Squat tracking

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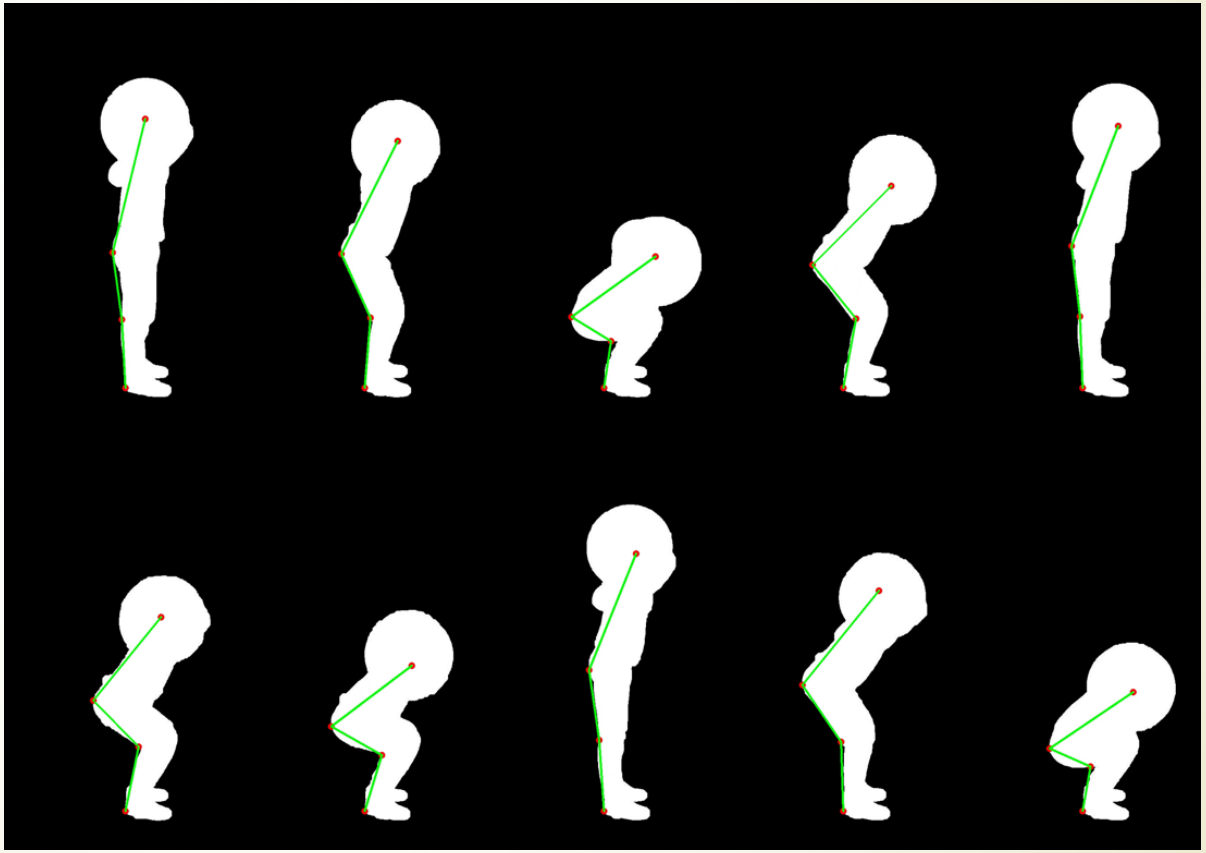
Overview

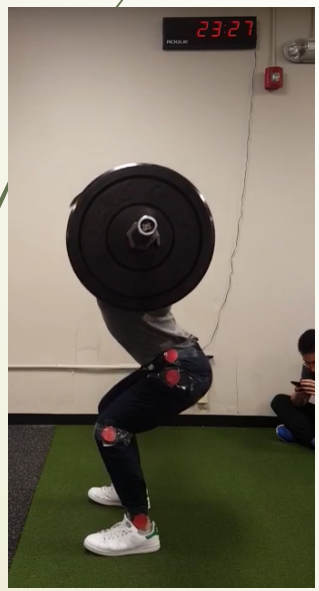
- Dataset
- Pre-processing
- Feature extraction & tracking
- Results & analysis

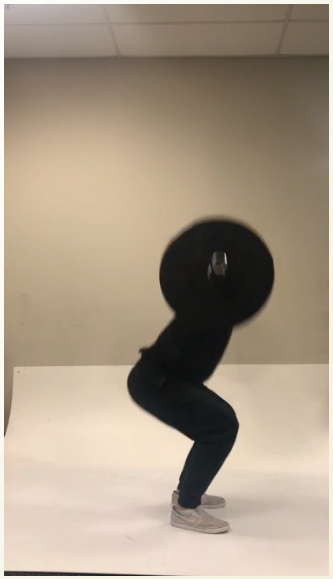
Introduction



Dataset

- Self made dataset
- Hypothesis
- Ground truth
- 2 different background





Pre-processing

- Background extraction
- Regular Background subtraction
  - Mixture of Gaussian
- Background subtraction use optical flow
- Edge detection

Background extraction

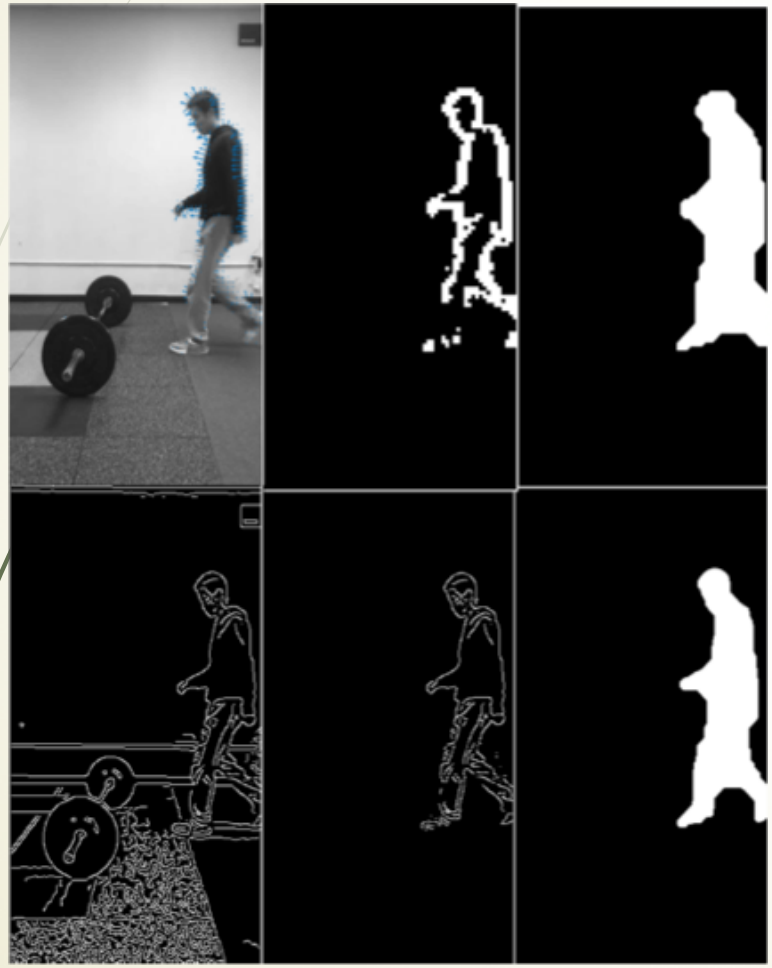
Regular Background subtraction

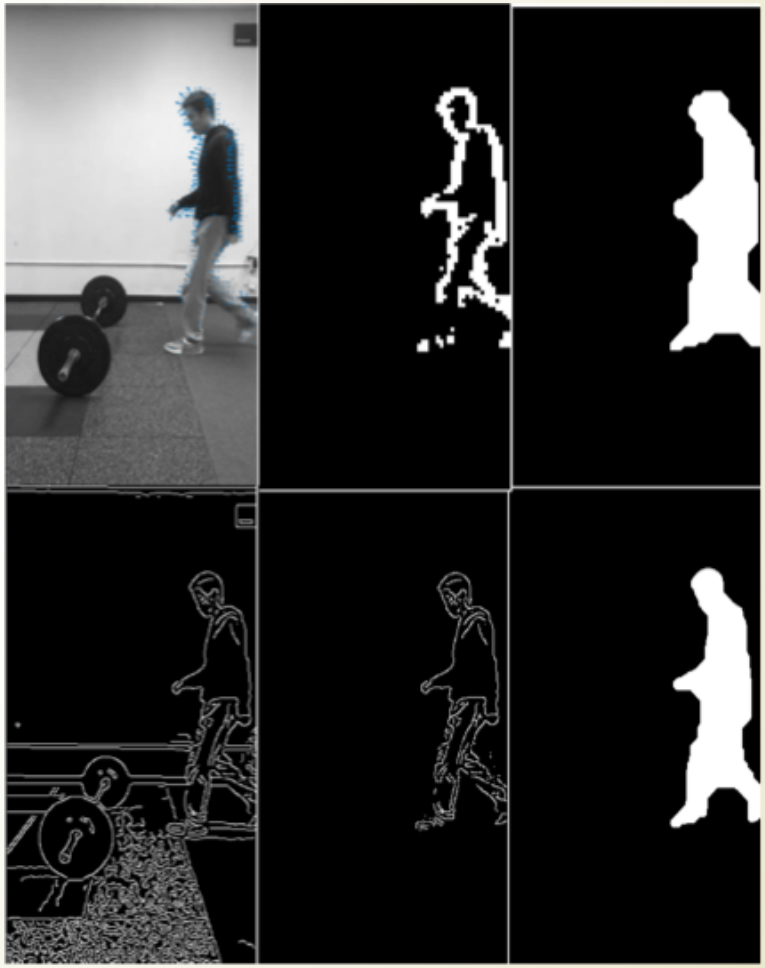
CNT

GMG

Mixture of Gaussian

Optical flow



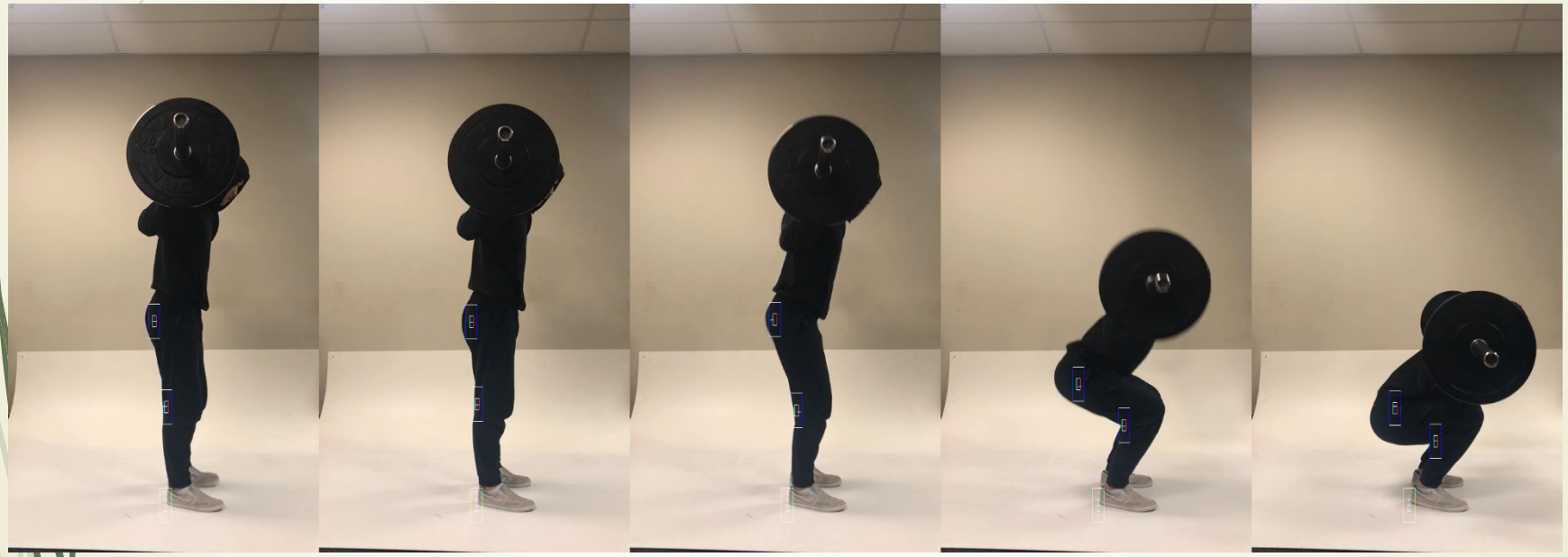


Feature extraction

- Hough transform
- Maximum curvature
  - Polygon representation
- Human kinematic constraints
- Extreme points

Tracking & speed

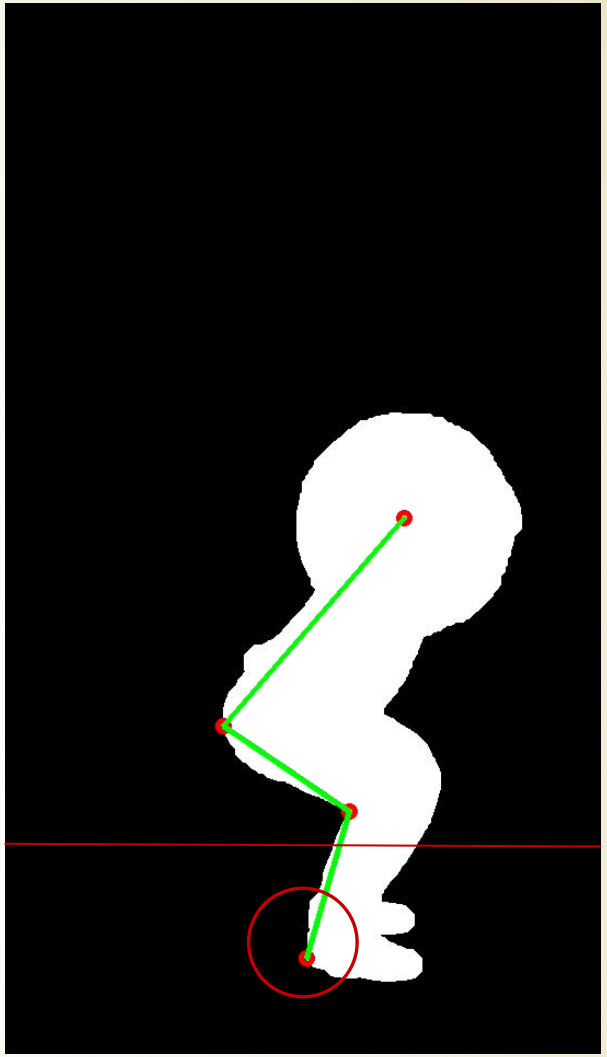
- Option 1: Vtrack
- Option 2: Process each frame completely



foot

Compute at first frame
Leftmost point

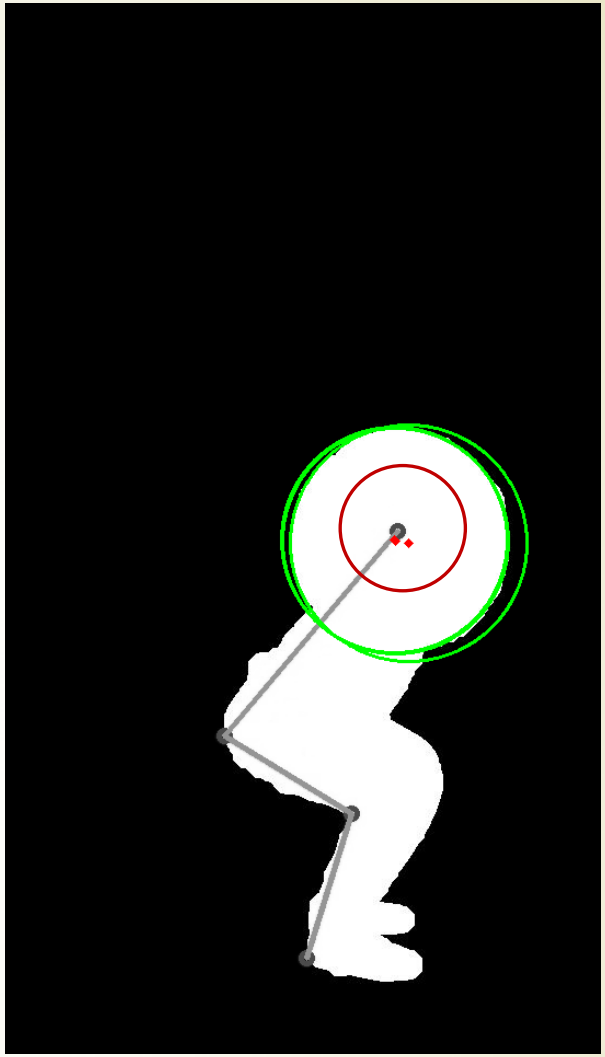
And then fix it



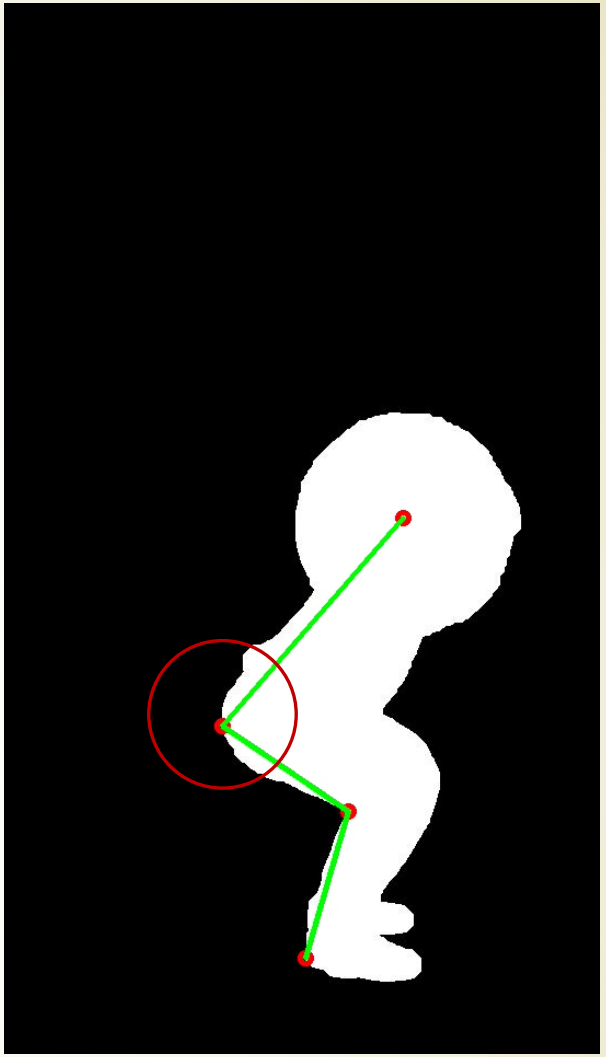
Barbell centroid

Hough transform

Find circles and centroids
Choose the one that is closest to the previous frame



hip

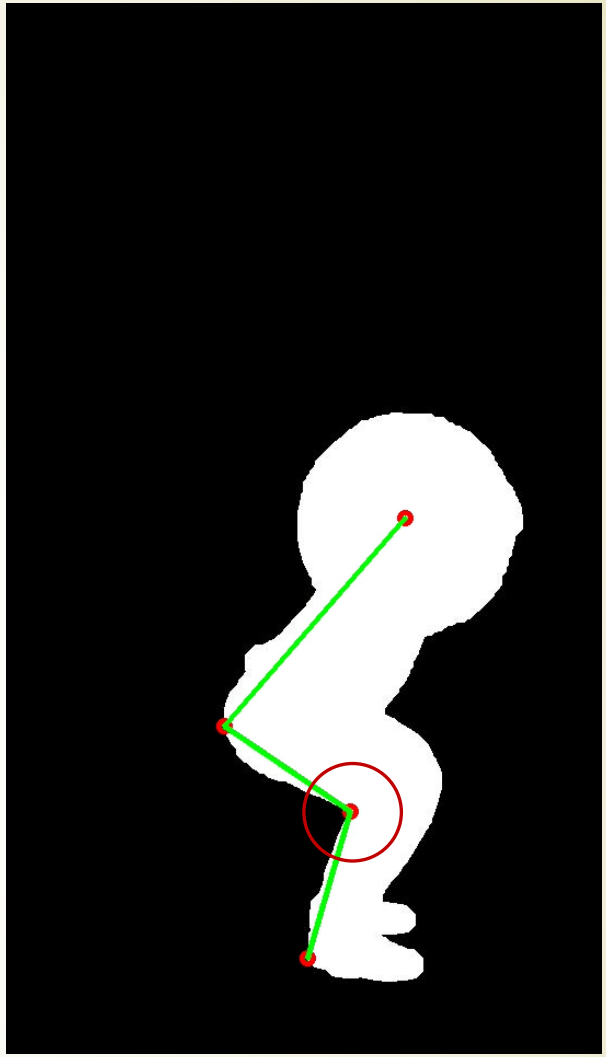


knee

Connectivity: two points belong to the same region if you can make a straight line between them without intersecting any silhouette boundaries

Connectivity energy function

$$E(i,j) = f(x) = \begin{cases} D(i,j), & \text{if } connectivity(i,j) = 1 \\ 0, & otherwise \end{cases}$$



inspired by *Chih-ChangYu, etc. Automatic Human Body Tracking and Modeling from Monocular Video Sequences. IEEE, 2007*

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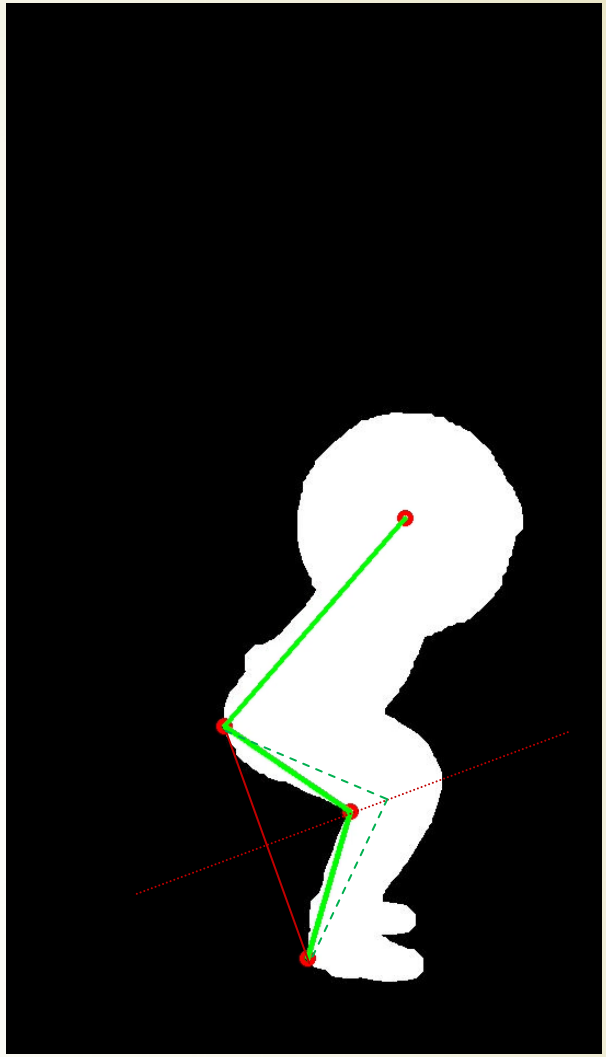
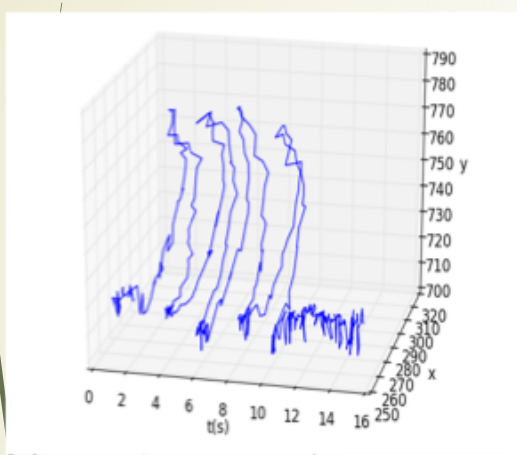


Knee point can be obtained to minimize the connectivity energy function

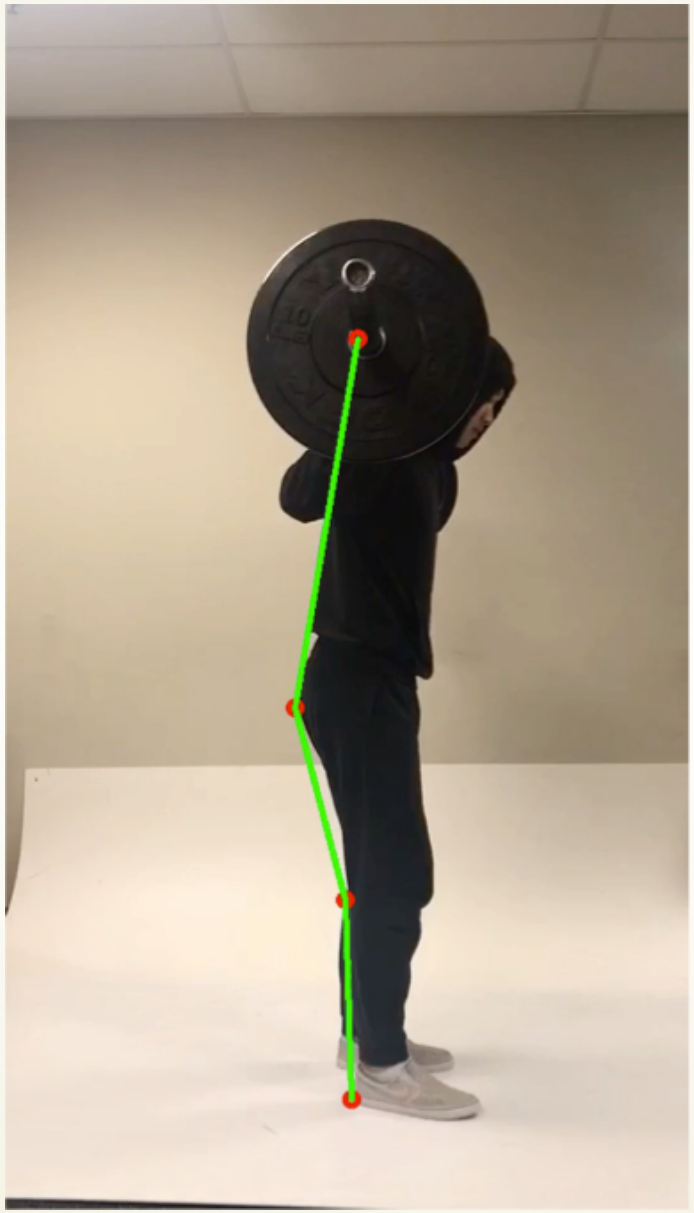
$$E_{total} = argmin_{knee}\{E(hip, knee) + E(knee, foot)\}$$

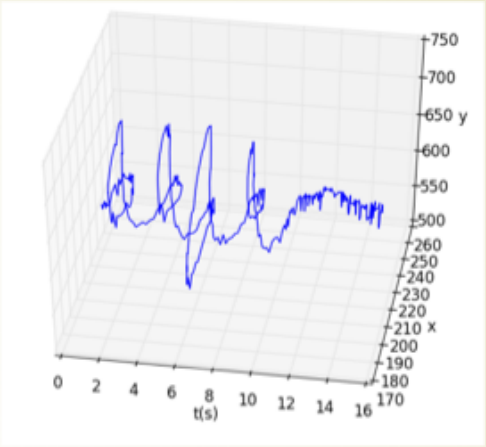
inspired by *Chih-ChangYu, etc. Automatic Human Body Tracking and Modeling from Monocular Video Sequences. IEEE, 2007*

Results & Analysis

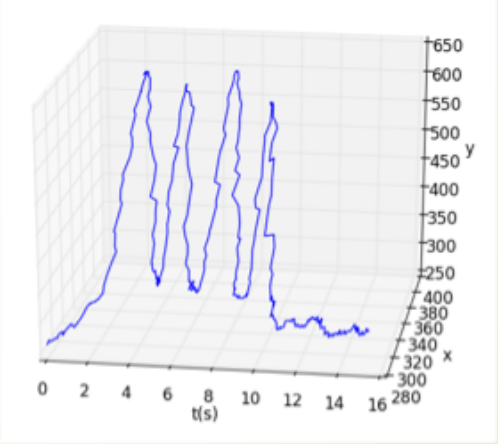


knee



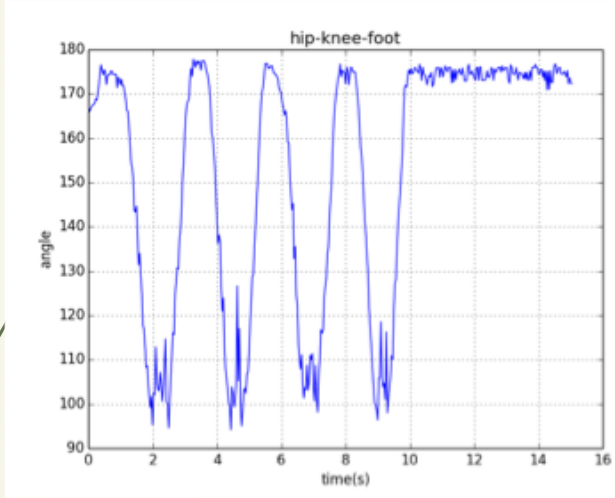


hip

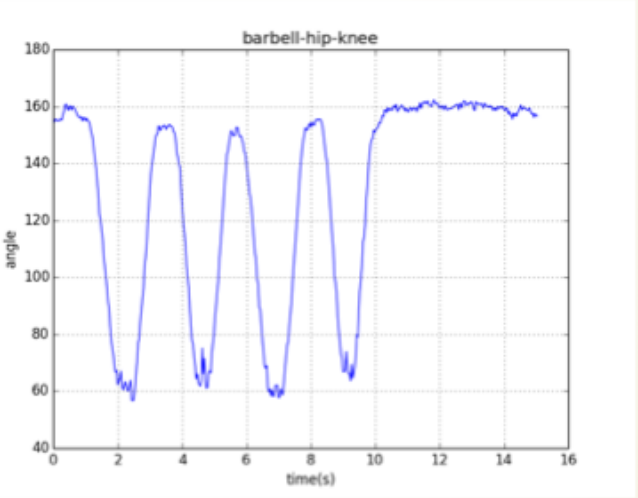


shoulder

Angles Computing



Angle at knee



Angle at hip

Results Evaluation

- Using Markers
- compute points using proposed algorithm, if it is within marker, it is correctly detected, otherwise wrong.

Q & A