DrawingSpinUp: 3D Animation from Single Character Drawings Supplemental Materials

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1 CONTOUR REMOVAL

1.1 Training Data Preparation

We train our contour removal network on the 3DBiCar dataset [Luo et al. 2023]. We render front-view images and contour lines of different thicknesses from 1,500 textured 3D biped cartoon characters in 3DBiCar with Blender [Blender Development Team. 2022]. In order to increase data diversity, we render front-view images with random rotation and render contour lines with random stroke widths (ranging from 1 to 30) and random colors. We train our removal network for only 4 epochs since too many training epochs might lead to over-fitting.

1.2 Comparison of Different Methods

Fig. 1 shows the results of contour removal based on different backbones, including a DoG edge extractor mentioned by Panic-3D [Chen et al. 2023], Pix2PixHD [Wang et al. 2018], and FFC-ResNet [Suvorov et al. 2022]. The DoG-based method treats all lines indiscriminately and is unable to differentiate between external contour lines and internal texture lines, while Pix2pixHD tends to give inaccurate predictions due to a limited receptive field.

2 SHAPE REFINEMENT

2.1 Intersection Removal

Considering that the thinning deformation might affect adjacent areas (for example, the face might also be deformed when we thin the top of the neck), we need to ignore these intersections, i.e., pixels within the intersecting areas. We design an intersection removal algorithm to locate these intersections, as described in Algorithm 1.

ALGORITHM 1: IntersectionRemoval

```
Input: S_mov, S, r
endpoints1 = GetEndPoints (S_mov);
endpoints2 = GetEndPoints (S);
for each point p in endpoints1 do
    if p not in endpoints2 then
        for each pixel in a circle of radius r around p do
            set pixel value to 0 in S_mov;
        end
    end
end
Function GetEndPoints(skeleton):
    endpoints ← Empty list;
    for each pixel (x, y) in skeleton do
        if skeleton[x, y] = 1 then
            count ← the sum of 3 × 3 neighborhood of (x, y);
            if count = 2 then
                Add (x, y) to endpoints;
            end
        end
    end
    return endpoints;
Output: S_mov with removed interseactions
```

2.2 Shearing Transformation

Since Wonder3D [2024] adopts an independent coordinate system for each object that is related to the input view, the posture of the reconstructed character may be slightly tilted, e.g., making the body lean forward or back. We mitigate this problem with a simple shearing transformation, as illustrated in Fig. 2. We adopt shearing instead of rotation because we want to keep the front-view boundary consistent with the input image. We project all vertices onto the YOZ plane. Then, we calculate the eigenvectors with the PCA algorithm and get the incline angle $theta$. So we can know the displacement in the z-direction of each vertex and update the z value of each vertex:

$$z_{shear} = z - y \cdot \tan\theta. \quad (1)$$

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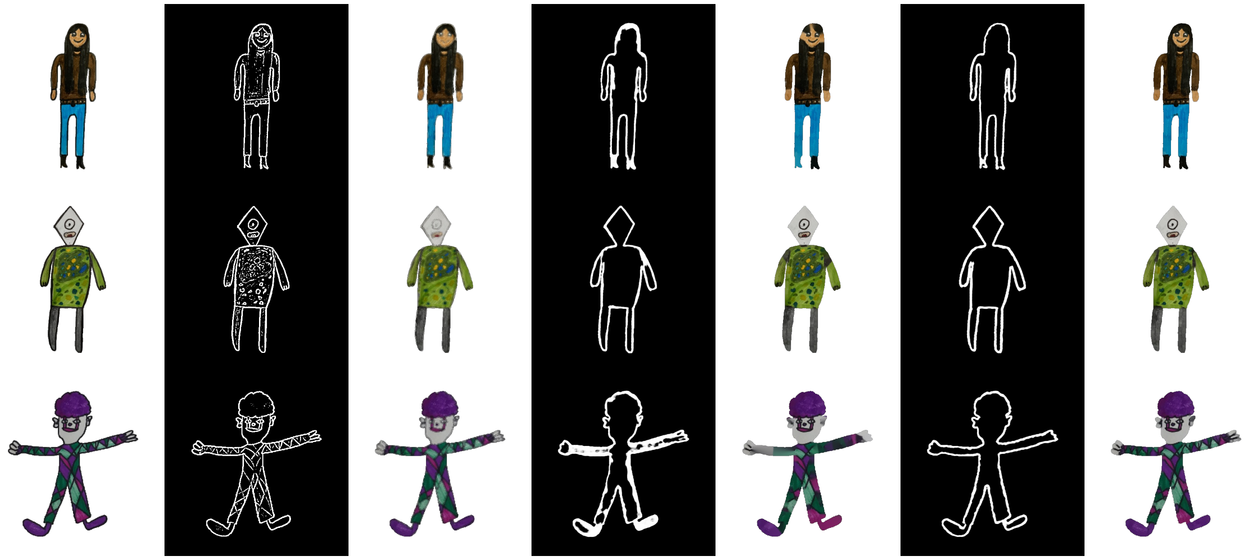

(a) Input (b) DoG + FastMarching (c) Pix2PixHD + FastMarching (d) FFC-ResNet + FastMarching

Fig. 1. Comparison of different backbones for contour removal.

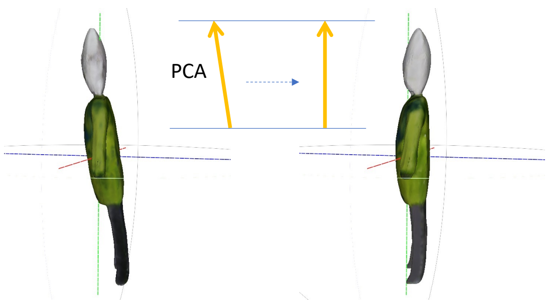

Fig. 2. An illustration of shear transformation.

2.3 Different Deformation Strategies

In addition to the bilateral deformation approach we employed, we also experimented with single-side deformation strategies, as shown in Fig. 3. It can be observed that single-side deformation tends to generate distorted surfaces.

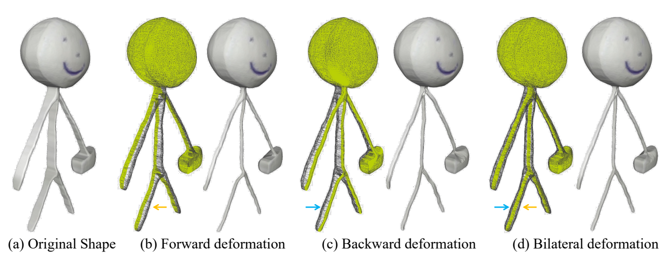

Fig. 3. Different deformation strategies.

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