Morfit v1.0

- Interactive Surface Reconstruction Software with Curve-Driven Topology and Geometry Control

A Guide for User

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1. Introduction

Morfit is an interactive surface reconstruction software developed based on the paper:

Morfit: Interactive Surface Reconstruction from Incomplete Point Clouds with Curve-Driven Topology and Geometry Control. (Proc.SIGGRAPH ASIA 2014)

You can freely use the software and the source code in your research. If you will use it for commercial purpose, please contact Hui Huang/Kangxue Yin for patent issues.

Here is the interface of morfit for preview:

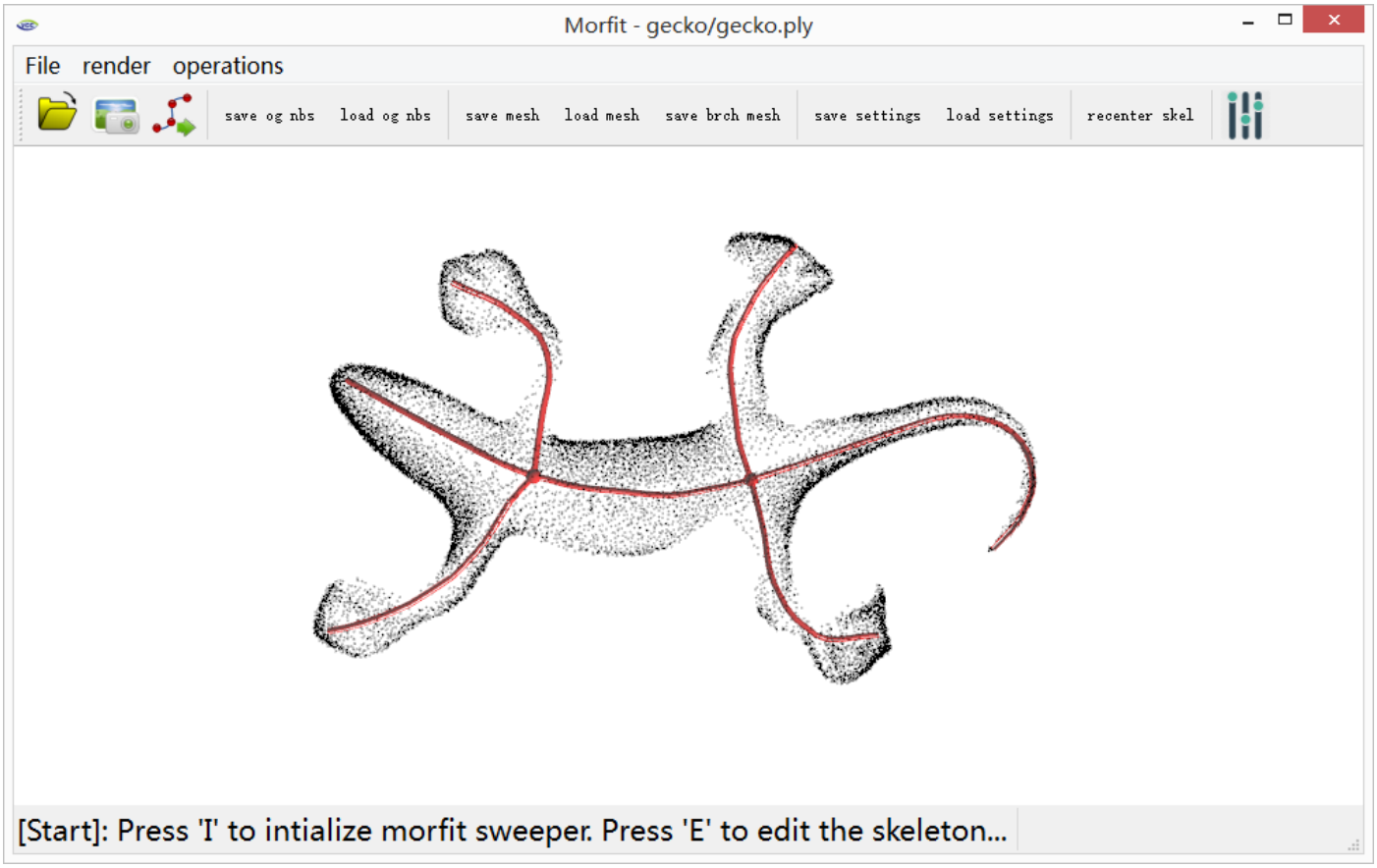

Figure 1. Preview of Morfit interface

2. Input Data

Morfit accepts input of 3d scan with skeleton. Point cloud is stored in ".ply" format. Skeleton is stored in ".skel" file. The format of ".skel" file is:

CN branch_num
CNN node_num_of_1st_ branch
x0 y0 z0
x1 y1 z1
x2 y2 z2
…
xn yn zn
CNN node_num_of_2nd_ branch
x0 y0 z0
x1 y1 z1
x2 y2 z2
…
…
…

This skeleton file format is compatible with the output of L1-Medial skeleton demo program. Find it from:

http://vcc.siat.ac.cn/index/getInfo?title_id=453&id=24&to_path=project

Note that, as set defaultly in the program, skeleton file is considered appendant to a scan file. When you load your data, you only select a "ply" scan file. The skeleton file will be found automatically by attaching a ".skel" postfix. For example, if you select a scan file "rabbit.ply", the system will load "rabbit.ply.skel" automatically as its skeleton.

3. Buttons

Figure 2 describes the function of each button.

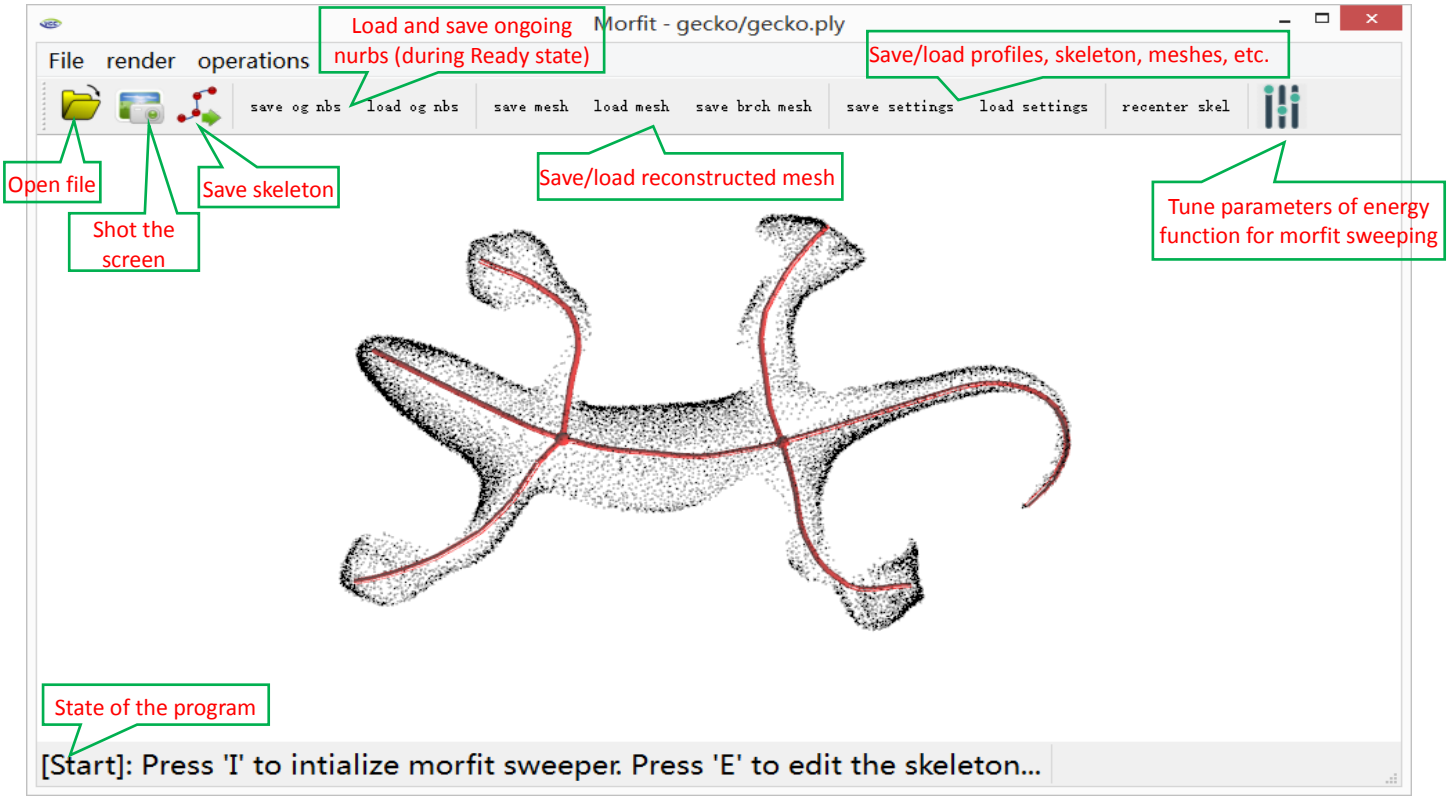

Figure 2. Description of buttons

Keyboard:

You can press ‘M’ to save the current view, and press ‘L’ to lock the view to saved view.

4. States and Stroke-based Interaction

Morfit has 6 operating States:

Start, **Skeleton**, **Stroke**, **Ready**, **Segment**, **Update**.

Figure 3 shows how to migrate from one state to another.

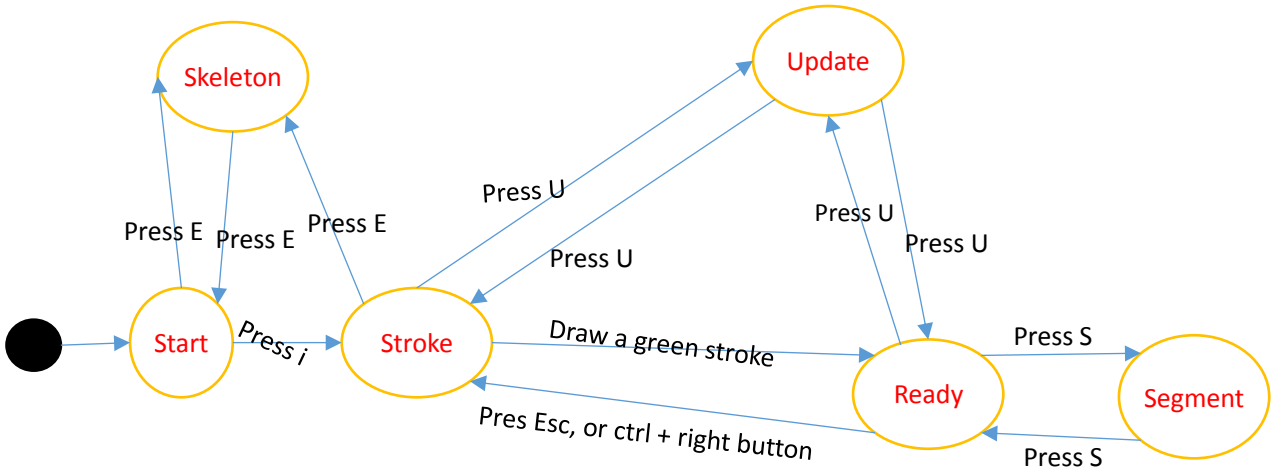

Figure 3. State migration diagram.

The status bar at bottom of the interface tells you which state the software is in, and what you can do. (See figure 2).

1). “Start” State

Start state is where the system is after startup. In this state, you can only view the data.

Press ‘E’ to enter “Skeleton” state, or ‘I’ to enter “Stroke” state.

2).“Skeleton” State

This state allows you edit the skeleton. You can:

- Deform the skeleton by drag it with your right button.
- Draw rosy stroke with you left button. The rosy strokes can indicates operations include: cut, delete, extend (See figure 4).
- Combine these operations. Basically, you can get any editing result.
- Press ctrl+Z to undo, or ctrl+Y to redo.

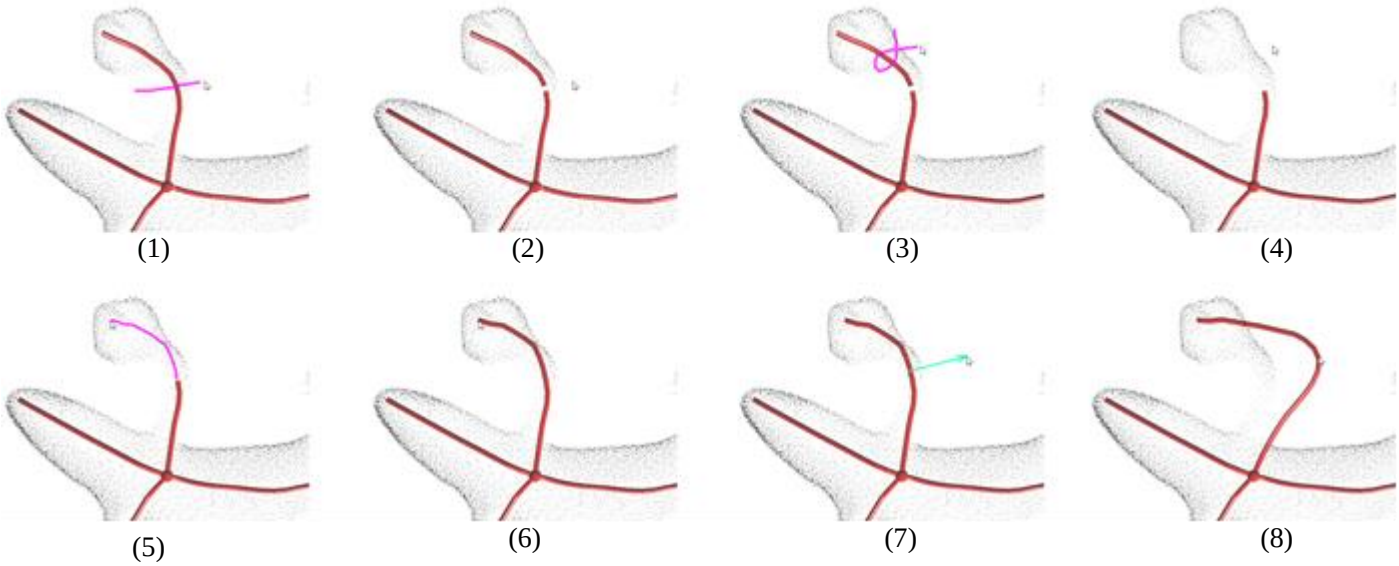

Figure 4. Skeleton Editing. 1-2: cut. 3-4: delete. 5-6: extend. 7-8: deform.

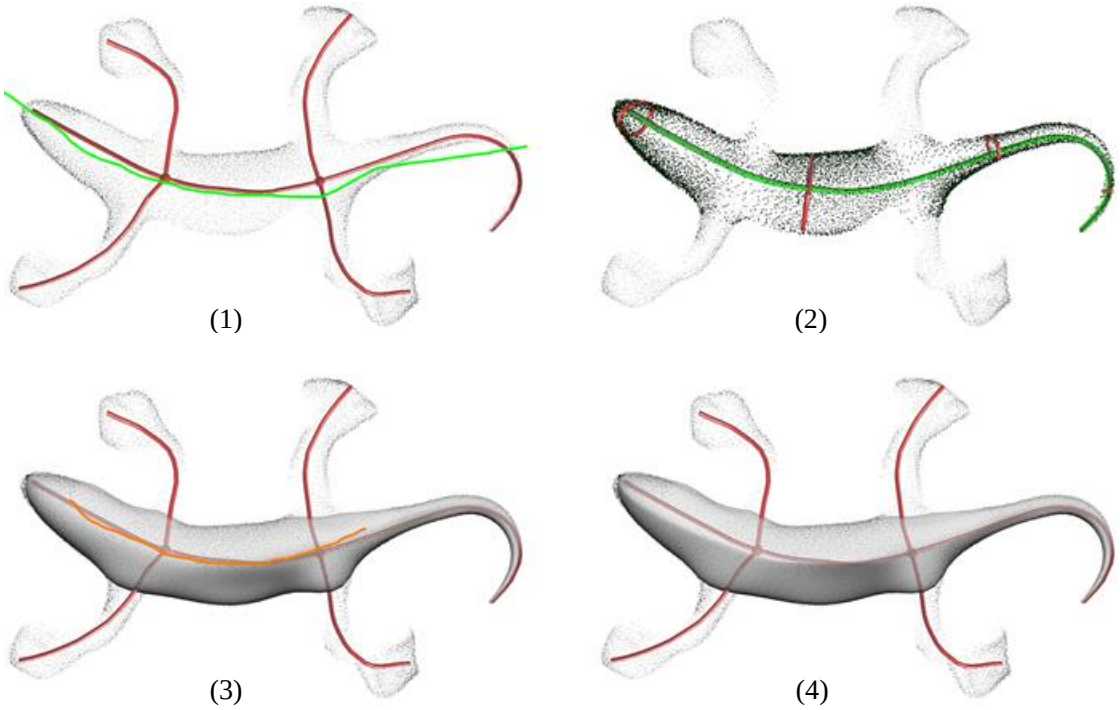

Figure 5. Stokes. (1)Path stroke. (2)Selected path and the seed profiles (“Ready” State). (3)Sharp stroke. (4)Sharp feature.

3). “Stroke” State

In this state, you can draw two kind of strokes with your right button (figure 5):

- Path stroke. With ctrl pressed, move your right button, you can draw a green stroke. Stroke along a path on the skeleton, you will select them for morfit sweeping. The program will smooth the path, find points associated with this path (the points that will be used for morfit reconstruction), and fit seed profiles by

nurbs. See figure5(2). Then the program enter “Ready” state automatically.

- Sharp stroke. With shift pressed, move your right button, your can draw an orange stroke. Stroke on a reconstructed generalized cylinder, you can indicate the sharp feature.

3). “Ready” State

Figure 5(2) show what you can see in “Ready” state. In this state, you can press ‘R’ to reconstruct the shape of the selected path. As show by figure 6. Or

- Double click a red profile, and edit it by dragging the control points.
- Press ‘S’ to enter “Segment” state and refine the segmentation.
- Click the green path with your right button to select/de-select seed profiles.

Also note that, if you dislike a branch you just reconstructed, you can always delete it by pressing ‘Esc’.

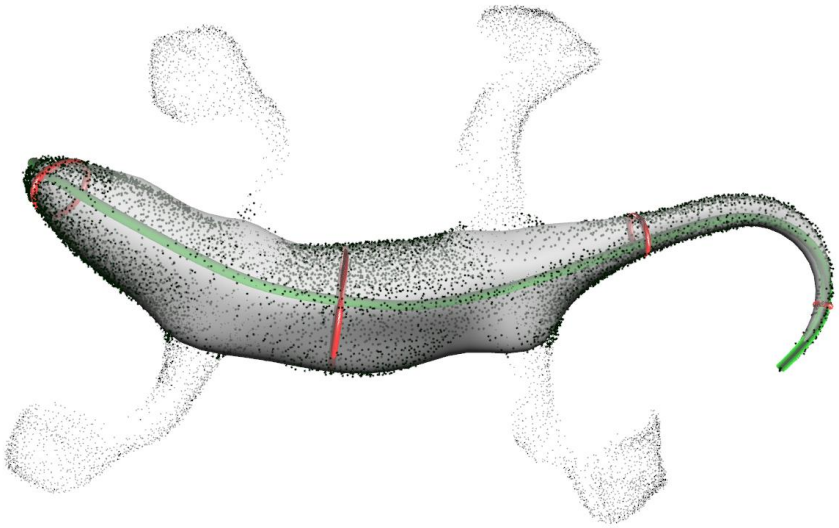

Figure 6. Reconstruction result of selected path.

4). “Segment” State

After enter this state, you can draw a cyan circle with your left button. When ctrl pressed, points in the circles will be included in the set of points that contribute to the reconstruction of the generalized cylinder. If shift pressed, points in the circle will be excluded from the set of points that contribute to the reconstruction.

If you draw darkgreen circle with right button, you are forcing the tip of a skeleton branch inside that circle to produce/not produce a tip on the reconstructed shape.

5). “Update” State

In “Stroke” or “Ready” state, you can press ‘U’ to enter “Update” state. In this state, with ctrl pressed, you can draw a blue stroke with your right button to select a nubrs profile. Edit it by dragging the control points (see figure 7). Then, press ‘R’ to add the new profile as a constraint of morfit optimization and resolve it to update the shape.

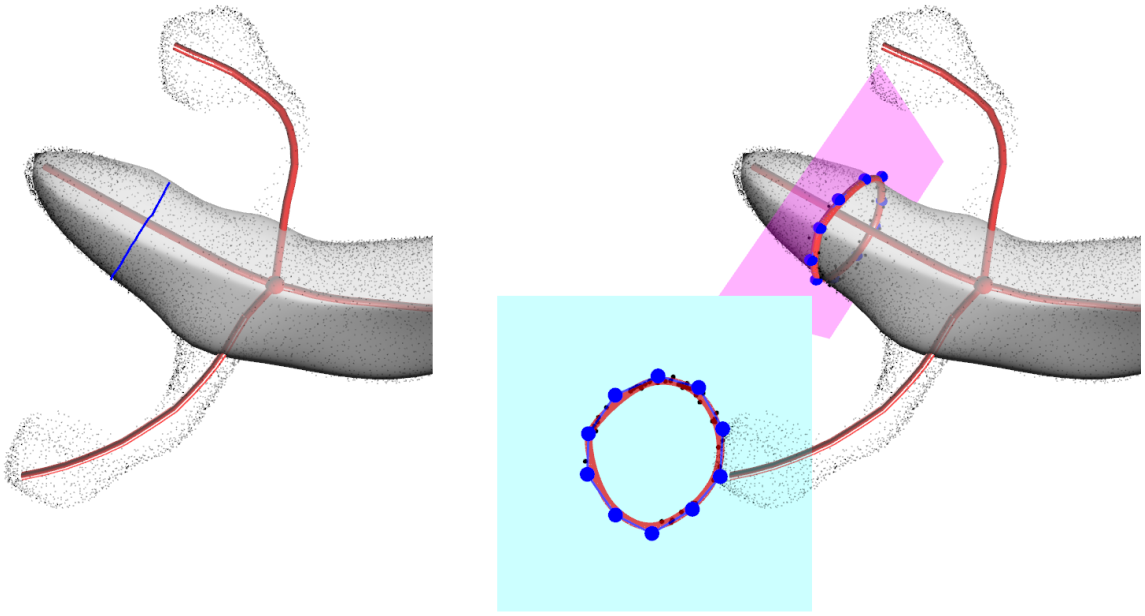

Figure 7.Update the reconstructed shape. Left: draw a blue stroke. Right: the selected profile is shown.

5. Build the code

To build the source code, you need VS2010 or later version, with QT add-in 1.2.3, or later version, installed. The following libs are required:

Qt-5.1.1
http://download.qt-project.org/archive/qt/5.1/5.1.1/

PCL-1.7
http://7.pointclouds.org/http://7.pointclouds.org/news/2013/07/23/pcl-1.7/

vcglib
http://vcg.isti.cnr.it/~cignoni/newvcglib/html/

Eigen-3.0.3
http://eigen.tuxfamily.org/index.php?title=Main_Page

glew-1.10.0
http://sourceforge.net/projects/glew/files/glew/1.10.0/

nlopt-2.3
http://ab-initio.mit.edu/wiki/index.php/NLopt#Download_and_installation

lemon-1.2.3
http://lemon.cs.elte.hu/trac/lemon/wiki/Downloads

nurbs++-3.0.11
http://libnurbs.sourceforge.net/old/download.shtml

ann-1.1.2
http://www.cs.umd.edu/~mount/ANN/

glut
https://www.opengl.org/resources/libraries/glut/