GymBro

Enhancing exercise posture through AI-driven assistance.

Team Quad-eye

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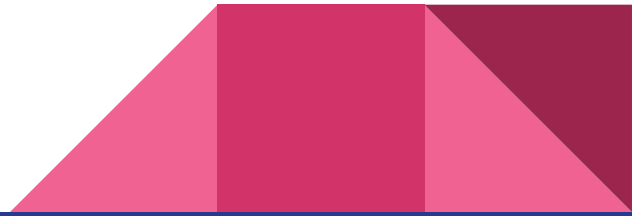


Brief Summary

- Gym Bro is a project designed to assist fitness beginners by providing virtual help.
- It uses deep learning techniques and computer vision, leveraging pre-trained state-of-the-art (SOTA) models.
- The system analyzes user posture during exercise and offers real-time feedback for improvement.

Problem Statement & Motivation

- The fast-paced lifestyle and sedentary work culture lead to significant physical fitness challenges.
- Unhealthy eating habits and long commutes reduce time available for wellness.
- Difficulty in arranging physical trainers results in improper exercise execution, leading to sprains and injuries.
- National Health and Nutrition Survey (Japan) shows a 30% obesity rate in engineers with desk jobs, 10% higher than non-engineers of the same age range.

Pipeline

1. Pose Estimation
2. Trainer Key-frames extraction
3. Dynamic Time Warping
4. Optical Flow tracking
5. Aligning points using Affine Transformation

Pose estimation

- ➔ Pose estimation is capturing key points like shoulders , elbows , hips and knee etc which are essential in assessing the posture while exercising .
- ➔ We employed MoveNet which is an ultra fast and accurate model which detects 17 key points in the body , totally covering all the points required for our analysis (excluding points such as 2- eyes)
- ➔ Lightning variant was preferred because we need real time estimation and the model is optimized for speed and efficiency best suiting our need.
- ➔ From these points were calculated the key angles which mattered to the correctness of the exercise.

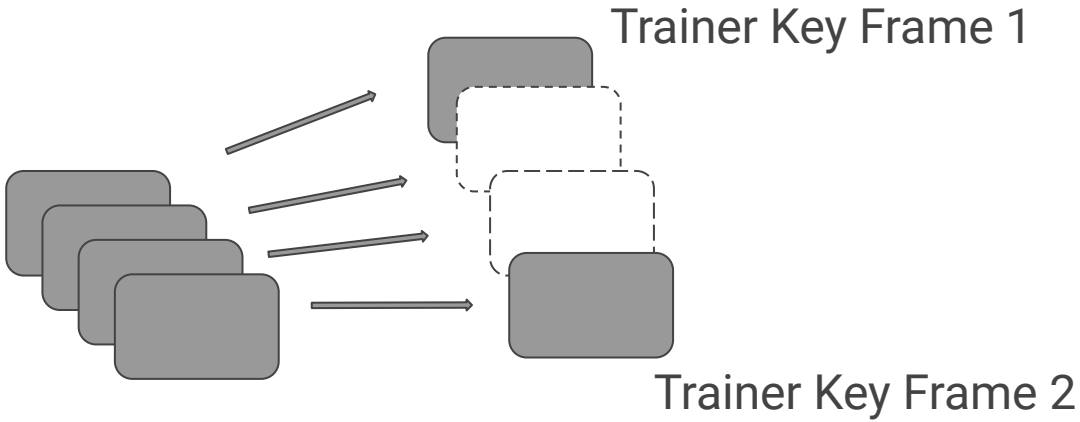
Eg: Right Shoulder - Right Elbow - Right Wrist &

Left Shoulder - Left Elbow - Left Wrist

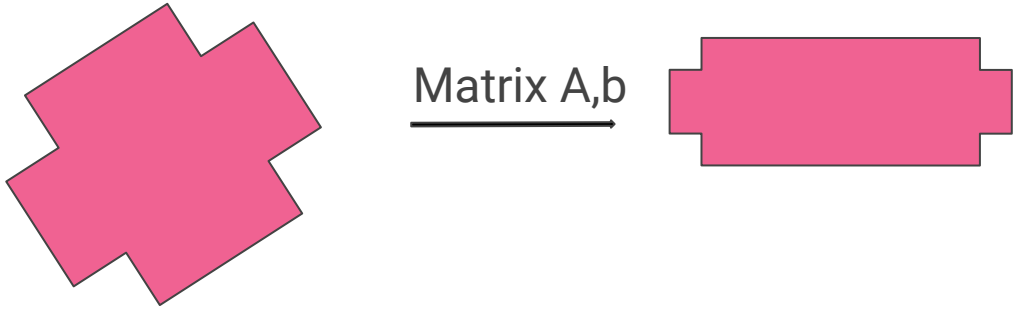
Key-Frame Extraction

- ➔ In the trainer video i.e the video of exercise being done correctly , we collect the first frame of the video and the key angles which are consequential are vectorized and noted
- ➔ We are continuously capturing video frames. For each frame, the key-angles vector is calculated . Comparing this vector with the last key-frame's vector, the L1-norm we compute. Exceeding a predefined threshold if it does, the frame will be saved as a key-frame.
- ➔ In this way we keep noting the key frames , save their keypoints and key-angles into csv files used further in the project.

Dynamic Time Warping and Optical Flow Tracking

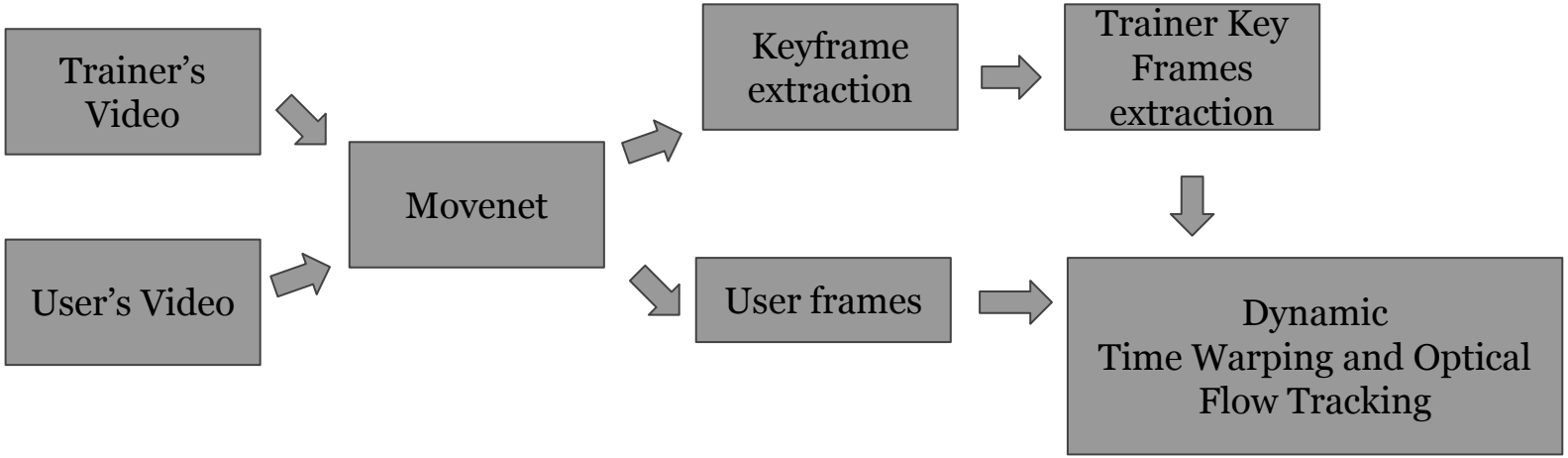


Affine Transformation

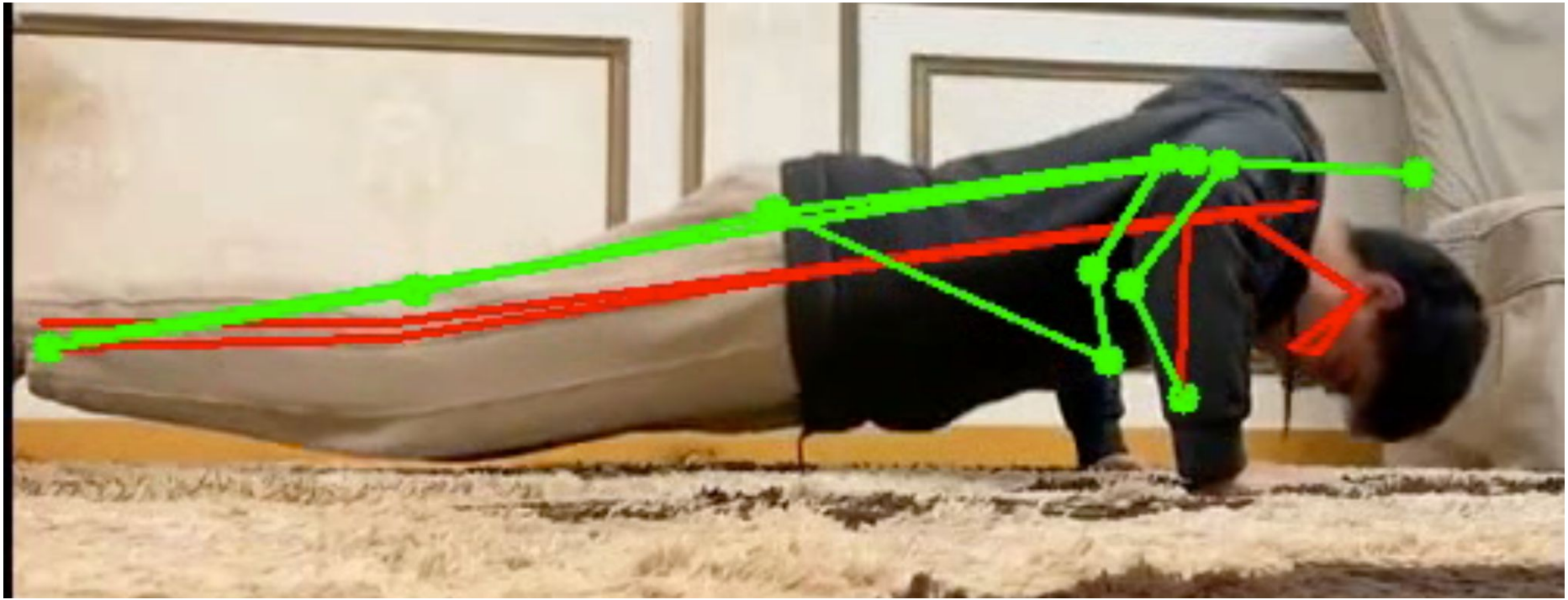


AX + b = Y

Find the best matrix A to compensate for the alignment of Trainer and User's frames into a common frame of reference, ensuring consistent comparison.

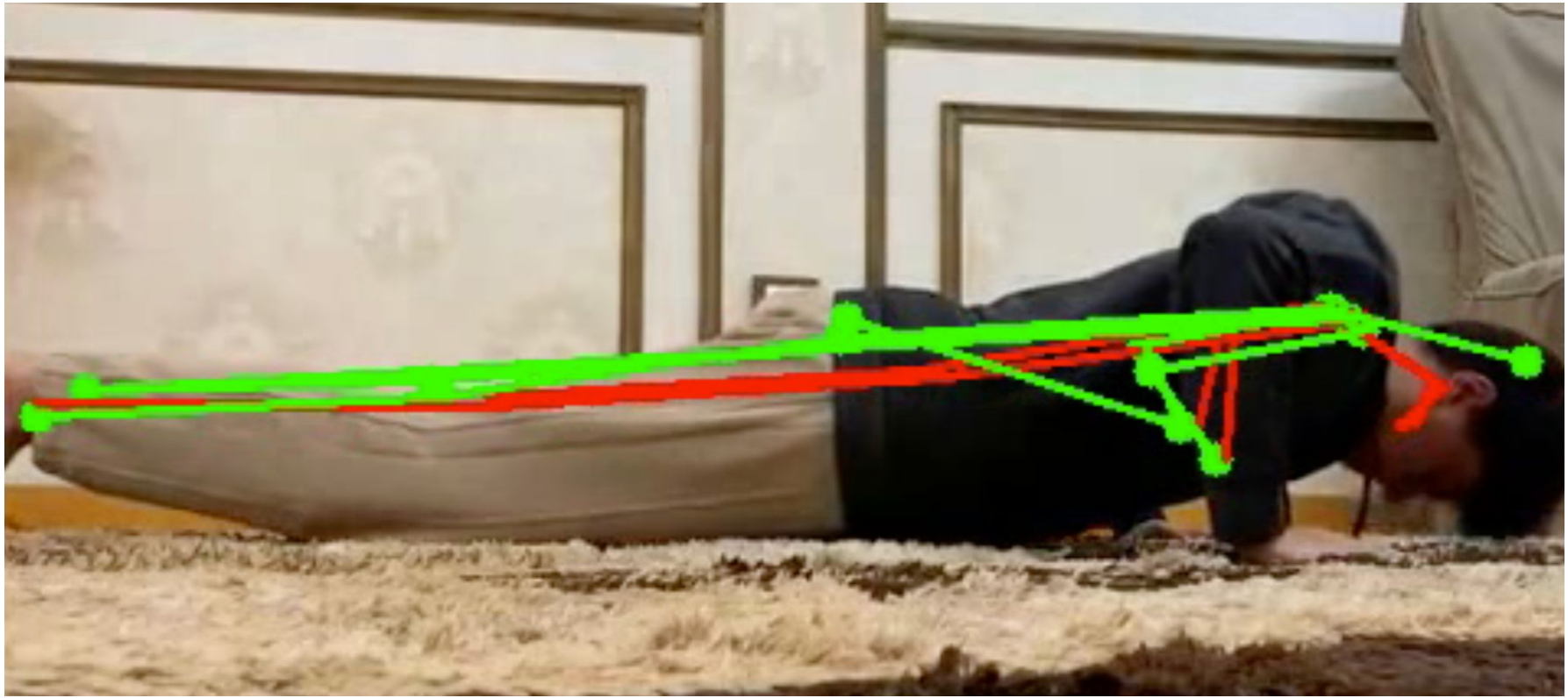

Trainer's Video
User's Video
Movenet
Keyframe extraction
User frames
Trainer Key Frames extraction
Dynamic Time Warping and Optical Flow Tracking

Results



Here we can see the stark difference in the posture of the user(red) and the trainer(green) identified by our project

Results



Here we can see user has been able to attempt this particular posture of the trainer

References

https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8856547&tag=1