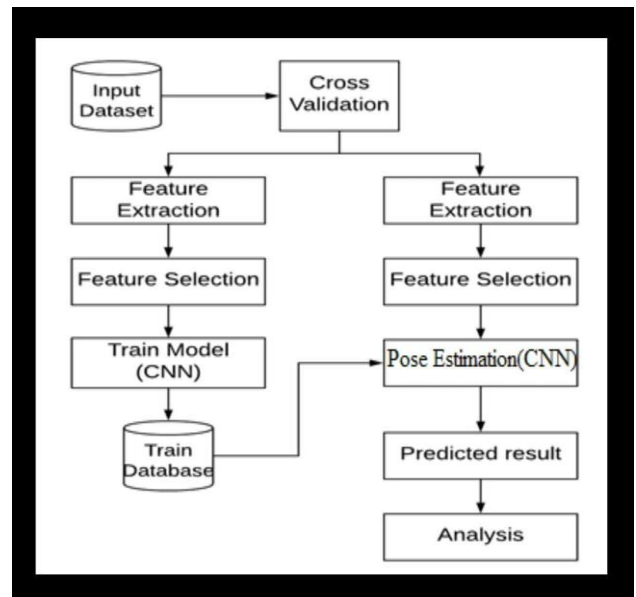
3.1) Problem statement:

As we all know that due to covid-19 crisis the world had gone into lockdown and hospital were full of covid-19 patient. This gives rise to the problem that a person who is just physically injured(difficulty in changing physical posture) would not really opt to go to hospital due to fear of getting covid-19 from any patient in hospital. So normally people would go to personal trainer rather visiting the hospital but the cost that personal physiotherapist would charge would be too high and can't be affordable for normal people. It is not necessary that patient gets injured by accident only, it can also happen in gym while lifting heavy weights which you were not suggested by your trainer but then to you go and lift those weight and end up getting cramps, damaging lower back or any issue in knee joints. Muscular injuries can also occur because of lack of warm up exercises before starting intense workout.

3.2) Solution:

The System we have designed is to treat the patient without visiting the hospital or clinic of physiotherapist. The patient will start felling better after doing proper exercises from the system and with proper posture and will eventually recover from the injury.

3.3) Implementation :



The user of the system should have the camera setup which he/she can place where ever they want ,but the condition of placing the camera is that their body should be visible in the camera and the exercises they perform should be clearly visible in the frame of the video. There is no requirement for any type of camera or any special camera for this purpose just an ordinary camera can do the work effectively.

The video can be of any quality but should satisfy the above mentioned condition. The video adjustment can be done by using any software. Open pose software do support all format of the video uploaded in the system.

The key point extraction is done from the uploaded video by the user. The open pose model is use to detect the key points from the video uploaded by the users, the model easily identify the key points from any format of the video. Open pose takes 17 to18 point in consideration for the system which can be such as knee, eyes, hips, elbow, shoulder, feet, etc. the open pose is very easy to install and does not require any huge load of system to run and give the output on the system. The output of open pose which consist of predicted coordinate of key points for users body.

The system is used by the users who are in different shape, height, size, weight and may be some would stand in different distance from camera .The accuracy and key point score can be largely affected by the all of those previous factors. The sum of square of key is made equal to one by applying L2-Normalization on the key point got from open pose.

With comparison between users key point and data key point the feedback is generated for users. The dynamic time

warping (DTW) is used for comparison in key point of data set.

Nonlinear similarity between two time series is measured using DTW. The problem of phase shift of two similar sequences is overcome by DTW. Troughs and peaks with same pattern are perfectly matched by one-to-many matching pattern so that there is no left out for both curve. The DTW is applicable in system like stock market, computer vision etc. there by the usage of dynamic time warping is to balance the key point of same exercises. Home based physiotherapy exercise dataset is used. Eight exercises are focused by dataset on shoulder and knee: seated legs, swing arms, circle arm, static triceps, and seated hamstring. The exercises are performed by actors and with different posture and frequency. Both RGB and gray-level of video are stored. Our system make use of only four exercises.

4] CONCLUSION:

This report is written to introduce open pose in the system with the DTW machine learning algorithm to estimate the correct exercise poster of the person using the system. As we have explained in the implementation of the system that how the system works. The extracted points are compared with the point of data set used by the system and a feedback is generated by the system. The feedback generated informs the users the measure of correctness in the form of the exercise performed by them.

5] Future scope:

In future scope the accuracy of the system can be increased by using more powerful machine learning algorithm if possible. We can also go for live video in the system so that the user can directly perform the exercise in front of the system and no need to upload the video. And we can add different feature in order to help the user make it more user friendly.

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