

FitBuddy

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Abstract—Nowadays, people are not having enough time for their health because of their busy schedule and those who are in the field of Information Technology, working in front of screens for hours have high health risks because of their sedentary lifestyle. Less physical activity increases more chances of having chronic diseases. Hence we propose a system that will help individuals in doing proper exercise at home no need to go out and pay for the gym instructor.

Gym instructor can tell how to do a particular exercise but he can not dedicate his time only to one person. This system will assist the user in real time. The system can recognize users from a distance and is able to provide visual feedback on the exercise like biceps curls, push-ups, situps, tricep curls and squats which is enough for a person who has very little physical activity. This system will not only tell you how to do a particular exercise but also assist you by giving visual feedback, where you are going wrong and how you can correct your mistake.

Keywords—Health, Fitness, Instructor

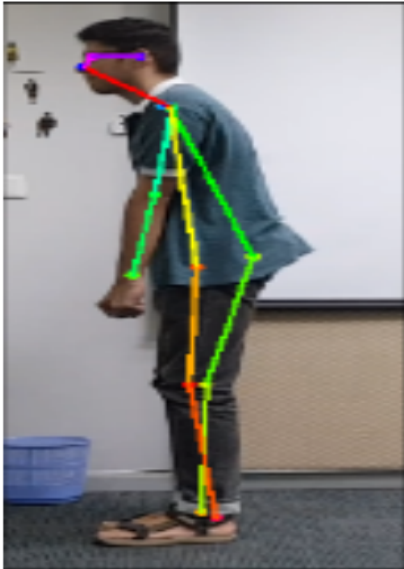
1.Introduction

The health of a person is an important factor in his/her life. Because people are having busy schedules, workload or they are indulging in too much food consumption or anything that is affecting their brain activity but they are not aware of all the issues that will arise out of this. Exercise and diet, if considered generally, varies with different users with different lifestyles, height, weight, age, and activity level. Exercise as well as diet are important and related. There are so many workout videos present on the internet and they are so much popular among those people who are interested in doing exercise at home but problem is with the posture which they are unable to retain. Busy lifestyle, Financial issues and not being able to be consistent in going to gym people are adopting working out indoor independently. Although it is easy and convenient to workout at home, there is an issue with it. If the gym instructor is not available, there is no way to know whether the exercise was performed properly or not but this system is able to detect when the user goes out of sync and shows the correct pose.

We propose a system which an individual can use if he/she has a device with an inbuilt camera. The system is reliable and it is able to handle out-of-sync users by matching the user's frame with a reference video frame where the actual trainer is doing that exercise.

2. Proposed methodology

The most important thing is to identify the human body parts for pose estimation and for that we are using a model which is mentioned in Cao et al. [4] in Real time Multi-Person 2D Pose Estimation using Part Affinity Fields. 10 layers of VGG-19 are used to get a vector representation for a given large image that is fixed in size and it will be used by the network[1]. It follows two multi-step branches of CNN[6] (Convolutional Neural Network) one branch is applied to predict confidence maps for joints location represented as dots in Fig.1.



Second branch tries to predict vector field maps which can be used to deduce association between the body parts provided by the first branch with the help of bipartite graphs.

Body parts in column 1 are connected to that in column 2 and further in column 3 this single element is defined as a limb

Body-Part-1	Body-Part-2	Body-Part-3
Nose	Neck	Right Shoulder
Nose	Neck	Left Shoulder
Neck	Right Shoulder	Right Elbow
Neck	Left Shoulder	Left Elbow
Right Shoulder	Right Elbow	Right Wrist
Left Shoulder	Left Elbow	Left Wrist
Neck	Right Hip	Right Knee
Neck	Left Hip	Left Knee
Right Hip	Right Knee	Right Ankle
Left Hip	Left Knee	Left Ankle

Because the trainer's exercise video will be available offline, each frame in the trainer video can be used to run an estimation model offline to get all body parts and it will be an initialization step. Now this data is ready to be delivered to the users device so that analysis can be performed on users device because if we try to perform analysis of each user frame in real time, it is not possible because CNN needs heavy hardware and it will increase the latency in getting feedback.

To decrease the latency to user feedback limbs will be obtained from the user input video from every nth frame,

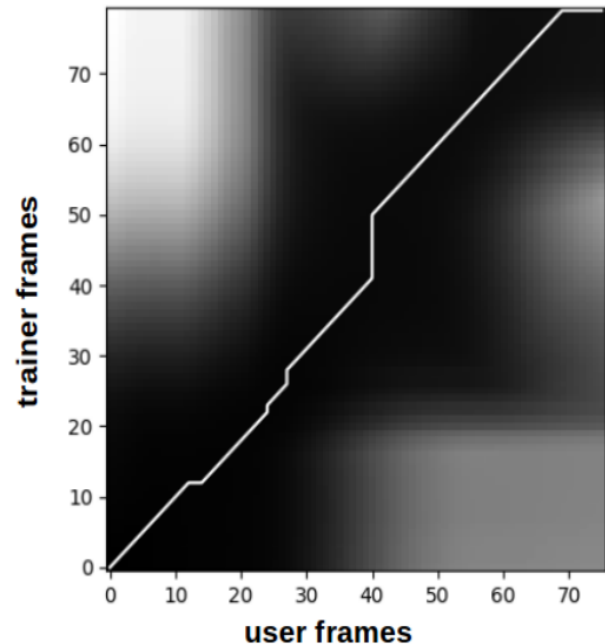
and intermediate frames can be provided by the optical flow tracking to get body parts from neighboring frames and for that purpose we will use Lucas-Kanade algorithm[7] that is implemented in OpenCV[8].

Lucas-Kanade Algorithm is based on intensity constancy in two intermediate frames and the advantages of this process are as follows

- Estimation of intermediate key-points on device.
- reduction of errors in estimation, in forward and backward direction.
- Approximation of missing key-point from a neighboring frame.

DTW algorithm is used for aligning time series sequences of pairs. DTW (Dynamic Time Warping)[5] needs a measure which has similarity between any two items and then it supplies a mapping with the item pairs that have been matched the closest. In this instance we have chosen a pair of frames in which one frame is from the user video and the other is from the trainer video which is a reference video. It is obvious that all limbs besides the targeted one will not be involved in a specific exercise therefore only those limbs will be chosen that have an important movement. In Fig.2 similarity is shown and it is given by the DWT algorithm and the sample used is trainer and user pair sequences. In case when more than one frames in a sequence are matched

with a single frame in another sequence of frames this algorithm can tackle that.



Similarity graph

On X-axis user's frames shown and on Y-axis trainer's frames are shown

There are three types of information which can be drawn from this graph.

- A horizontal line on the graph shows that more than one frame of the user video is matched with a single frame in the trainer's exercise video.
- A Vertical line on a graph represents that more than one frame in the trainer's video is matched with a single frame in the user's video.
- A line that is neither parallel to X-axis nor to Y-axis representing that a number of consecutive frames are matched in both the sequences.

3.Literature Review

1. Recommendation system of health was developed based on the framework that is called ontology framework which is used to recommend exercise and food to the patient based on his/her medical condition. To extract the information of the user a decision tree algorithm was used on the dataset. Out of multiple algorithms the random forest algorithm was quite accurate in monitoring of health. Remotely monitoring the health of elderly people is done by deep learning and data analysis was done by random forest, support vector machine.[9,10,11]

2. The CDC that is center for disease control and prevention has said that all the people who are entering in their adulthood are advised to workout for minimum 30 minutes and this should be moderate activity aerobics for five days in a week and training muscles for strength two days a week high intensity exercise should be done. People are recommended to go to the gym for weight training and use different kinds of equipments so that each muscle of the body can be targeted with different exercise.[12]

3. In the previously done research work it is found that physical exercise programs that are done in groups have comparatively better results than exercising alone. In fact the group based programs show that in the long-term there will be high level of participation in the exercising sessions but short-term results are not so appealing. It can be easily estimated that the significant factor in these group based training programs for exercise is social interaction and people are naturally drawn to the activity that is being followed by a large number of people collectively.[13, 14]

4. In this research paper it has been explained that most of the product that are available out there in the market, whether they are books, mobile applications or videos are having some problems with them for example they are less interactive that is why they fail to draw attention of the user and these products only give advice or tips for doing right exercise and the other problem is that some product which are cheap and fitbit like devices provide information like how many calories have been burned and how many steps are taken over an interval of time but these metrics are sometime inaccurate.

So in this research paper a virtual reality based app is proposed that will be more interactive and a kinect sensor is used that is able to capture color and depth of an image at the same time. This sensor is named as Microsoft kinect sensor that will enhance the user experience. This sensor is used in both scientific research and industry that are entertainment and healthcare [15]

5. In this research paper more importance is given to cardiovascular exercise because it is important for those who have very low physical activity. The word cardiovascular refers to the capability of the heart and lungs of pumping blood with enough oxygenated blood to the target muscles involved in exercise so that the muscle can use that oxygen effectively. Here the same kind of watch is proposed to wear that is used in present times. This watch is able to show temperature, heart rate.[16]

4. Conclusion

By this research paper a system has been proposed that will detect user deviation from exercise and it needs no trainer for supervision. The system is capable of detecting slightest deviation in the angle of limbs. This system can be more beneficial for those who are just starting their fitness journey and are conscious about their health.

For a beginner in workout the most important thing is to maintain the form while doing any exercise because doing without proper form can lead to serious injury, to avoid it this system will help the user to correct the form each time when the user deviates from it.

Before doing exercise with proper weight it is recommended to perform with less weight and more attention must be paid to the form.

In future we are considering adding another feature that will have a separate section where the user can get a diet plan recommendation according to his/her diet plan.

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