Motion Retargeting to Preserve Spatial Relationship between Skinned Characters

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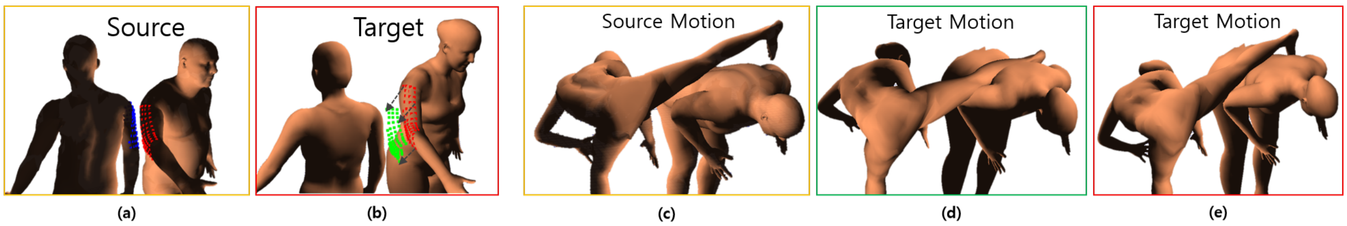

Figure 1: (a) Feature points expressing spatial relationship. (b) Retargeting is performed to preserve the spatial relationship of the feature points. (c) Source interaction motion. (d) Retargeting of individual characters. (e) Our skin-level retargeting.

ABSTRACT

Applying motion capture data for multi-person interaction to virtual characters is challenging because one needs to preserve interaction semantics in addition to satisfying the general requirements for motion retargeting, such as preventing penetration and preserving naturalness. An efficient method for representing the scene semantics of interaction motions is to define the spatial relationships between body parts of characters. However, existing methods of this kind consider only character skeleton, and thus may require post-processing to refine the interaction motions and remove artifacts from the viewpoint of skin meshes. This paper proposes a novel method for retargeting interaction motions with respect to character skins. To this end, we introduce the aura mesh surrounding a character's skin in order to represent skin-level spatial relationships between body parts. Using the aura mesh, we can retarget interaction motions while preserving skin-level spatial relationships and reducing skin inter-penetrations.

CCS CONCEPTS

• **Computing methodologies → Animation**;

KEYWORDS

motion retargeting, spatial relationship, close interaction

ACM Reference format:

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1 INTRODUCTION

Retargeting interaction motions between two characters is a difficult task. An animator must consider not only the individual character motion but also its partner's motion. Existing methods such as [1] efficiently solve the problem by defining the spatial relationship between skeletons, but in case of skinned characters, these skeleton-based methods may require post-processing to refine the interaction motions and remove artifacts from the viewpoint of skin meshes. We propose a new method for representing the skin-level spatial relationship, which allows for the direct motion retargeting with respect to skin meshes. The key idea of our method is to create a simple mesh structure called the *aura mesh* to define an interaction space around a character's surface, and retarget motions such that the interaction motion inside the aura mesh of a source character is transferred to the corresponding locations inside the corresponding aura mesh of the target character. The preservation of the spatial relationship using the aura mesh allows for retargeting of *close interaction* that does not involve direct contact between characters but is still significant for interaction.

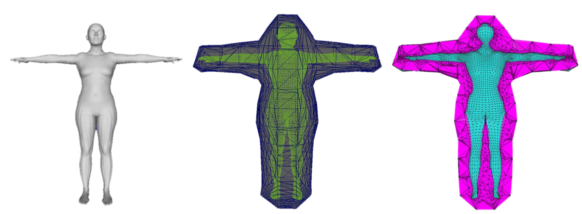

Figure 2: From the left, character mesh, interaction boundary mesh, and constructed aura mesh.

2 OUR APPROACH

We construct the aura mesh in pre-processing step and generate target characters' motions in a run-time phase, as illustrated in Fig. 3.

Figure 3: Overview of our method. Left: Pre-processing step to construct aura meshes. Right: Given interaction motions of source characters, our method extracts feature points that represent source skin-level spatial relationship and finds corresponding target feature points using the aura mesh of target characters. Target characters' motions are generated by following the desired positions of the feature points.

Aura Mesh

We construct an aura mesh by creating a volumetric tetrahedral mesh between a character's surface and an external boundary surface mesh as shown in Fig. 2, and the aura mesh defines the portion of the character's three-dimensional interaction space. For efficient computation, we enforce that aura meshes of every virtual character are topologically identical. To this end, we first construct aura mesh of a template character mesh I_t. Next, in order to obtain a character's aura mesh, we create a new tetrahedral mesh I_{tc} by deforming I_t so as to minimize the deformation energy while ensuring that the vertices of skin part coincide with the character surface. Therefore, finding corresponding points between two aura meshes can be performed easily, by identifying the corresponding vertices with their indices and using the same barycentric coordinates of the vertices (Fig. 4).

Figure 4: The corresponding points between the source interaction space (left, blue) and the target interaction space (right, green).

Skin-Level Spatial Relationship

In order to express the spatial relationship between two source characters, we define the vertices of the skin mesh that are included in the partner's aura mesh as the source feature points (Fig. 1(a)). For the efficient broad-phase collision test between a aura mesh and a skin vertex, we divided the aura mesh according to the body parts and constructed a bounding capsule for each segmented mesh.

When a character moves, the aura mesh is deformed by the same method used for animating the underlying skin, such that the aura mesh exhibits natural deformation and maintains the spatial relationship with the skin mesh. For this, we use the linear blend skinning (LBS) method with the skinning weights obtained by [2].

Target Characters Motion Generation

After identifying the corresponding skin vertices in the target characters, which are dubbed the target feature points, we compute their desired positions by finding correspondence between the source and target aura meshes (Fig. 1(b)). The retargeted interaction motion of the target characters is obtained by finding the joint angles that drive the positions of the target features points to their desired positions while trying to preserve the pose of the source characters as much as possible. Experiments show that our method (Fig. 1(e)) eliminates the artifacts, such as skin interpenetration, caused by individual pose retargeting (Fig. 1(d)), and preserves interaction semantics in the retargeted motions.

REFERENCES

[1] Edmond SL Ho, Taku Komura, and Chiew-Lan Tai. 2010. Spatial relationship preserving character motion adaptation. *ACM Transactions on Graphics (TOG)* 29, 4 (2010), 33.

[2] Alec Jacobson, Ilya Baran, Jovan Popovic, and Olga Sorkine. 2011. Bounded biharmonic weights for real-time deformation. *ACM Trans. Graph.* 30, 4 (2011), 78.