HUMAN POSE ESTIMATION BASED

POSTURE CORRECTOR

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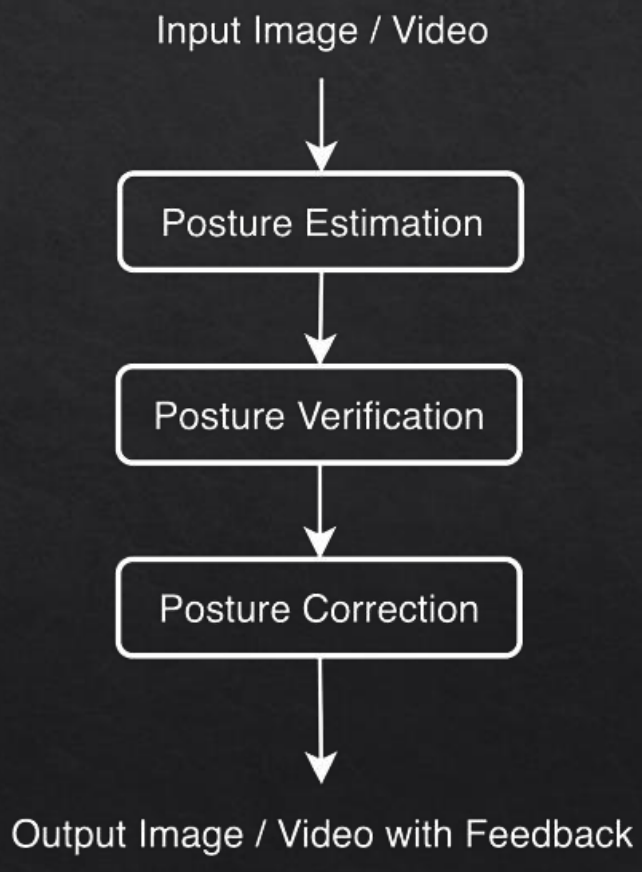
INTRODUCTION

- A healthy posture allows the body to operate more efficiently and reduces the risks of injury or muscle strains.
- While exercising, maintaining proper posture is crucial when you add weights, such as dumbbells, for strength training.
- We are proposing Posture Corrector for people who cannot afford personal trainer or prefer exercising alone. It is an effective tool for people to monitor and correct their exercise form without the need for trainers' physical presence or financial investment.
- Users can now be more confident that they are performing the exercise correctly and avoiding potential injuries that can result from incorrect posture.

ARCHITECTURE

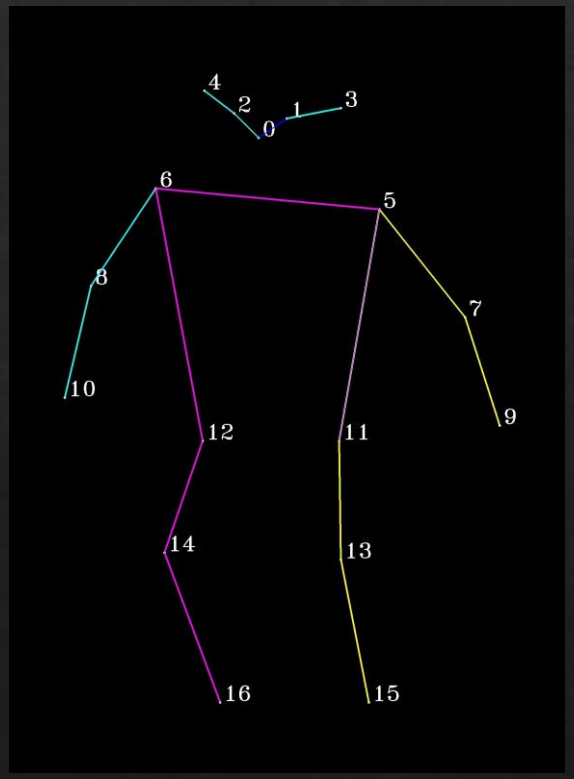


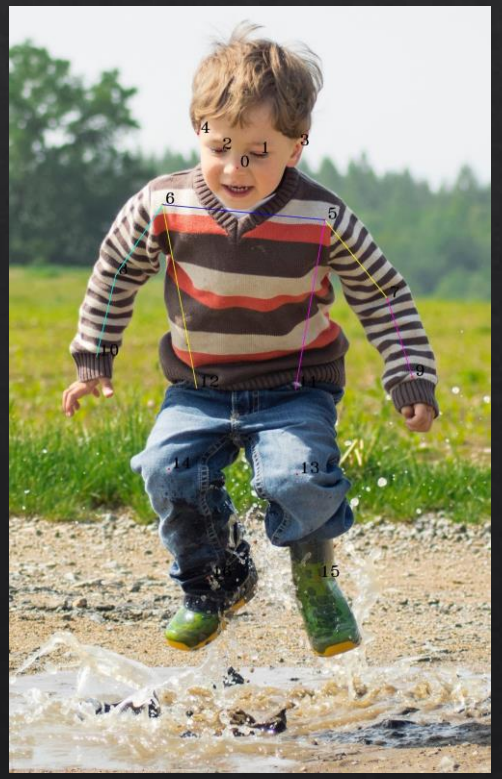
METHOD

- Posture Estimation:
  - We are using a PyTorch KeyPoint RCNN with a ResNet50 backbone to detect key points on human bodies.
  - ResNet50 is a 50 layers deep CNN architecture pre-trained on COCO keypoint dataset, which helps us extracts high-level characteristics from images.
  - The dataset has 80 object categories, including people, animals, vehicles, household objects, and more..

METHOD

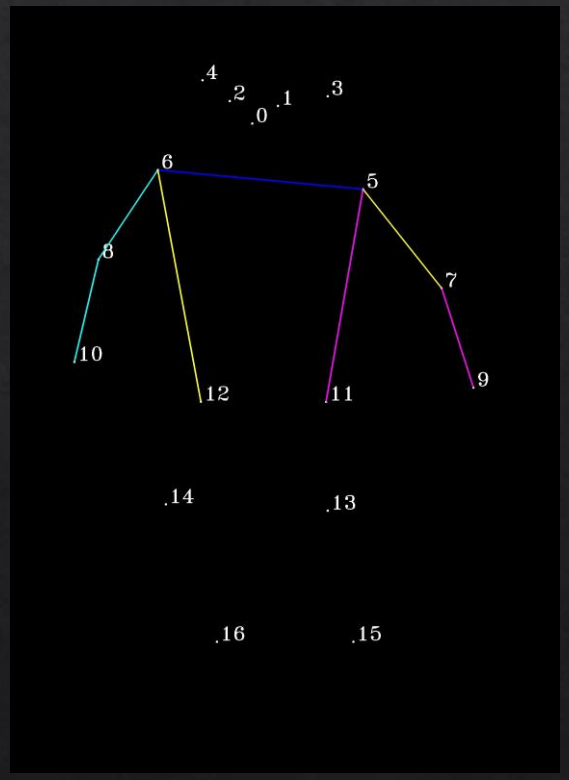
- Posture Estimation:
  - Characteristics/Key points extracted:

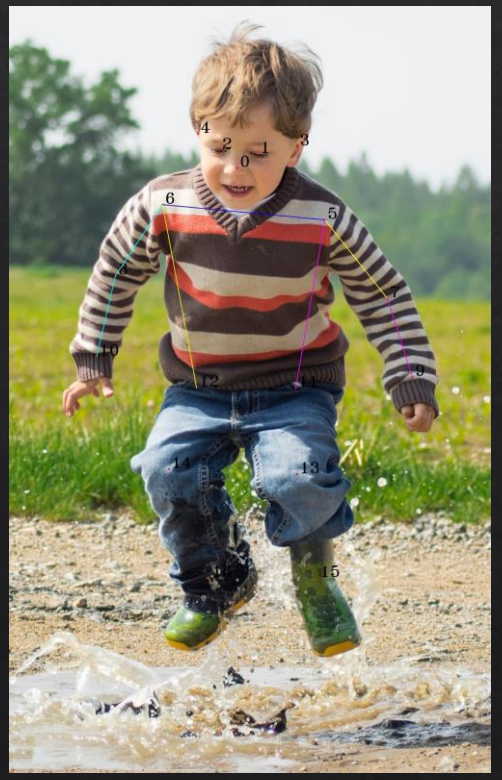




METHOD

- Posture Estimation:
  - Required Characteristics/Key for biceps curls:



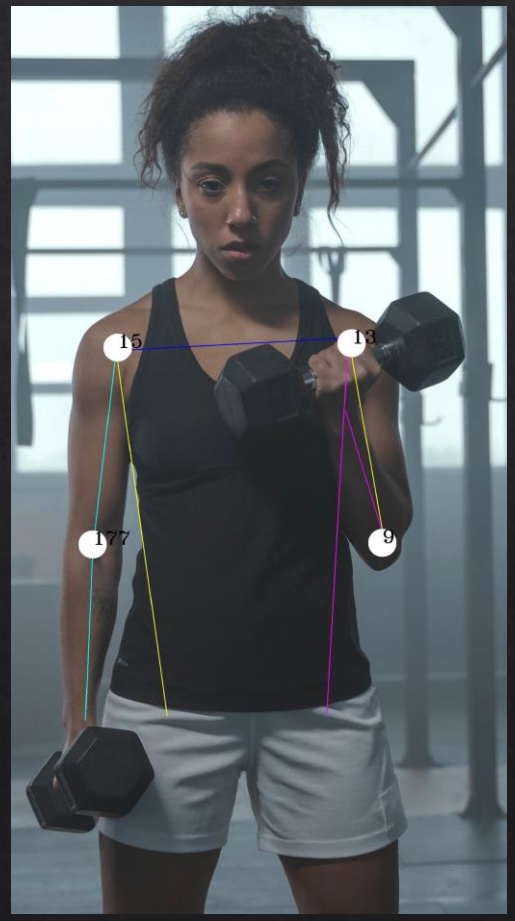


METHOD

- Posture Verification:
  - We then compute the angles at these joints between the upper arm and torso with the help of Numpy Library.
  - The angle between Right Elbow – Right Shoulder – Right Hip and the angle between Left Elbow – Left Shoulder – Left Hip are calculated.
  - These angles are then compared to the benchmark angle which is 30^{o} to 35^{o}.

METHOD

- Posture Verification:



METHOD

- Posture Correction:
  - The system explicitly states whether the angle between the torso and the arm is incorrect during a bicep curl.
  - The system provides a corrective feedback to help users adjust their posture for optimal form.

METHOD

- Posture Correction:

DEMO

EXPERIMENTS

- Why this method:
  - Initially we experimented with Media Pipe Framework for pose detection.
  - Media Pipe Framework is less configurable and contains more complex key features.
  - RCNN with ResNet50 is more configurable and less complex which is more suitable for our system.

EXPERIMENTS

- Evaluation Metric:
  - A sample of 100 exercise images was randomly selected from Pexels.com to represent various body poses and environments with different lighting conditions to ensure the system's robustness and adaptability.
  - Out of the 100 images, 8 were marked as incorrect, this result indicates the system's accuracy rate is 92%.
  - One of the weaknesses identified in the system is that the user's full body must be visible in input image or video. Partial images that do not capture the entire body may result in weaker accuracy.

NEXT STEPS

- Future Improvements:
  - The system can be expanded to cover other exercises and activities, providing a more comprehensive posture correction tool for users.
  - The accuracy of the system can be improved by using ML application.
  - The system may be updated to offer real-time feedback.

Thank You!