Integrating Human Body MoCaps into Blender using RGB Images

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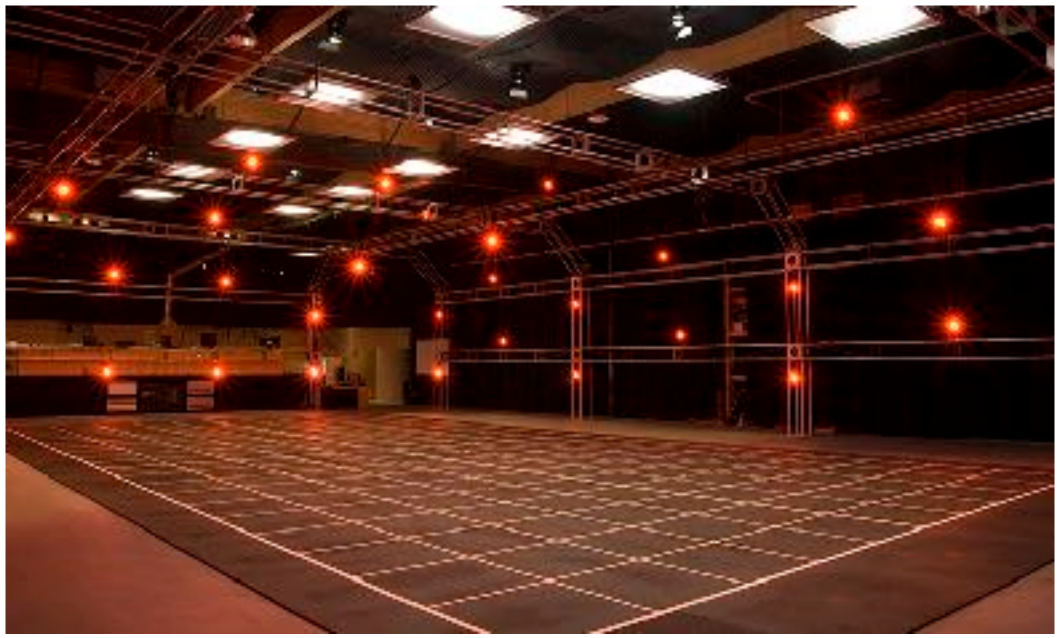
Outline

- MoCap systems and applications
- Blender MoCap integration
    - From RGB image to 3D body joints
    - Match 3D human model to 3D skeleton movement
- Offline results with synthetic and real data

MoCap studio



https://www.activision.com/company/locations/activision-capture

https://anotherindiestudio.com/diccionario-o-vocabulario/que-es-la-captura-de-movimiento-o-motion-capture/

- Installation with multiple cameras
- Needs dedicated space

} → Expensive

- Actor to track needs to wear a suit with markers
- Retrieved data needs to be processed

\+ Obtain high quality motion files

MoCap from suit

https://www.rokoko.com/en/products/smartsuit-pro

- Sensors are incorporated in the suit
- More cheap, but still not affordable for everyone

+ Can be used outdoors
+ Quality of recorded action is high
+ Usually comes with software to process data

MoCap from RGBD

Commercial

https://www.reallusion.com/iclone/mocap/

Free

https://brekel.com/kinect-3d-scanner/

- Quality of motion is more unstable
- Indoor actions between 0.5-2 meters of the camera
- Usually only compatible with Windows OS
+ Commercial and open source versions
+ Affordable for broad public

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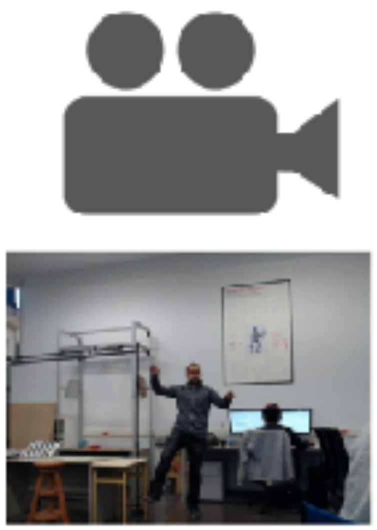
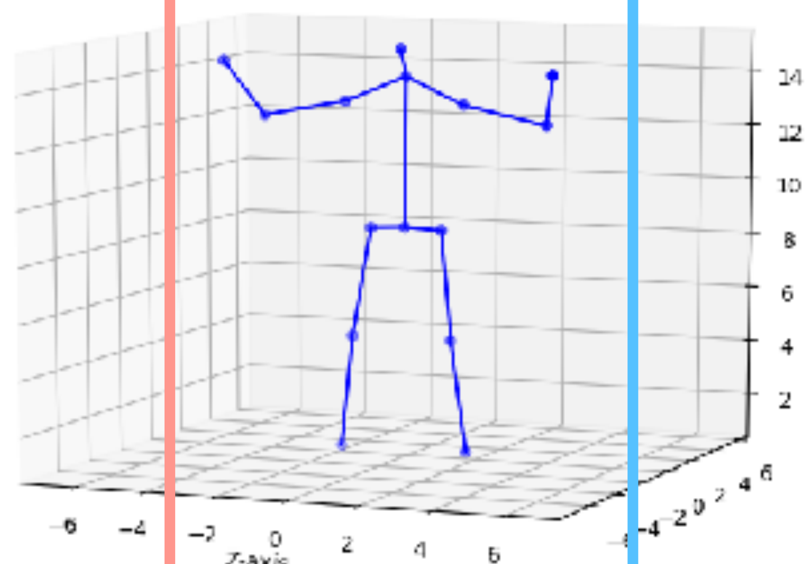
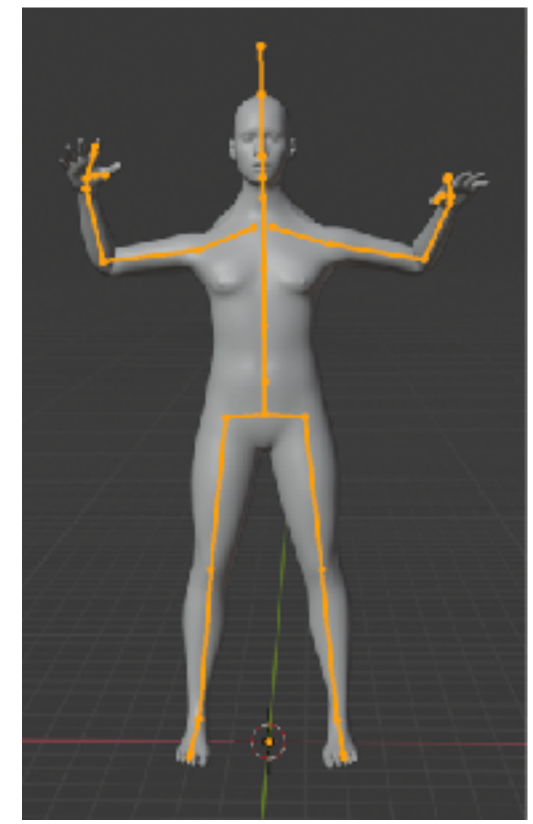
MoCap system



1



2



Get 3D joint coordinates

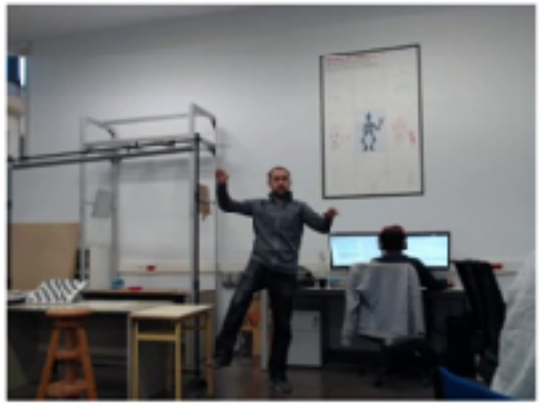
Transfer motion

Pose estimation

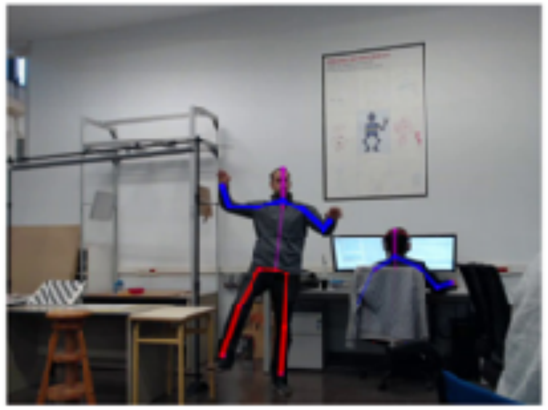
Pose transfer

Human 3D pose estimation

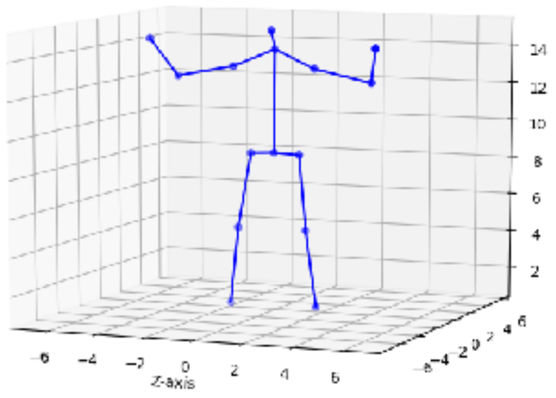
RGB



2D joints



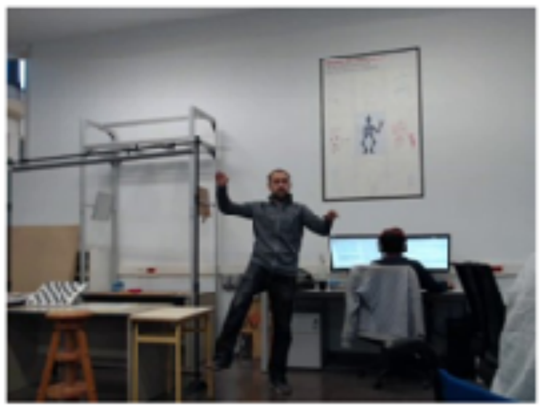
3D joints



- Standard approach
- Allows fast inference
- Reliable detections, we can use already trained weights
- Easy customisable

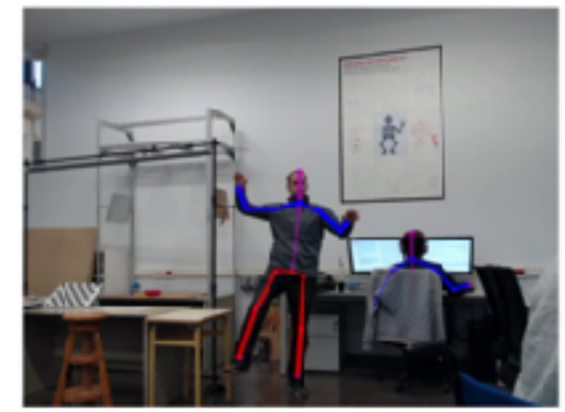
Obtain 2D joint coordinates

RGB



AlphaPose*

2D joints



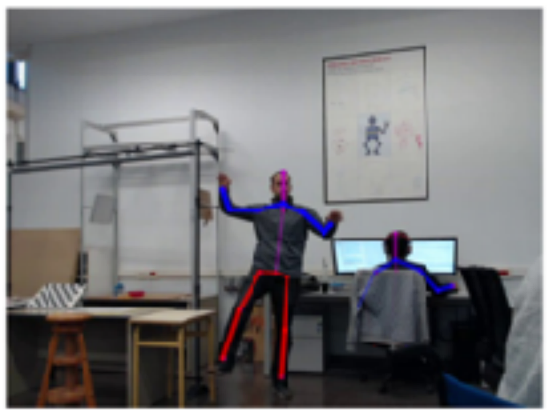
- Top down approach
- Rely on human pose detection → {
  - Complications if many people in scene
  - We expect usually on person in scene
- Very fast to perform inference

- Skeleton similar to our human model
- Better performance OpenPose
- Use default weights

* H.-S. Fang, S. Xie, Y.-W. Tai, and C. Lu, “RMPE: Regional multiperson pose estimation,” in ICCV, 2017.

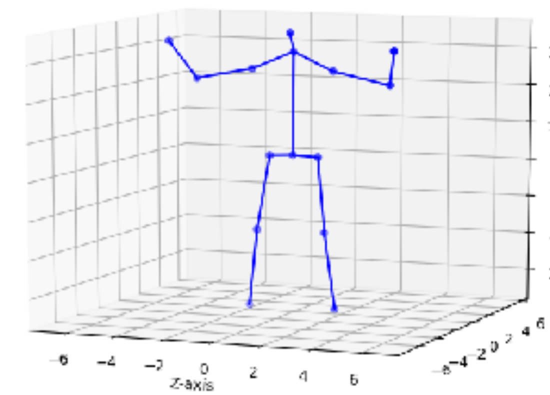
Obtain 2D joint coordinates

2D joints



Martinez et al. *

3D joints



- **Fast to train and fast to perform inference (ms)**
- **Network simple linear model**
- **Can customise with our own data world reference coordinates**

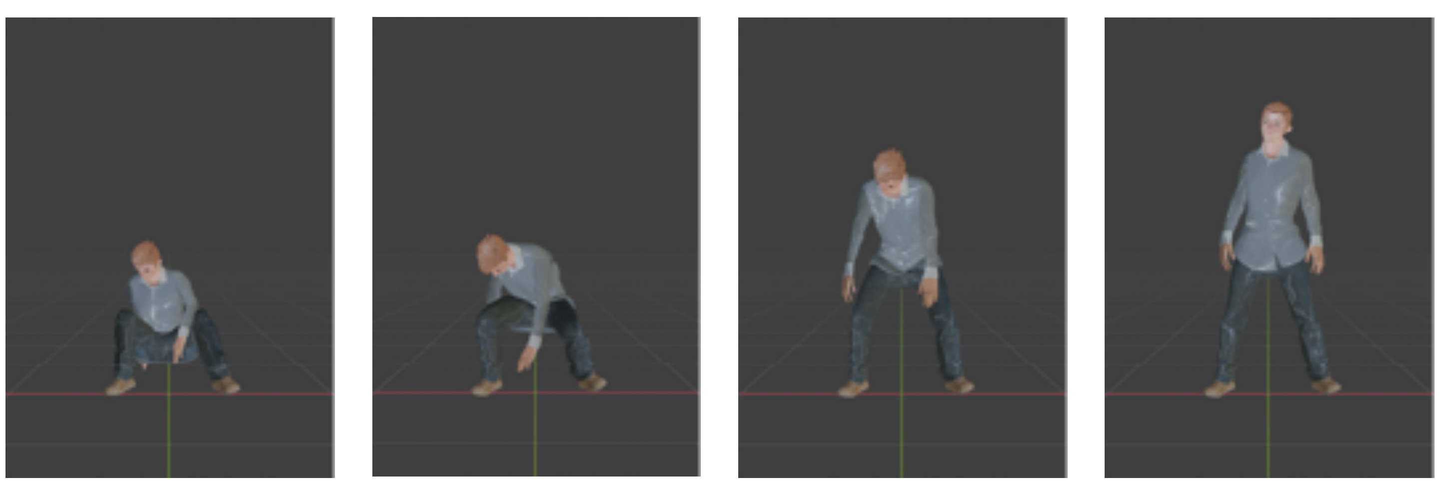
* J. Martinez, R. Hossain, J. Romero, and J. J. Little, “A simple yet effective baseline for 3d human pose estimation,” in ICCV, 2017.

Training dataset

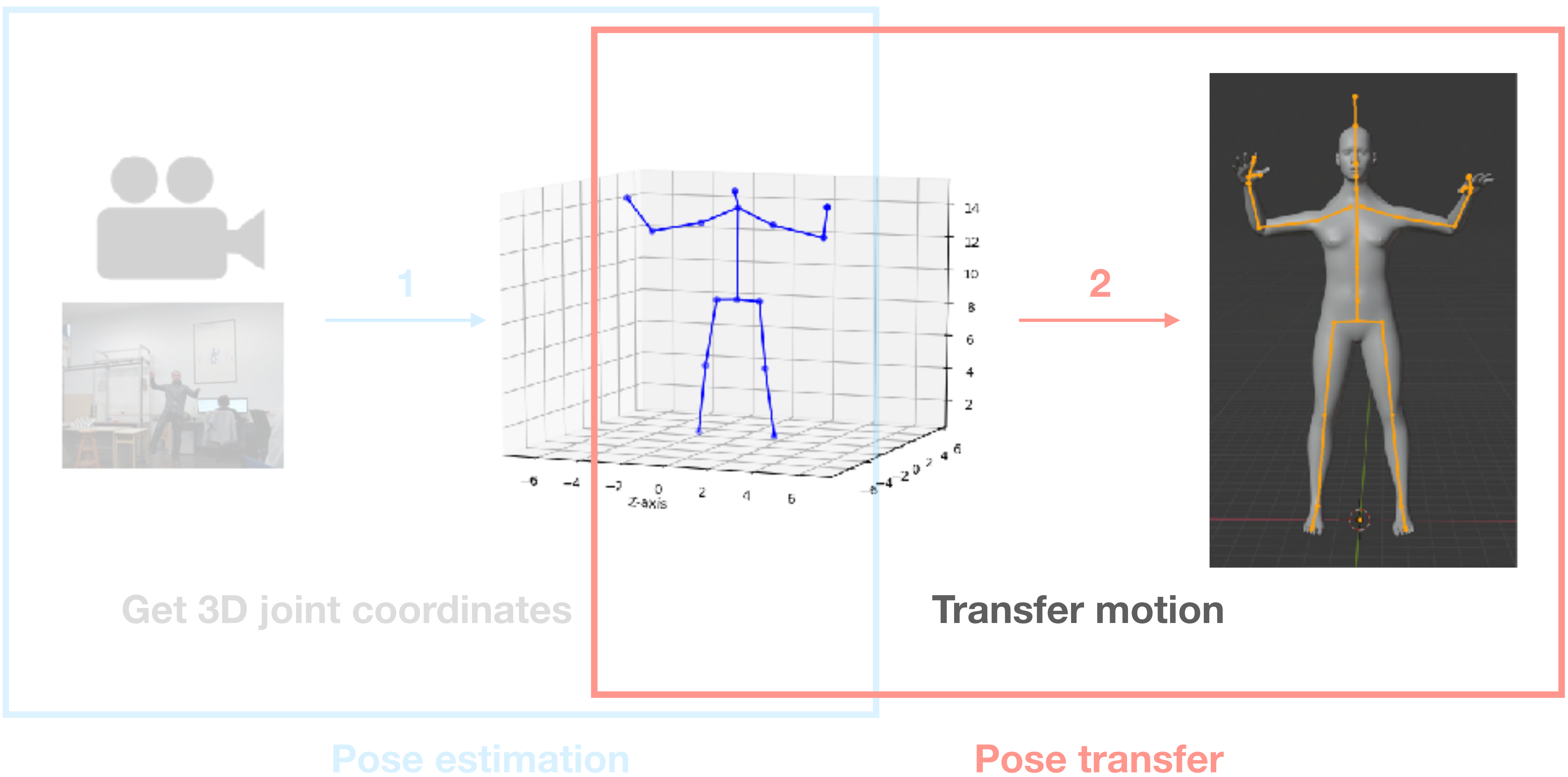
- Create a small dataset to train 2D-3D module
  - 6 human models of different sizes
  - 54 actions
  - 1 camera 640x480
- We extract 2D and 3D joint coordinates

3D human models

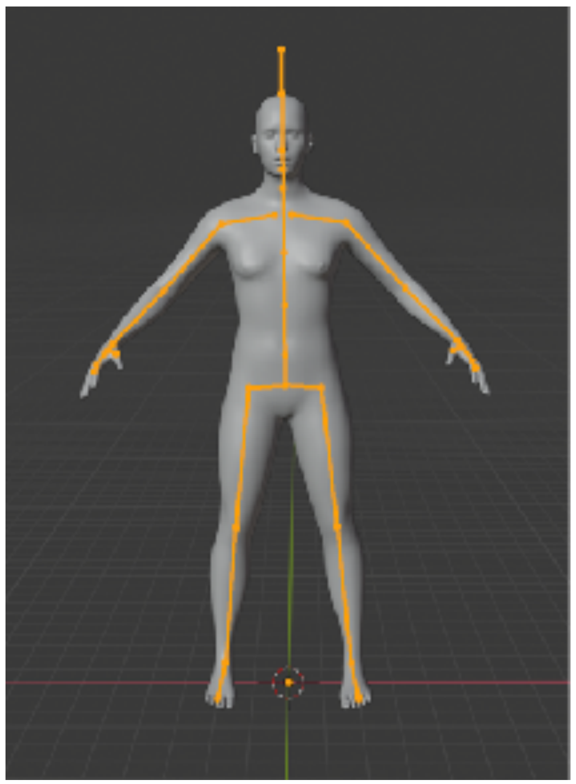
stand up action



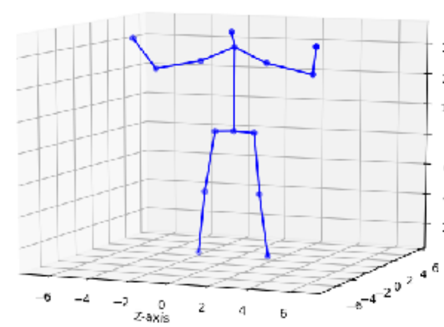
MoCap system



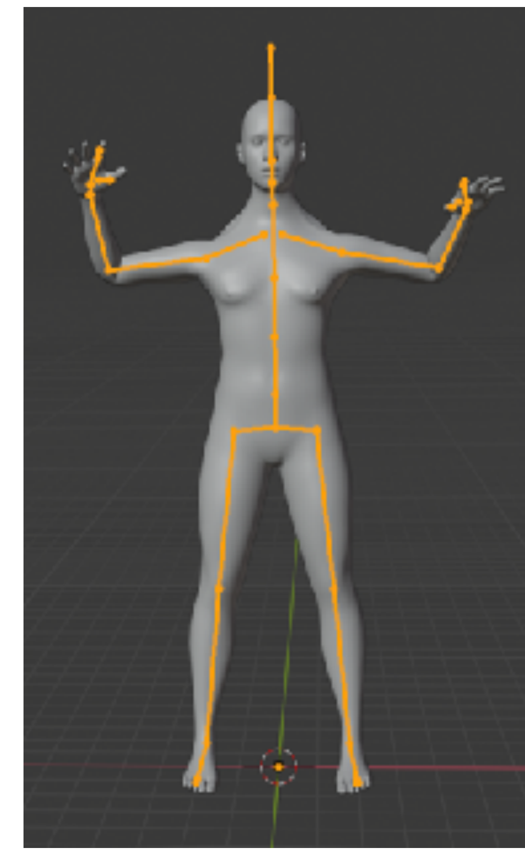
Calculate rotations



Reference



Detected 3D joints

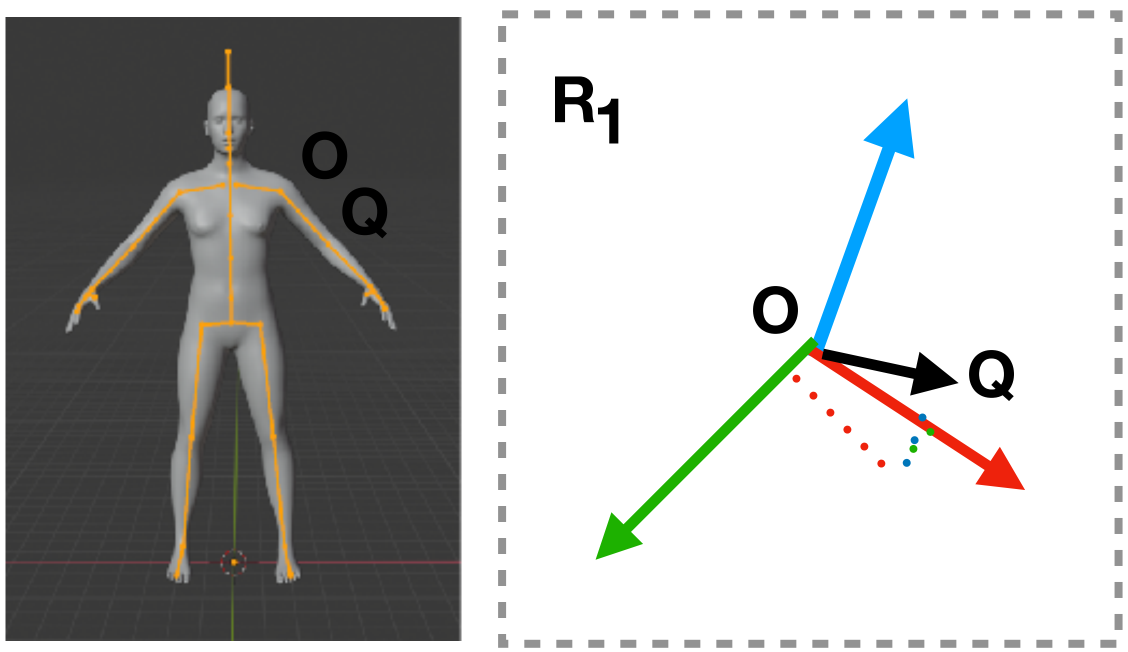


Retarget pose

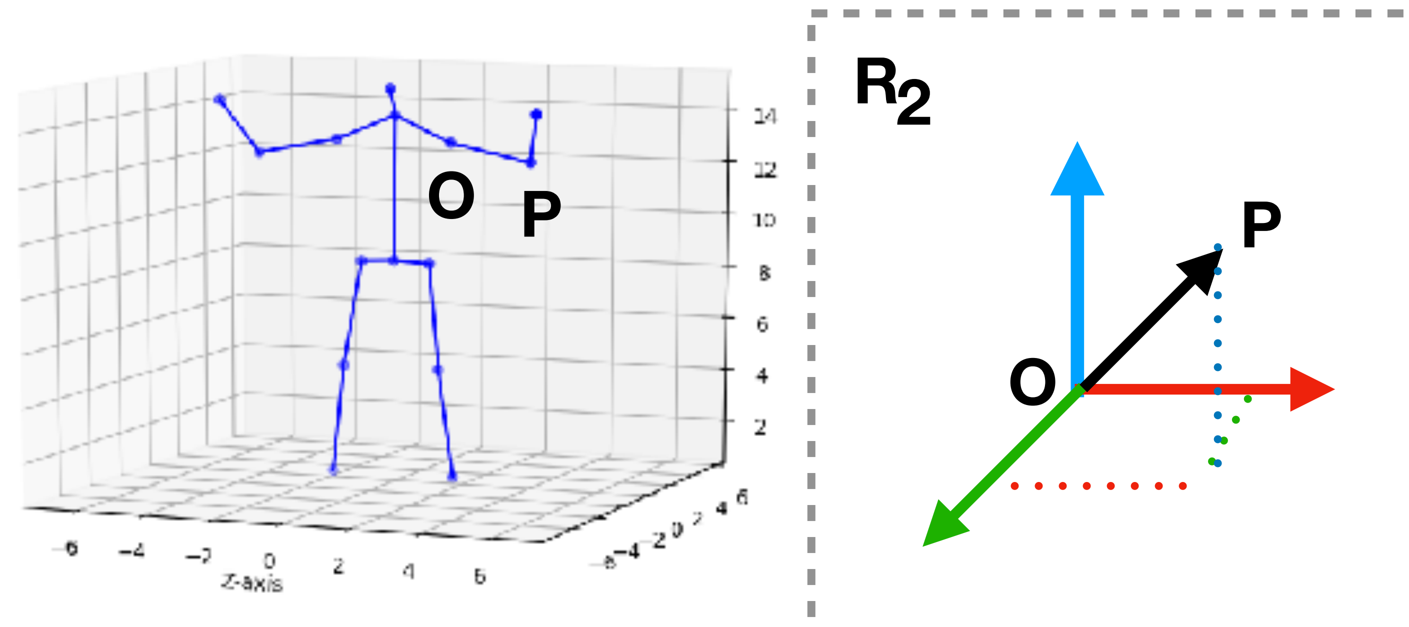
- Want to transform reference pose to the detected 3D joint coordinates
- Calculate rotations for each joint to match both skeletons
- Rotations need to be calculated in a hierarchical manner

Calculate rotations

- We want to find rotation angle between the different two reference systems:
- Need to scale and align human model with 3D joints

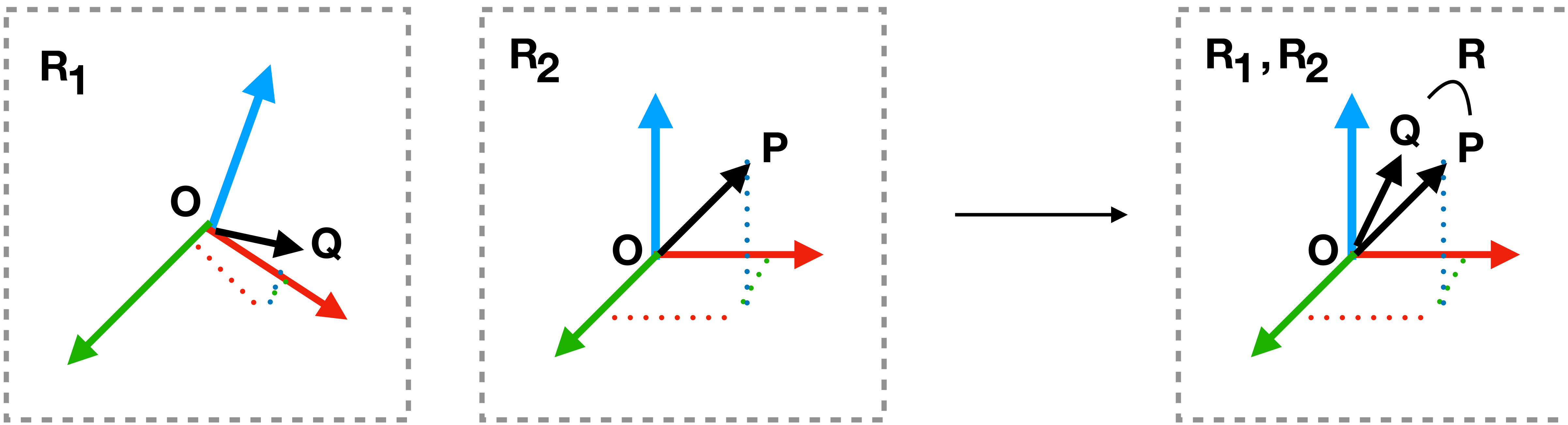


Joints from 3D human model



Detected 3D points from image

Calculate rotations



- We need to align reference system R1 and R2
- Then, rotation matrix R to go from Q to P can be found
- Finally, we need to convert global rotation R to local coordinates of the joint

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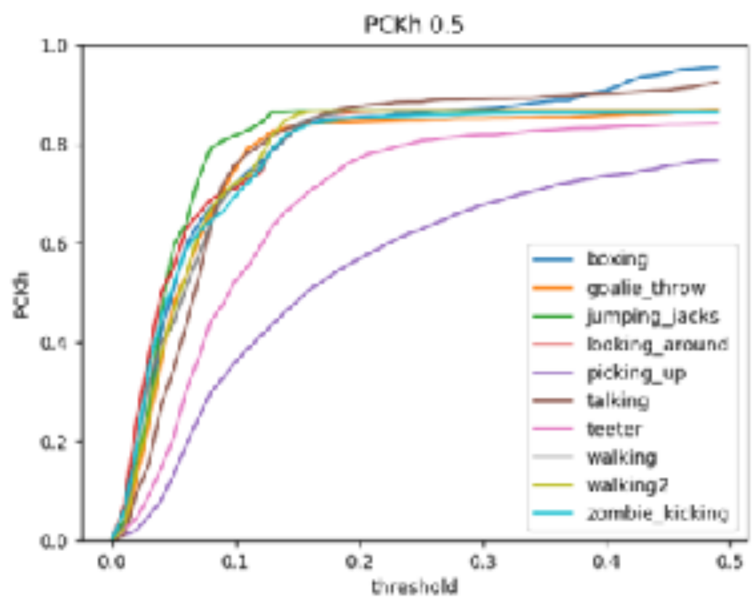
Quantitative results



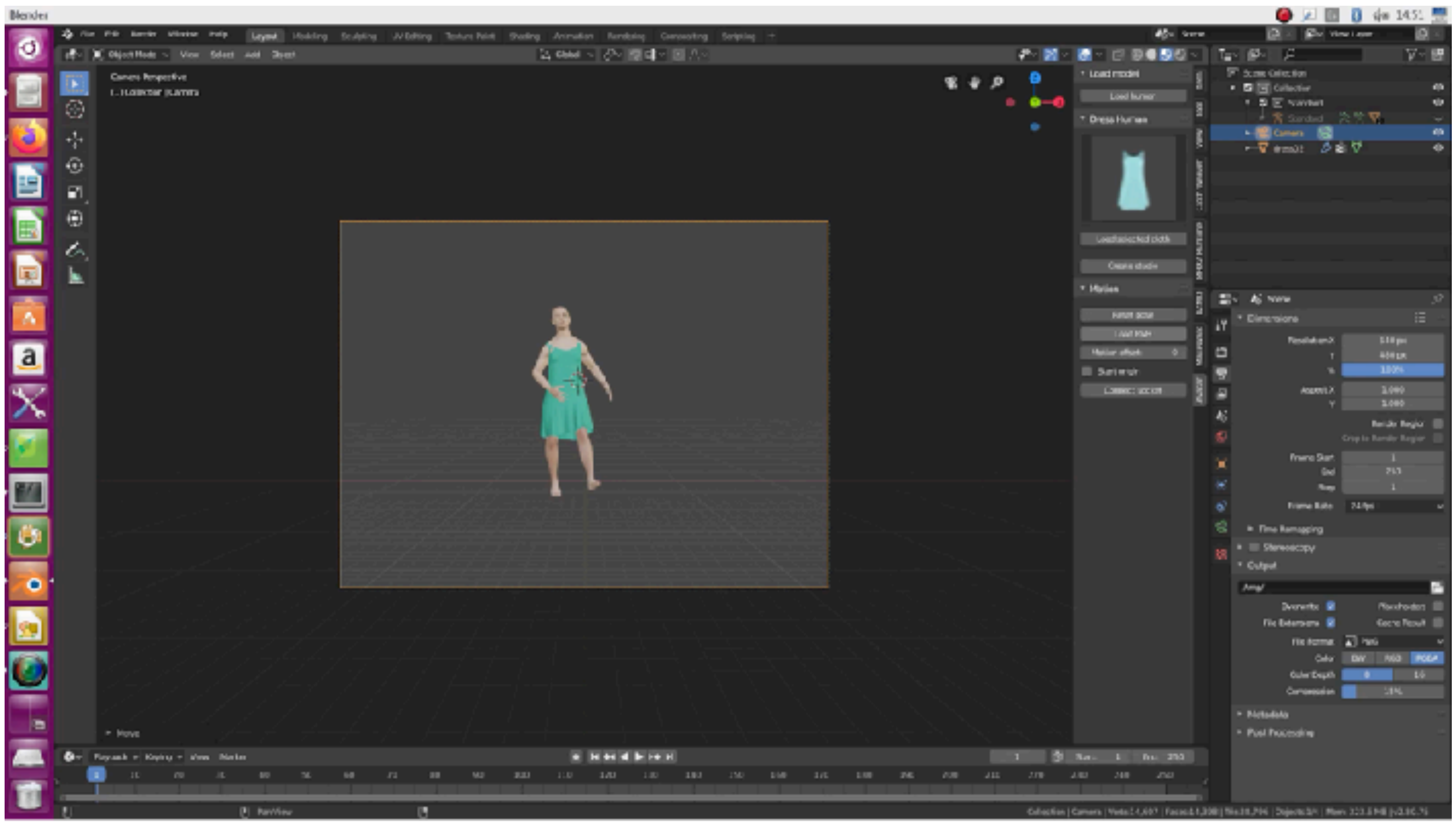
2D module

Action	Error (m)
Boxing	0.0961
Goalie throw	0.0989
Jumping jacks	0.1299
Look around	0.1585
Pick up	0.1399
Talking	0.0952
Teeter	0.1416
Walking	0.1621
Walking 2	0.1535
Zombie kicking	0.1288
Average	0.1304

3D module

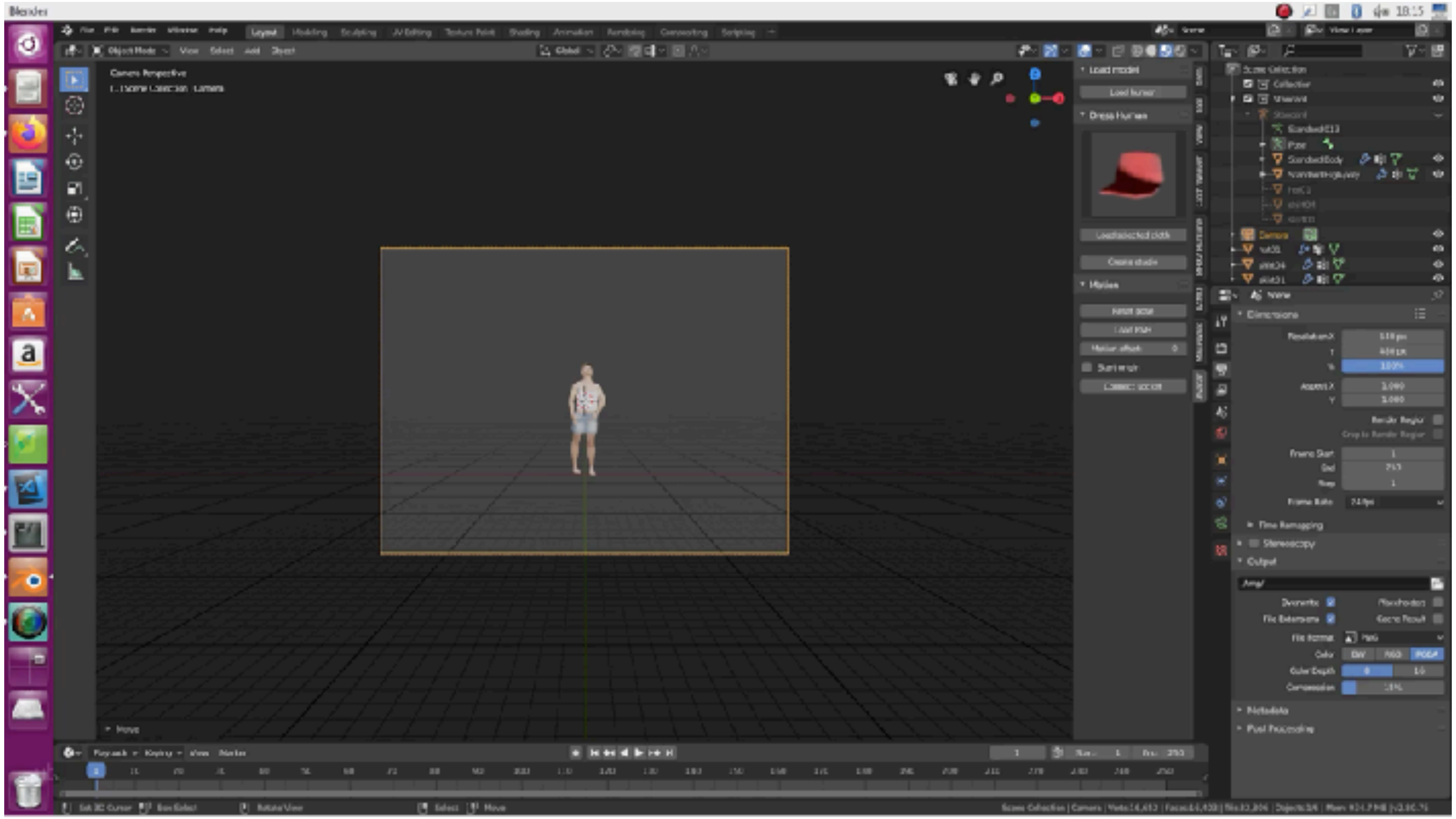
- **Tests performed on synthetic dataset**
- **Show only few actions**
- **Worst performing actions in 2D module have more self-occlusions**
- **Worst performing actions in 3D module have more variability**

Qualitative results



Synthetic sequence

Qualitative results



Real sequence

Thank you for your attention!!