ShapeWorks Lab Walkthrough

1   Installation

The command line tools for ShapeWorksGroom and ShapeWorksRun, and the GUI for Shape-WorksView are available on the USB stick provided to all participants.

1.1   Windows

Windows binaries are located under software → ShapeWorks → Executables → Windows

1.2   Mac

Windows binaries are located under software → ShapeWorks → Executables → Mac

2   Example 1: Torus

software → ShapeWorks → data → TorusExample contains a population of synthetically generated tori, parameterized by the small radius r and the large radius R. The shapes in this population resemble the ones in Fig. 1
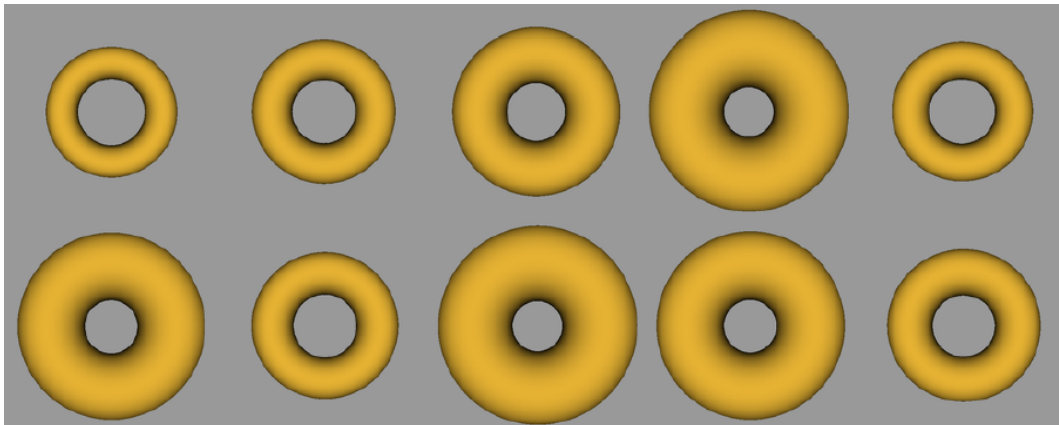

Figure 1: shapes from an example population of tori

We will initialize and optimize correspondences on these shapes to visualize and analyze the shape variation using the GUI tool.

2.1   Preprocessing

Follow these steps to apply preprocessing filters to the input segmentation data in order to prepare it for the particle optimization process. The first preprocessing step cleans the segmentation by isolating the largest connected component and centers every shape in a common bounding box. The second preprocessing step performs antialiasing and creates signed, smooth distance transforms for input into the optimization stage.

```
cd software/ShapeWorks/data/TorusExample
```

2.1.1 Windows

```
../Executables/Windows/ShapeWorksGroom.exe torus.preprocess1.xml isolate hole_fill center \\
../Executables/Windows/ShapeWorksGroom.exe torus.preprocess2.xml antialias fastmarching blur
```

2.1.2 Mac

```
../Executables/Mac/ShapeWorksGroom torus.preprocess1.params isolate hole_fill center \\
../Executables/Mac/ShapeWorksGroom torus.preprocess2.params antialias fastmarching blur
```

2.2 Optimization

Next, we will initialize and optimize correspondences on the tori, using the distance transforms as input. Fig. 2 displays example tori shapes with resulting correspondences overlaid as circular glyphs.

Figure 2: an illustration of correspondences on a few tori from example population

Use this command to perform this step and obtain a point-based representation of each shape in the population:

2.2.1 Windows

```
../Executables/Windows/ShapeWorksRun.exe torus.correspondence.xml
```

2.2.2 Mac

```
../Executables/Mac/ShapeWorksRun torus.correspondence.params
```

2.3 Analysis

Once the correspondences are optimized, we can obtain a mean shape model and analyze the variation in the population using PCA. Fig. 3 depicts the shape variation captured by the first two PCA modes in an example population of tori. The shapes are reconstructed from their respective point-based representations with point positions optimized in the earlier stage. Use the following command to bring up the GUI for the analysis tool:
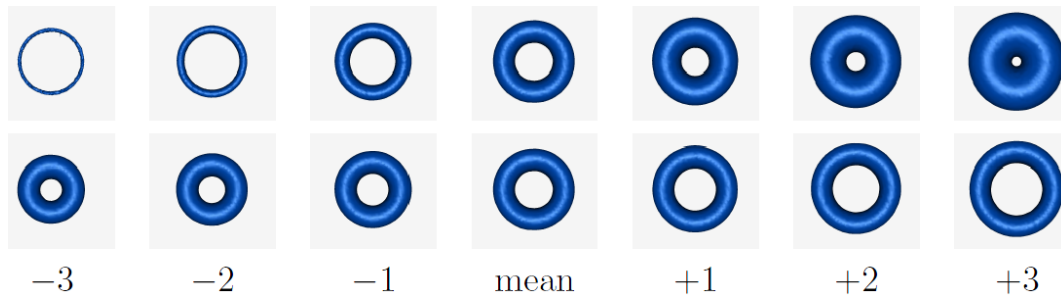
Figure 3: The top two PCA modes of variation for the torus shape model, shown in the first and second rows, respectively. These correspond to the shape changes from the generative model.

2.3.1 Windows

`../Executables/Windows/ShapeWorksView.exe torus.analyze.xml`

2.3.2 Mac

`../Executables/Mac/ShapeWorksView torus.analyze.params`

3 ShapeWorks Manual

More details about the various filters and parameters can be found in the ShapeWorks manual located in labs → ShapeWorks on the USB drive provided.