Exercise Posture Correction System using Deep Learning Techniques

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Introduction

Although exercise is important, It is also important during exercise to have proper breathing and good posture, this helps the body to function and will cut muscle strain and injury [1]. But many individuals struggle to maintain correct posture, leading to suboptimal results and increased risk of injury. Proper body posture has been associated with a reduction in incidence of injuries [2]. This correlation shows the importance of correct posture in mitigating the risk of exercise-related injuries.

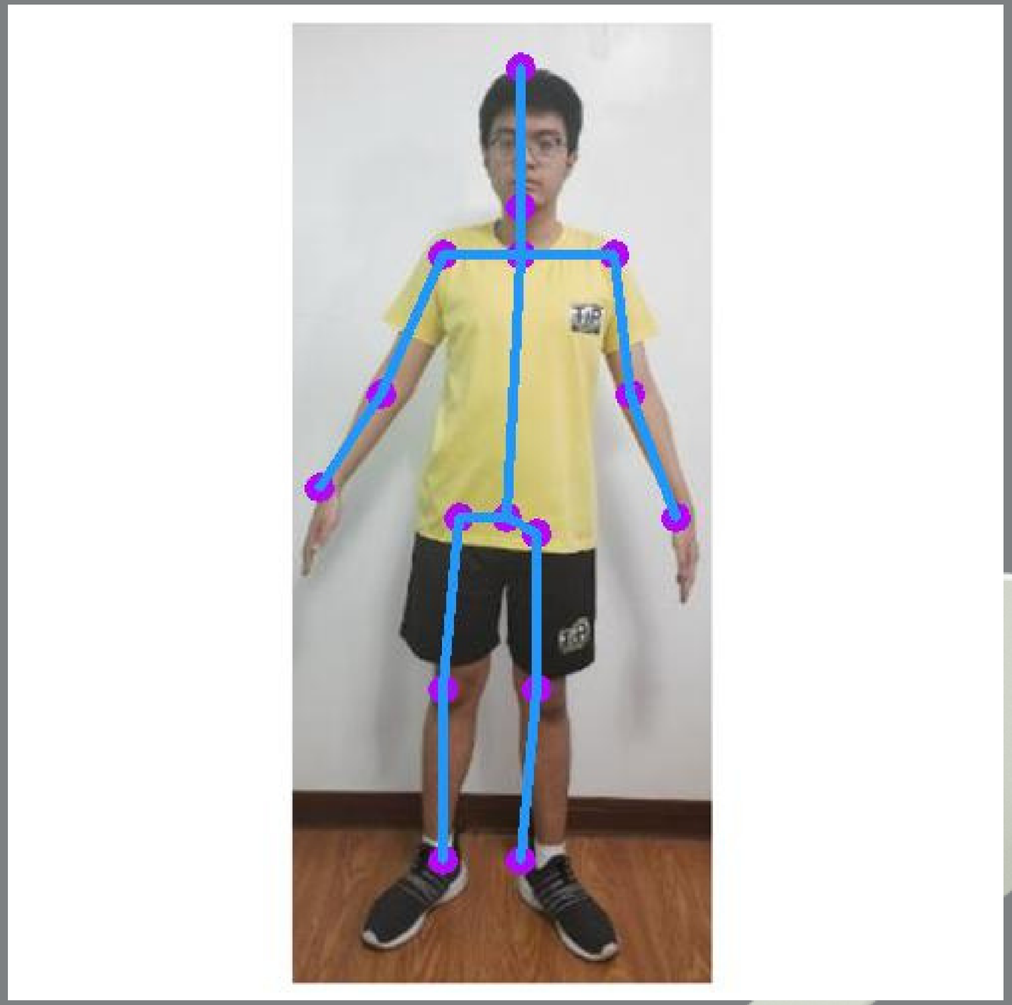
Methodology

Pose Estimation Model

The dataset was acquired in the MPII Human Pose Dataset, a rich resource containing images annotated with 16 key body joint locations. The dataset is then split into training, validation, and testing sets to facilitate model development and evaluation.

Next, we preprocess the dataset by standardizing image sizes to a consistent resolution suitable for input to the ResNet-50 model, typically 256x256 pixels. We normalize pixel values to the range [0, 1] and apply data augmentation techniques like random rotations, flips, and translations to enhance dataset variability and model generalization.

Methodology



Methodology

Human Activity Recognition

In the Human Activity Recognition, we utilize a dataset derived from the pose estimation model, comprising key points representing body joint positions, and classify it into binary categories corresponding to activities like push-ups, lunges, and squats. This dataset is then divided into training, validation, and testing subsets for model training and validtation.

Methodology

show points

show lines

use camera

predict

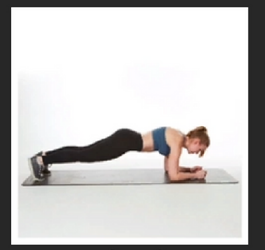
change sample

squat (leg 1)
85
good

squat (torso 1)
75
good

quit

Lunge



Plank

Squat

Results

Body Parts	*Scores*
Head	96.351
Shoulder	95.329
Elbow	88.989
Wrist	83.176
Hip	88.420
Knee	83.960
Ankle	79.594

Fig. 7. Mean Average Precision for Pose Estimation Model

Results

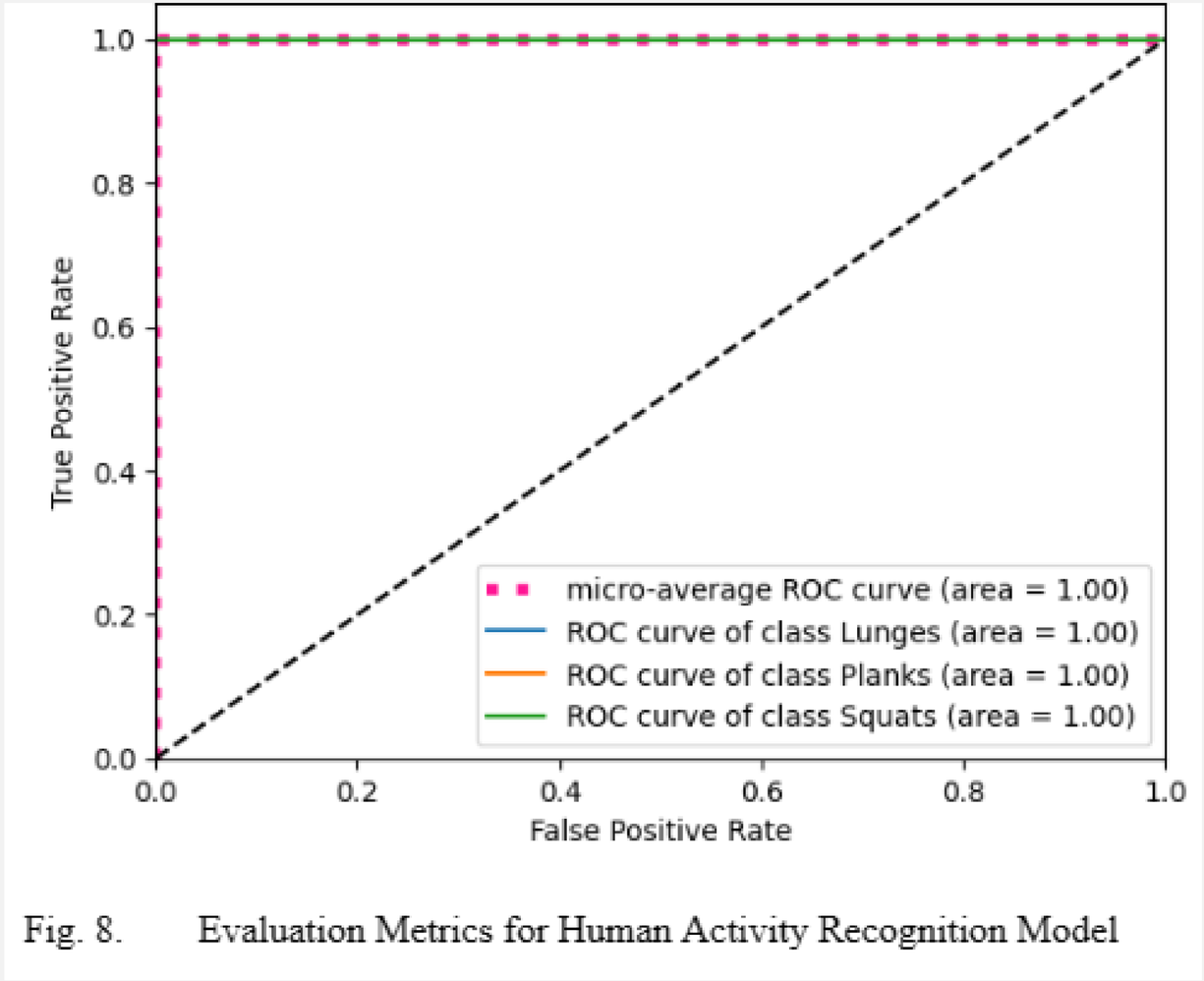


Fig. 8. Evaluation Metrics for Human Activity Recognition Model

Discussion

After testing the system, we can conclude that this system can detect pose and classify it, the models showed great results all across the metrics. The pose estimation showed great performance in the device were we simulated the software. Furthermore, the error detection algorithm that we used worked as we expected, and the responses in the software was correct and consistent.

Github Repository

https://github.com/Abyza/Project_Exercise_Posture_Correction

Video Demo

https://youtu.be/6aXK-A1TD4s