Evaluation of sensitivity to resolution of LiDAR gait recognition using simulation data

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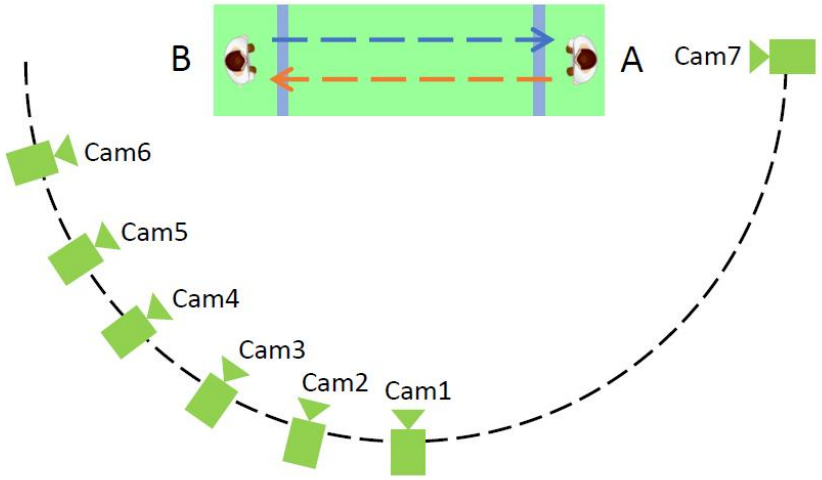
Background

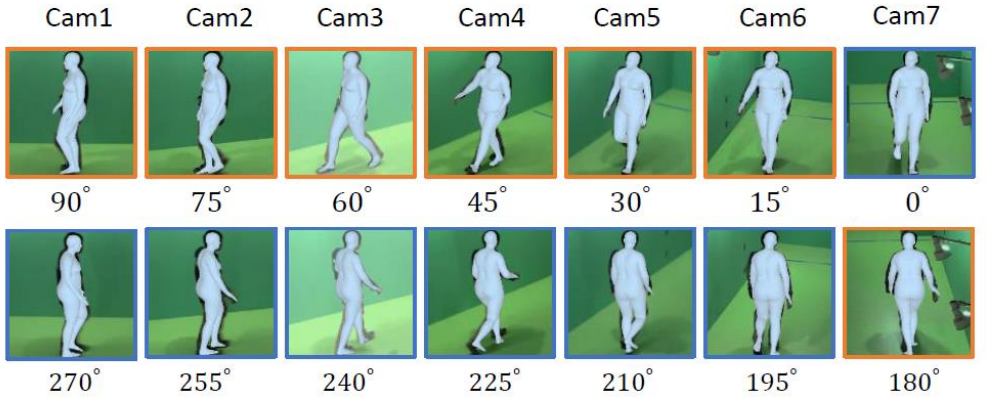
- 3D LiDAR
  - Expected to be used for self-driving car
  - Low resolution for distant objects
    →Difficult to use for person recognition

- Analyze how much accuracy gait recognition achieves for low-resolution data

OUMVLP-Mesh

- Multi-View Large Population Dataset with Human Mesh
- 3D human mesh
- 10,307subjects
  - 14view
    - 2sequences
      - 25frames
- IM2D joint
- HC3D joint
- 85-D SMPL parameter

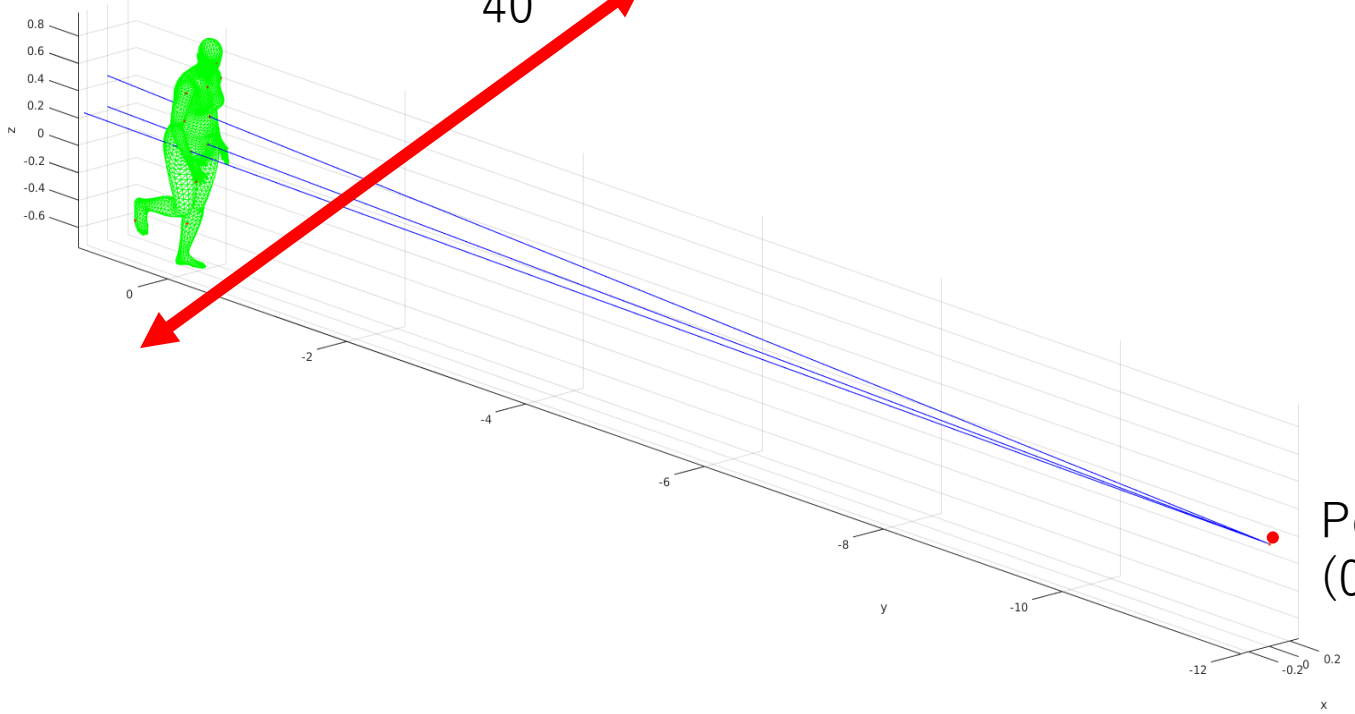




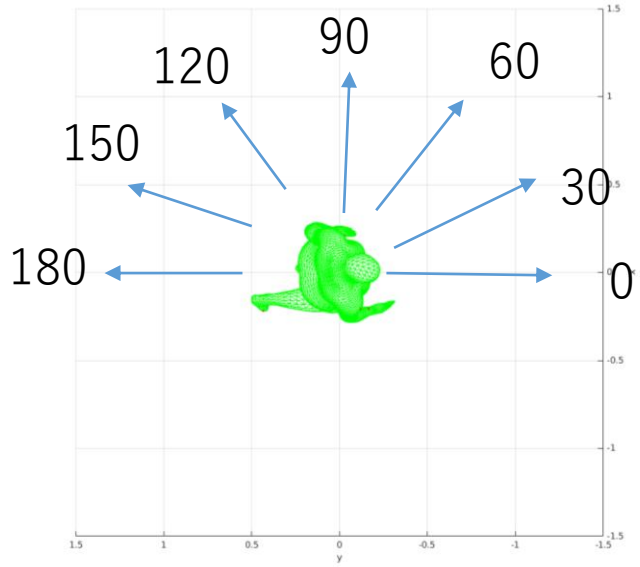
Generate simulation data

Vertical angle
20°

Horizontal angle
40°



Point of sight
(0,-12,0)



direction

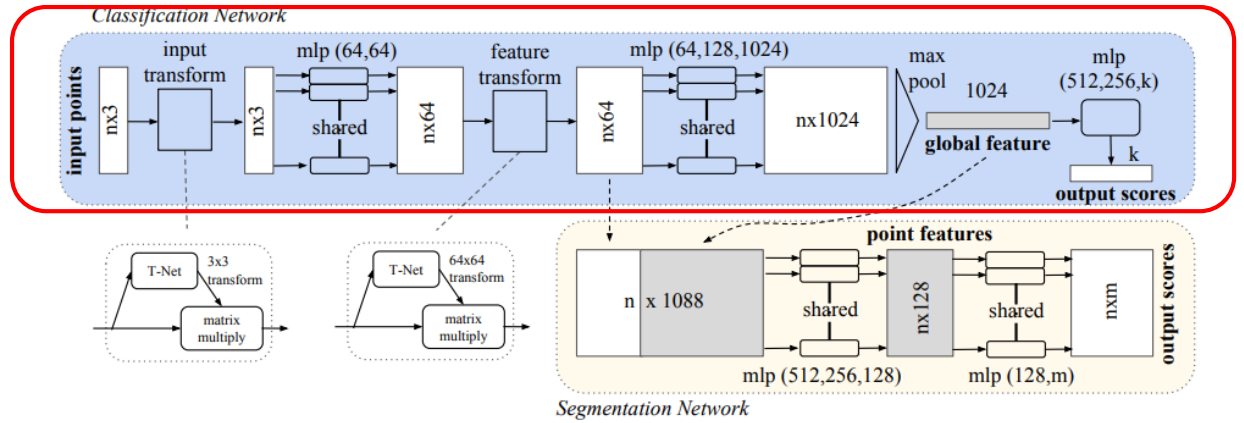
Point of sight

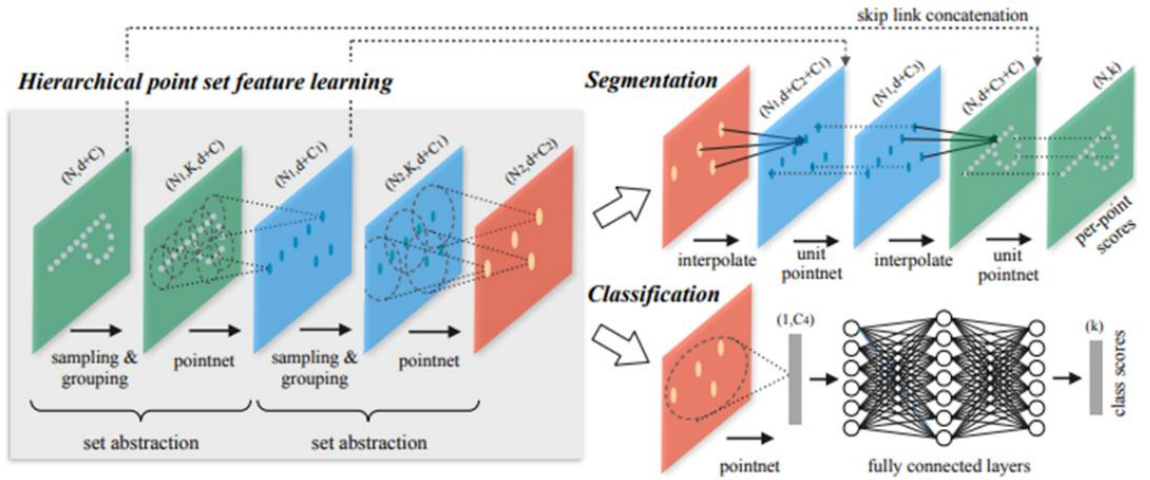
Estimate SMPL parameter

- Input: simulation data
- Output: SMPL parameter

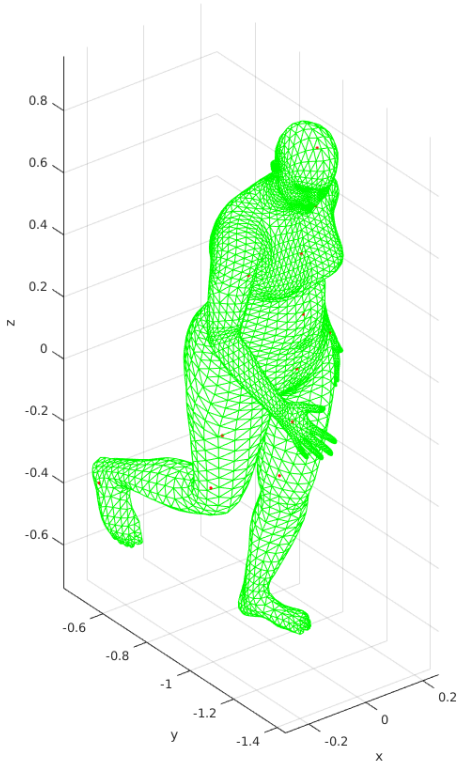
- Use pointnet++
  - Unordered
  - Invariance under transformation
  - Interaction among points

- Loss: MSE loss

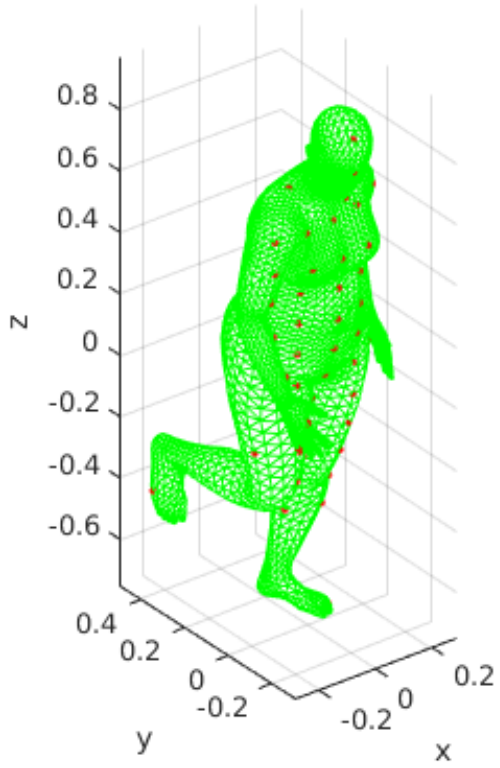




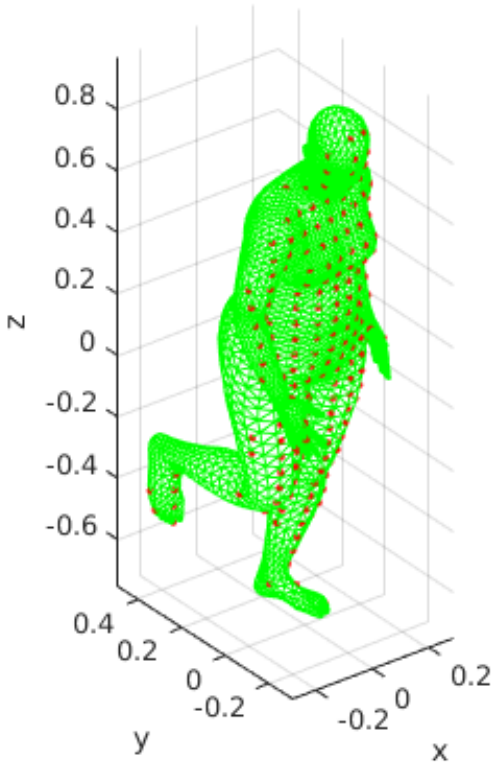
Result (generate simulation data)



1.0° x 1.0°

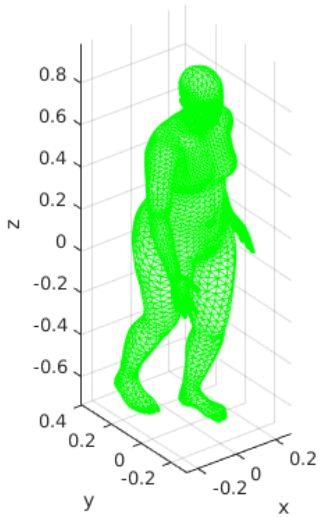


0.5° x 0.5°



0.25° x 0.25°

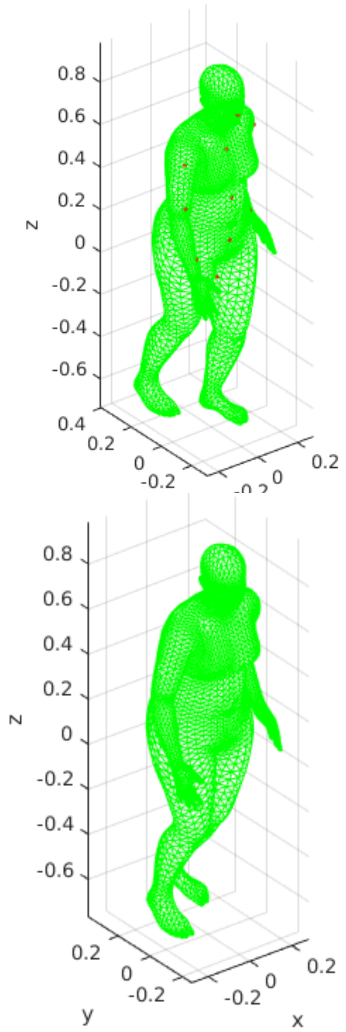
Result (estimation SMPL parameter)



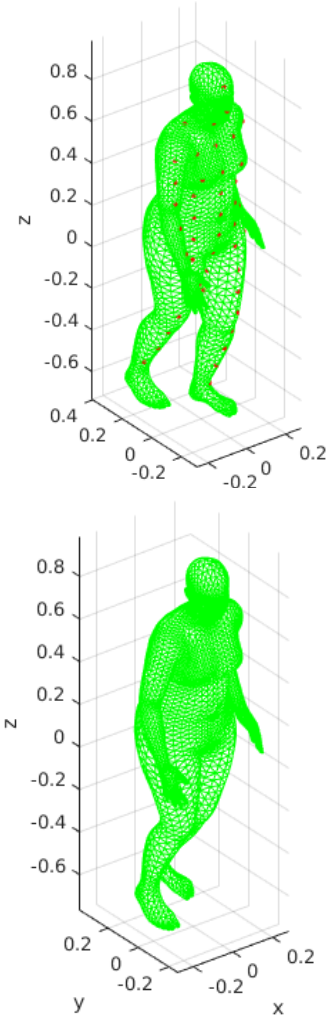
Original

input

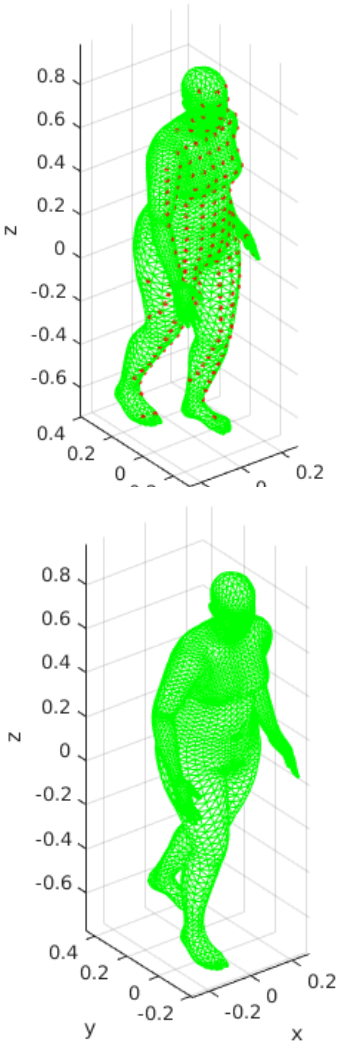
output



1.0x1.0



0.5x0.5



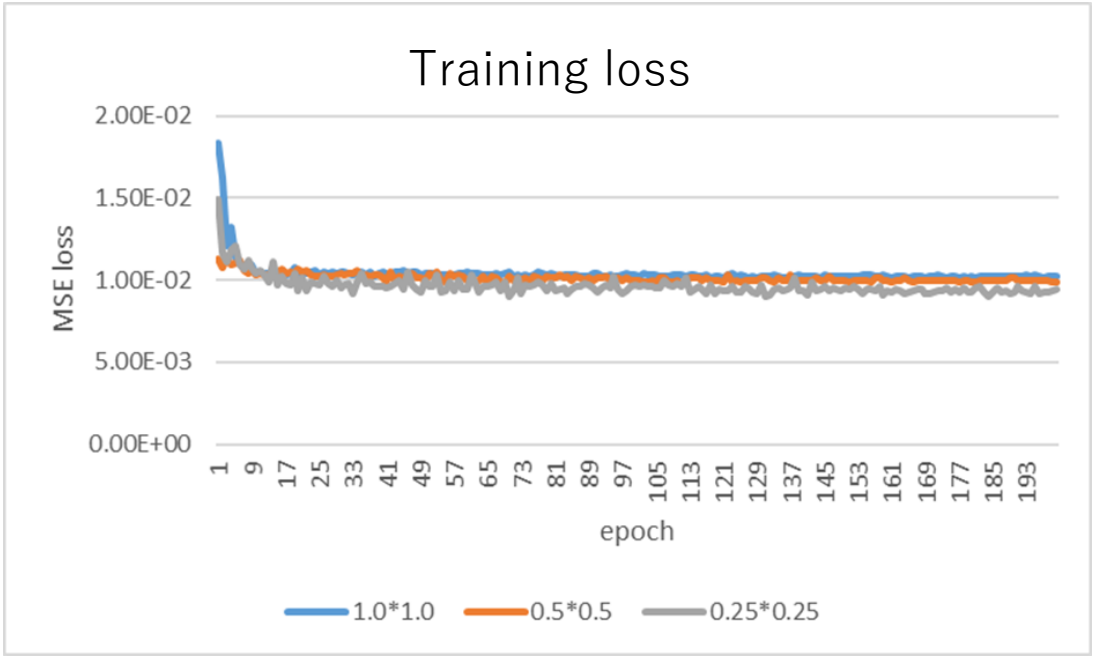
0.25x0.25

Result of estimation SMPL parameter

Simulation data(point cloud)

↓

SMPL parameter (85 dim)



- MSE loss for various resolution

Resolution	Camera	Root rotation	Pose	Shape	Whole data
1.0x1.0	0.0002	0.0011	0.0118	0.0007	0.009678
0.5x0.5	0.0002	0.0009	0.0100	0.0008	0.008248
0.25x0.25	0.0002	0.0009	0.0079	0.0008	0.006574

Summary

- Background
  - Gait recognition + 3D LiDAR
- Generate simulation data
  - Point cloud(resolution : 1.0x1.0, 0.5x0.5, 0.25x0.25)
- Estimate SMPL parameter from simulation data which have various resolution
  - Use pointnet++
- Result
  - Generate simulation data
  - Estimated SMPL model
  - MSE loss to various resolution