Symmetry-aware human shape correspondence using skeleton

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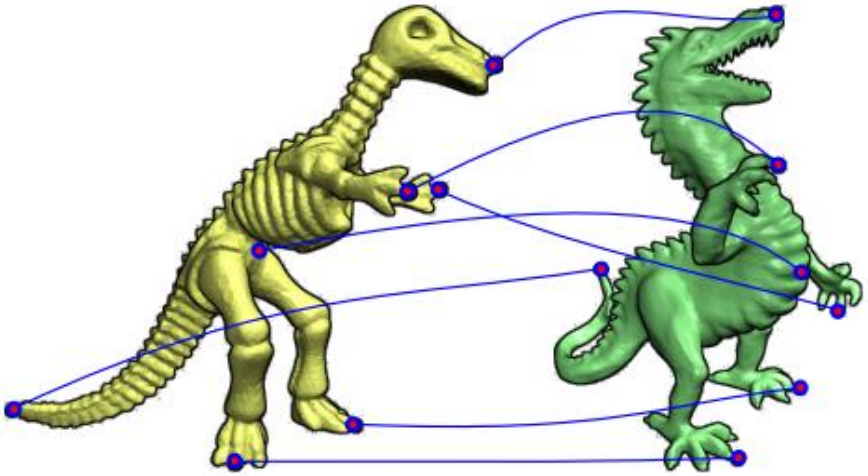
Introduction

- Given two 3d shapes, find **correspondences** between them.

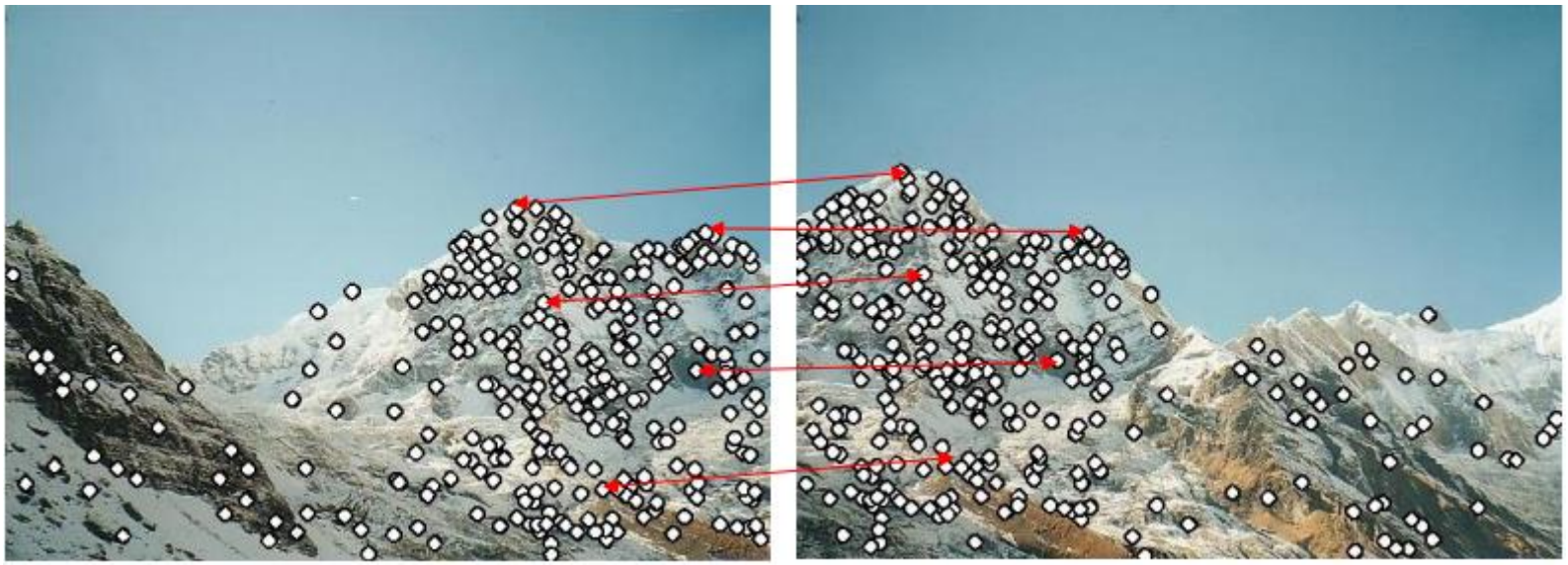


Van et al. CGF'2011

- Identify two points that are on different meshes but represent the same feature.

Introduction

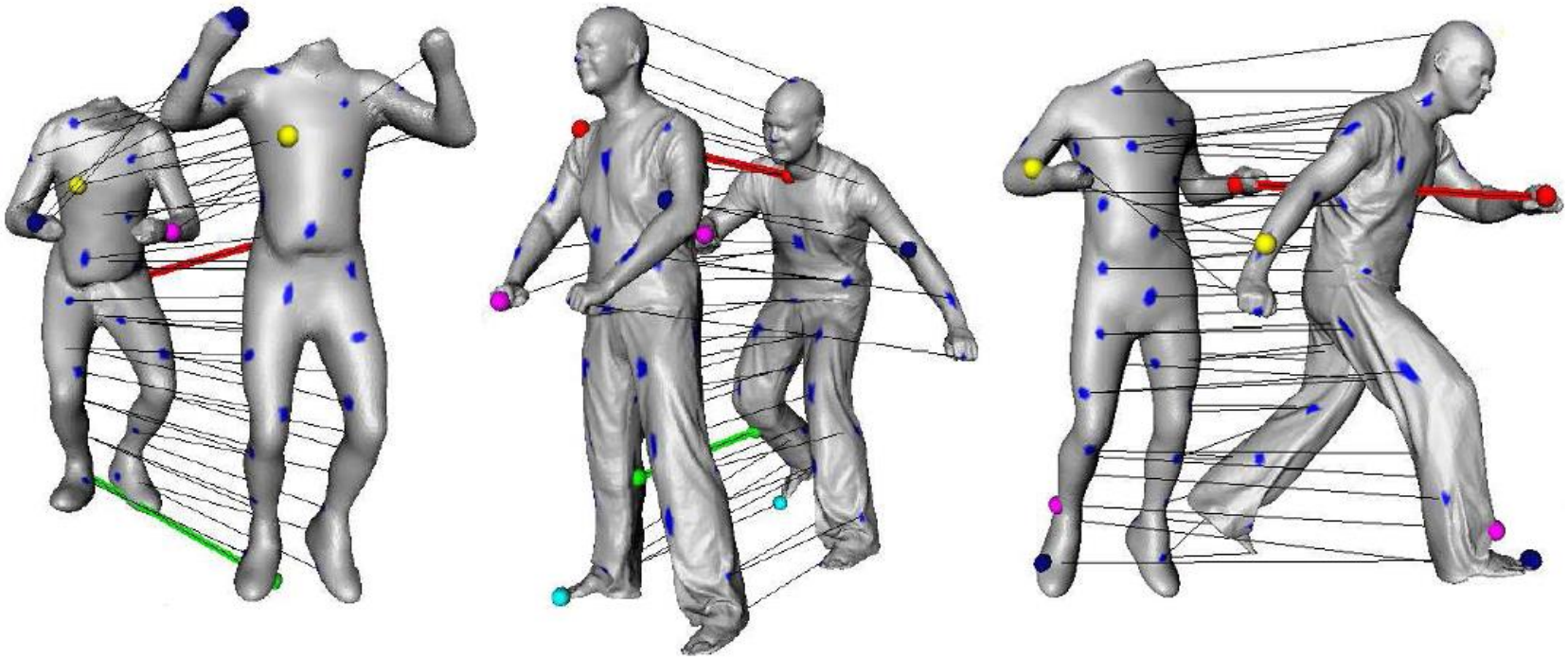
- Correspondences in images:
- More information is available, like color, texture, corner…
- More mature, robust descriptors are developed, like SIFT, SURF, Harris…



Brown et al. ICCV'03

Introduction

- When it comes to *3D Shape Correspondence*,
- Geometry information is not enough, especially for deformable shapes;

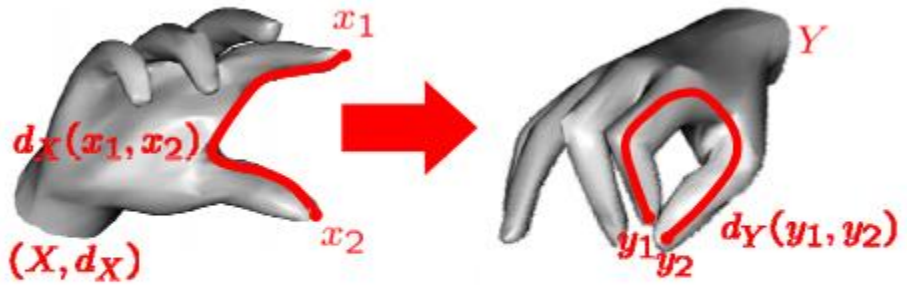


Sahillioglu et al, CVPR'10

Introduction

- 3D shape correspondence is challenging, especially for the deformable shapes.

- Isometric deformation model is common, and useful but limiting



Bronstein et al. PNAS'06

Symmetric flipped correspondences

- They cannot totally differentiate surface points that are symmetric or near symmetric;
- A left hand of one human model may be matched to a right hand of another.

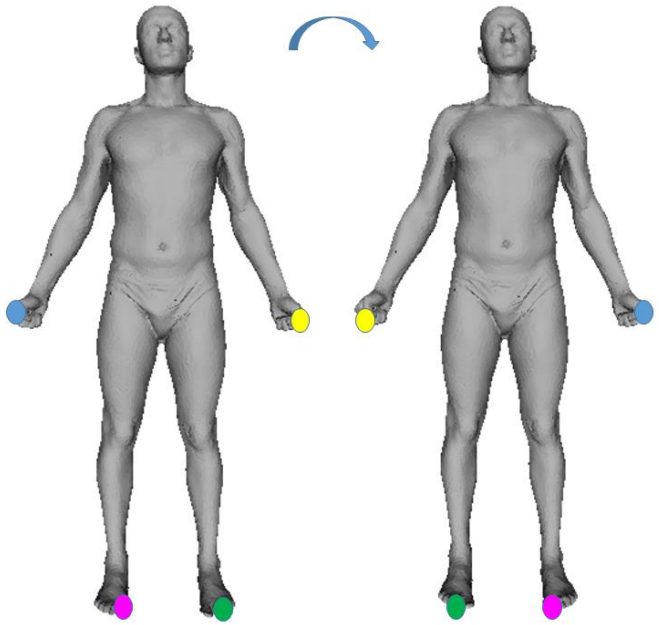


Fig. 1. Flipped correspondences.

Introduction

- 1. We propose an effective way to address the symmetric flip problem in finding shape correspondences between self-symmetric shapes;

- 2. This approach can effectively remove the flipped correspondences by introducing skeleton information and through minimizing distortion error;

Methodology

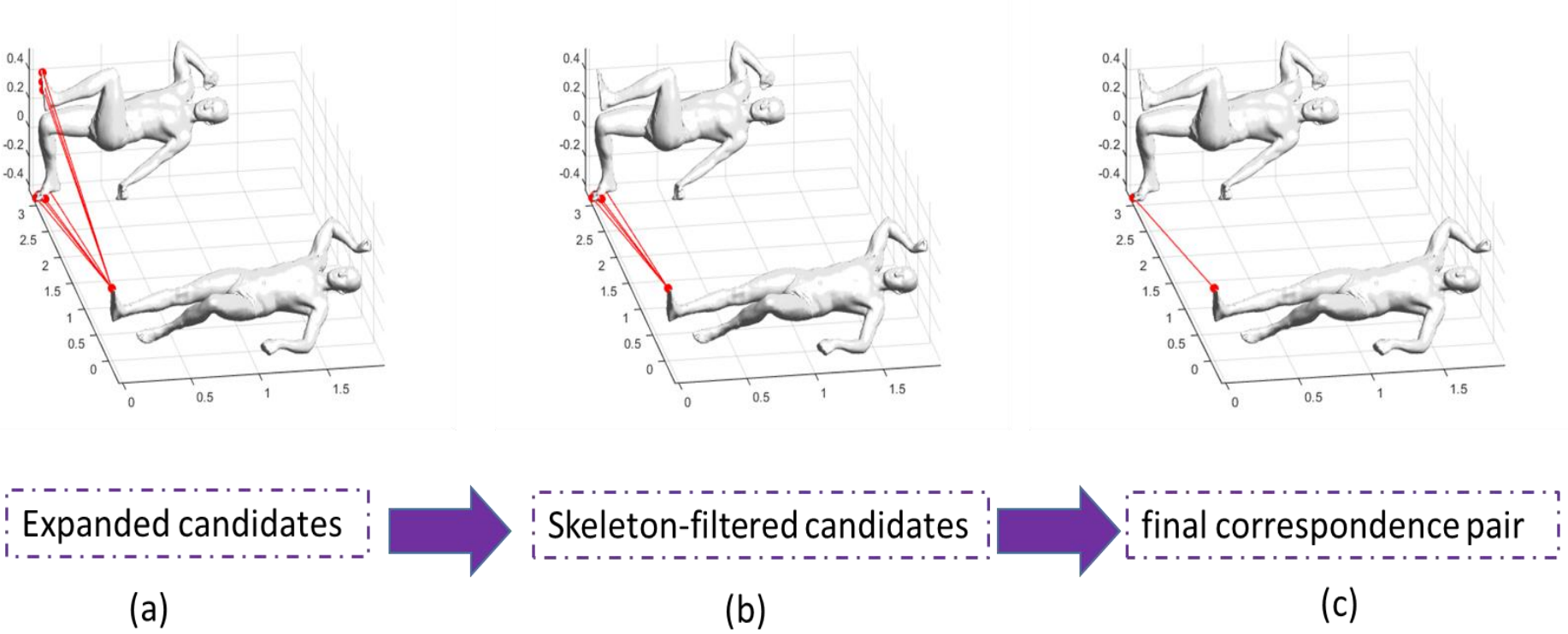


Fig. 2 Workflow of the proposed method: (a) the expanded candidate set for one point on the template; (b) the filtered candidate set using skeleton; (c) the final one correspondence point

Methodology

- (1) Compute correspondence candidates:
  - $\Delta s = \left|\left|HKS(p_t) - HKS(p_s)\right|\right|$
  - $CC = \{\Delta s \mid \Delta s < \tau\}$
- (2) Skeleton-based de-symmetry method
  - 2.1. skeleton divides mesh into 17 parts;
  - 2.2. each mesh part attached a segment has a unique label;
  - 2.3. the right extremity and its left counterpart have different labels.

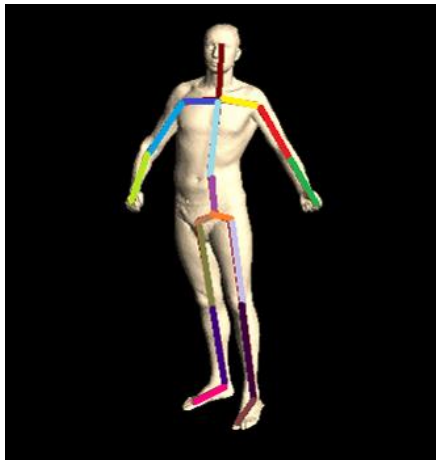
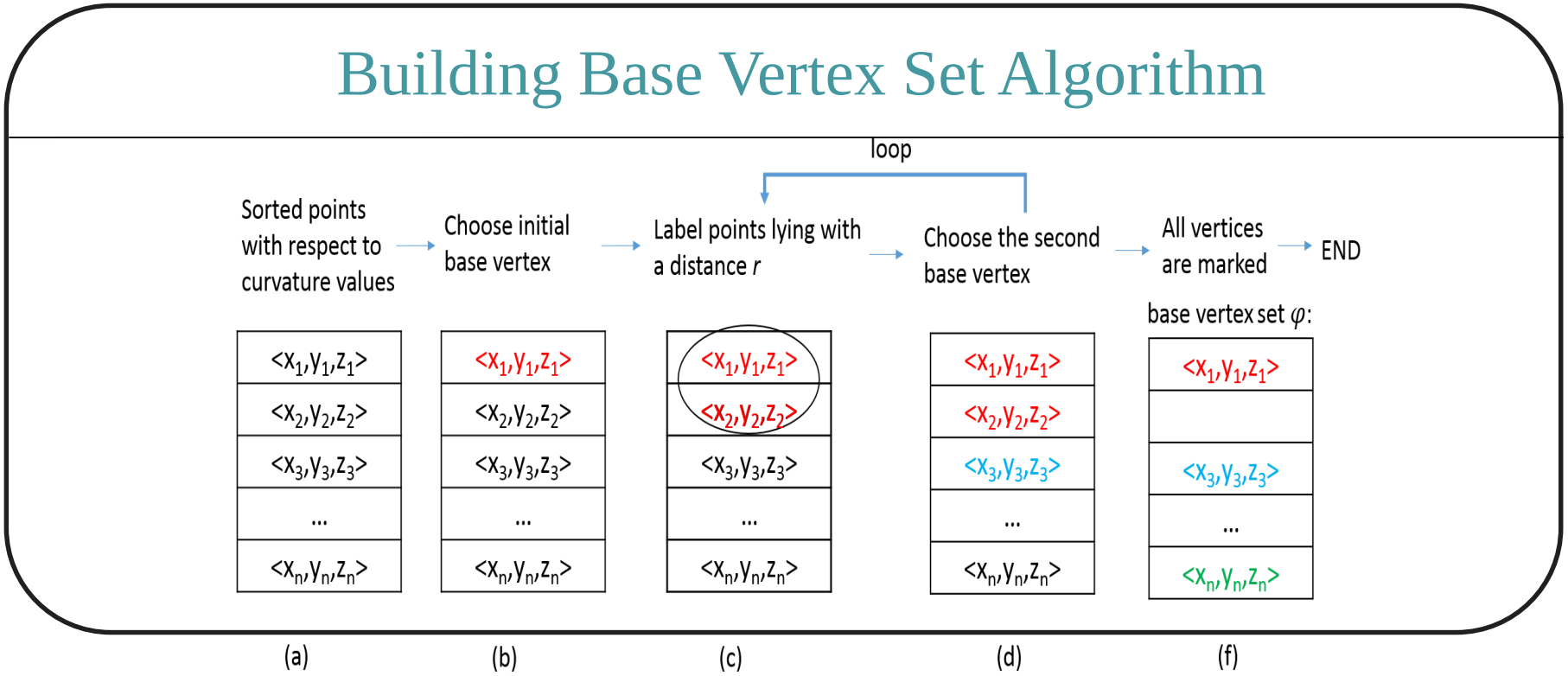


Fig. 3 Mesh division by skeleton; each colour represents a skeleton segment

Methodology

- (3) One-to-one correspondence:



we select the candidate with minimum distance to base vertex set as the final correspondence.

Results

Table 1. Comparison of our methods and C2FCM [1]

GeoErr / %Corr / Method	10	20	30	40	50	60	70	80	90	100
C2FCM	0.122	0.103	0.093	0.093	0.092	0.097	0.098	0.097	0.097	0.098
Ours	0.097	0.074	0.070	0.074	0.081	0.084	0.082	0.081	0.080	0.083

[1] Sahillioglu, Y., Yemez, Y.: Coarse-to-fine isometric shape correspondence by Tracking symmetric flips. In: Computer Graphics Forum. vol. 32, pp. 177-189. Wiley Online Library (2013)

Results

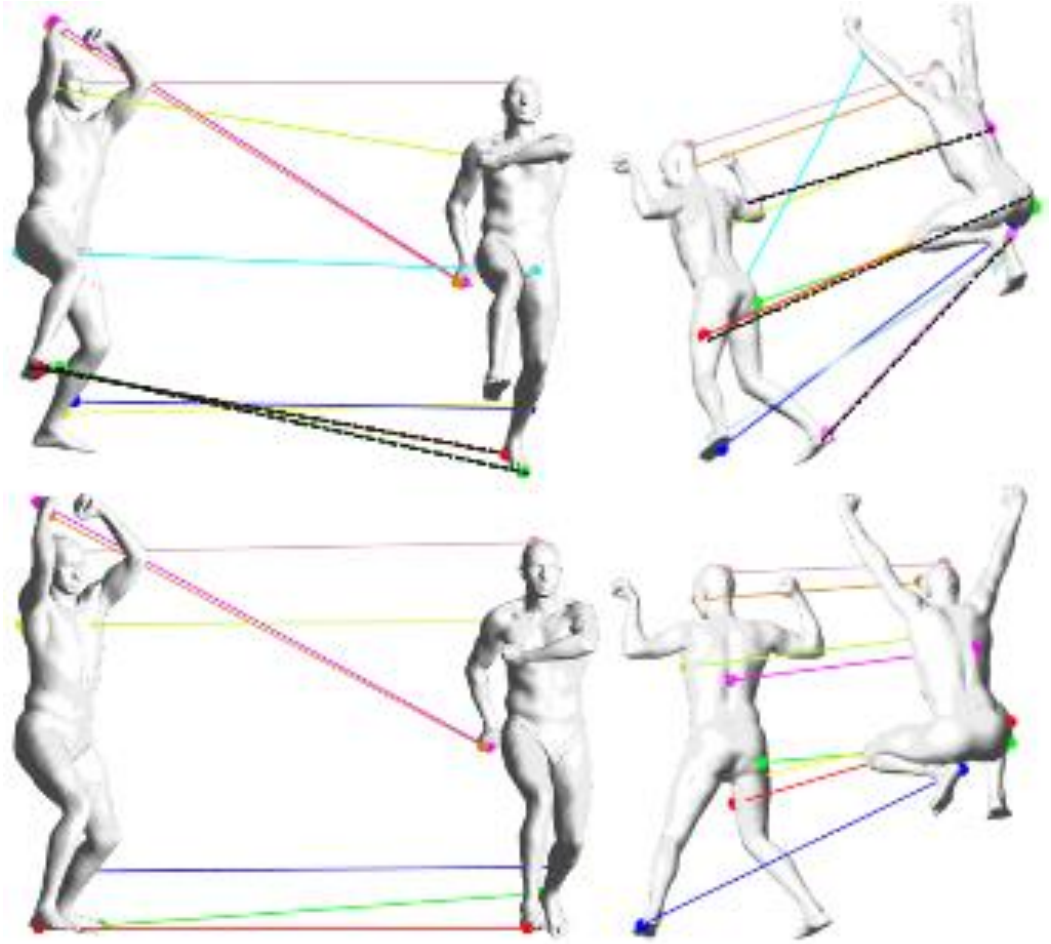


Fig. 4. Comparison between two methods: Top: results in [1]; Bottom: our results. Matched point pairs are connected by lines. Symmetry flips are connected by black dash lines.

- Are you interested in seeing yourself as a **3D geometric model**?

3D Capturing Platform

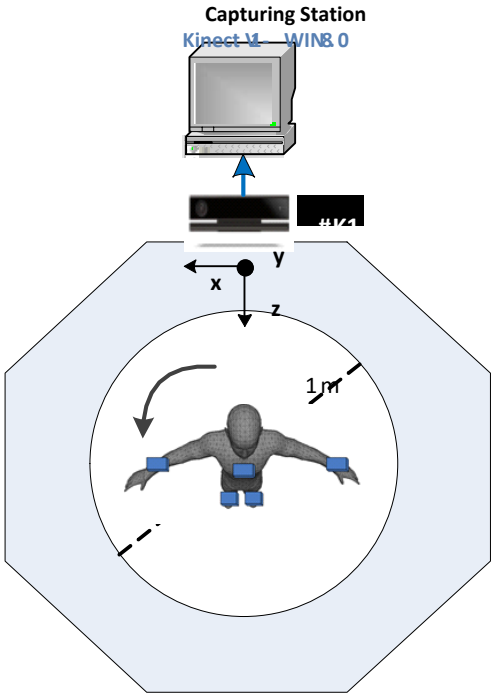


Fig. 5 Top View of Single Kinect's spatial arrangement

Fig. 6 The screenshot of our capturing process

3D Capturing Platform

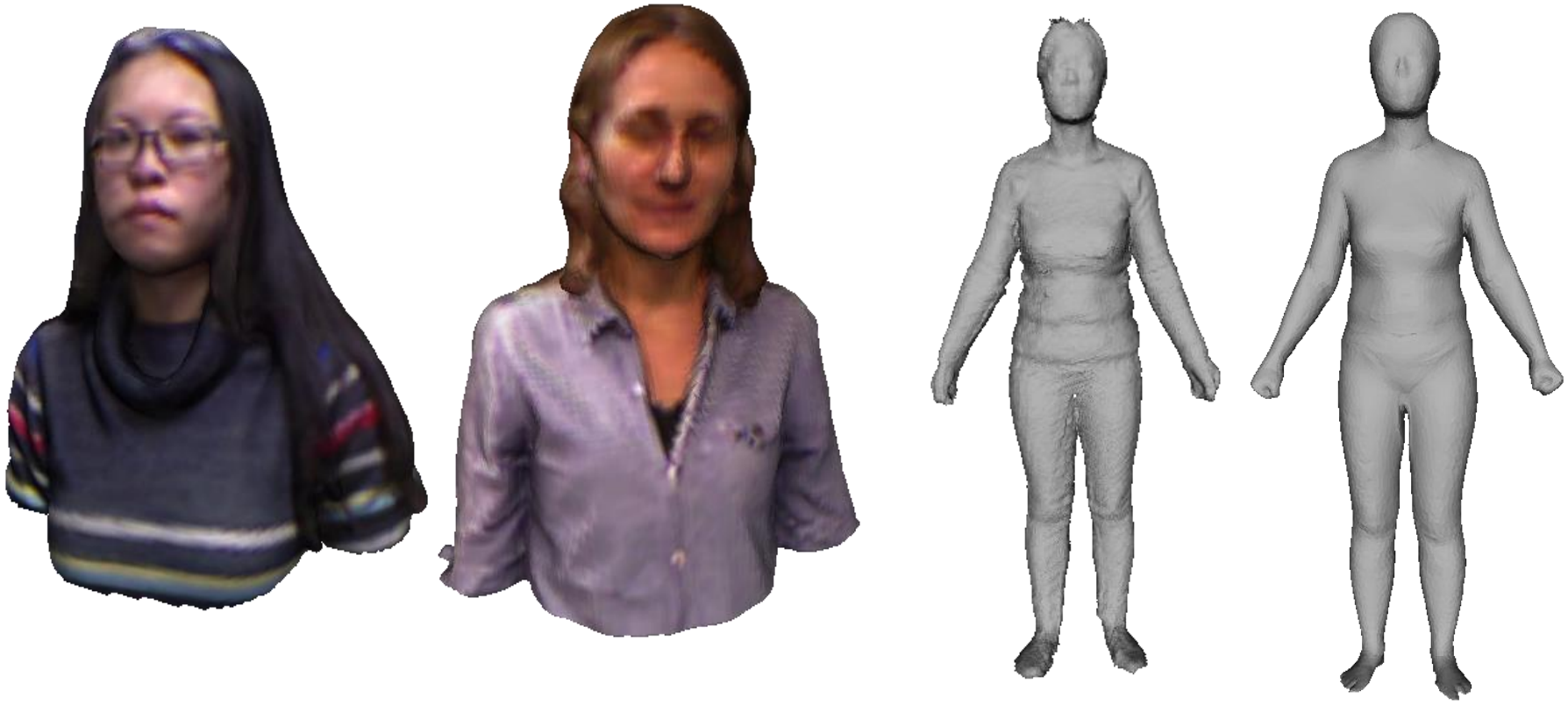
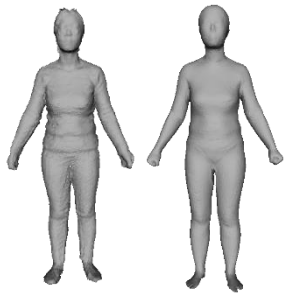


Fig. 7 Samples of captured meshes



- We are looking for volunteers to be the model for 3D scanning.
- if you are interested, please contact me:

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Q & A ?