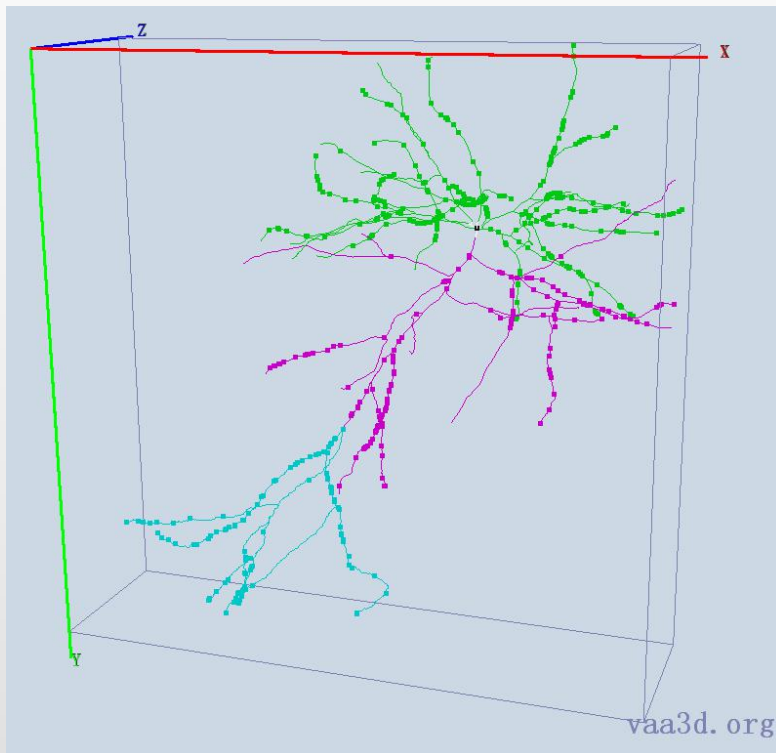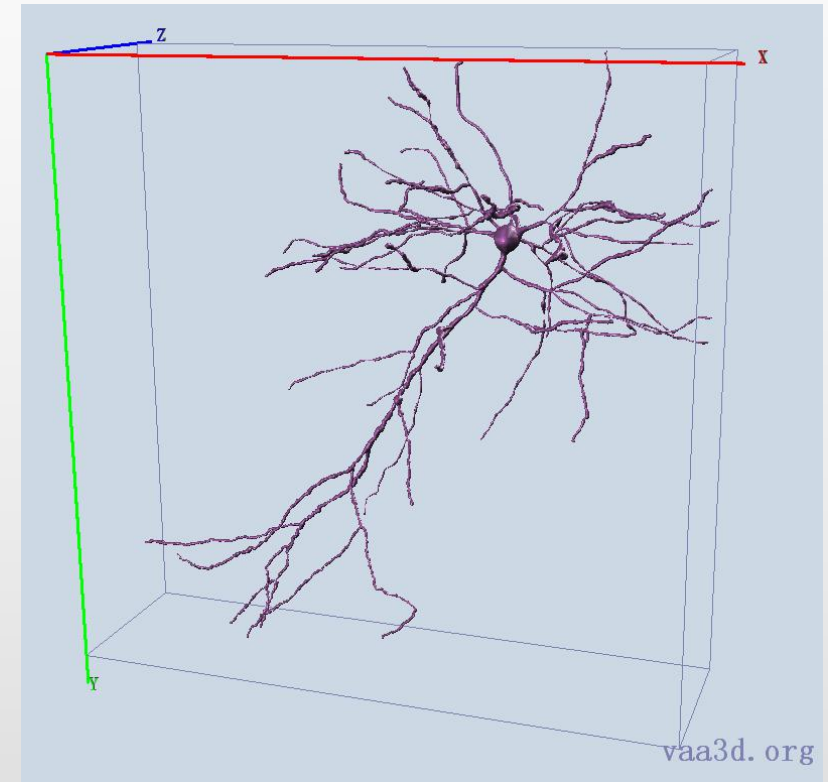# Transform SWC to 3D surface model

Zongcai Ruan
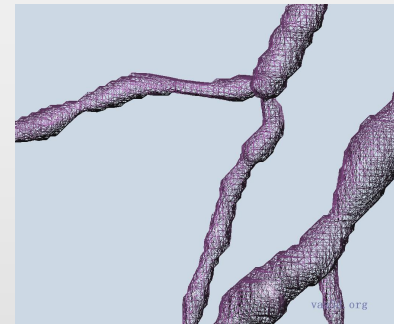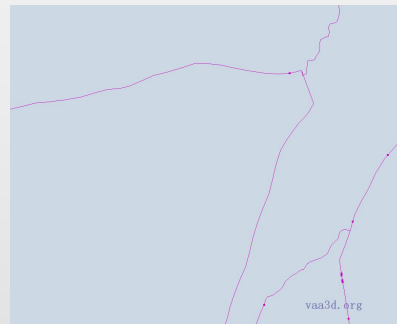
Skeleton model vs. Surface model

- SWC file

- skeleton model (line segment chain)

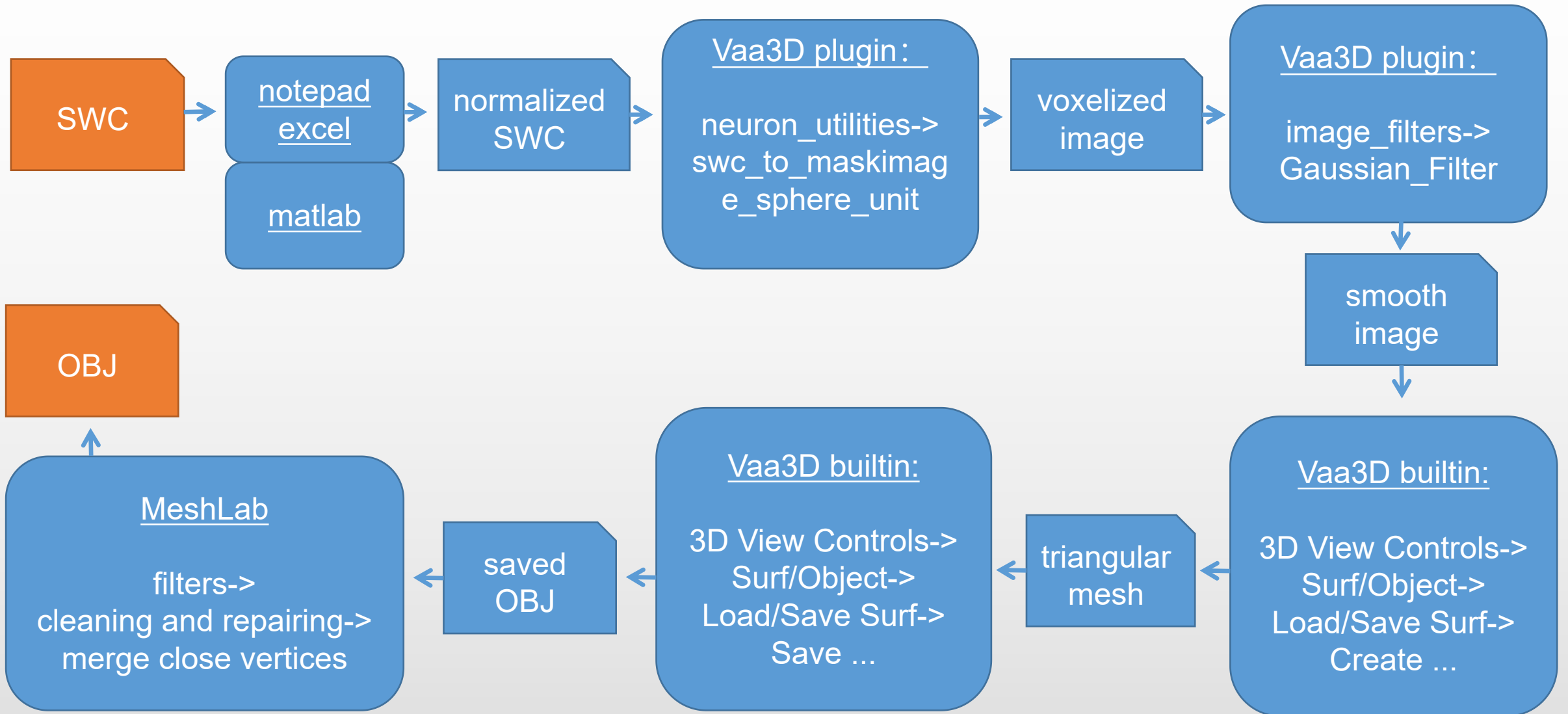- OBJ file (Alias|Wavefront)

- surface model (triangle mesh)

Pipeline

normalized SWC

- Voxelization resolution cannot be less than 1 pixel

- So we need to scale up to make the minimum node radius not less than 1

- It is better to shift the origin of the coordinate, so that the voxelized image is basically consistent with the SWC bounding box

- In addition, the voxelized image should be slightly larger than the SWC bounding box, otherwise the generated surface cannot be closed at the image boundary

voxelized image

- *Vaa3D plugin:*

- neuron_utilities-> swc_to_maskimage_sphere_unit

- The images generated by this plug-in are more clearly, but there will be more useless background from the bounding box to the origin

- neuron_utilities-> swc_to_maskimage_cylinder_unit

- The images generated by this plug-in are a little fuzzy

smooth image

- ***Vaa3D plugin :***

- image_filters-> Gaussian_Filter

- Hard mask image is not smooth and continuous enough

- The filtered image takes up more memory because it is represented by float32

- Four times the memory space of the original image
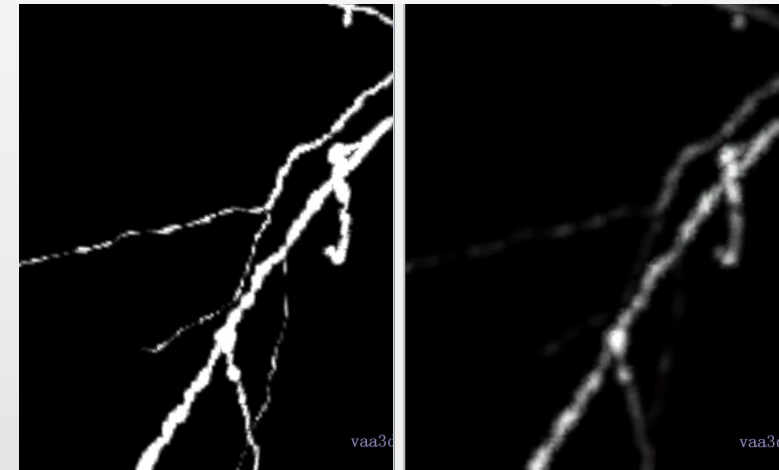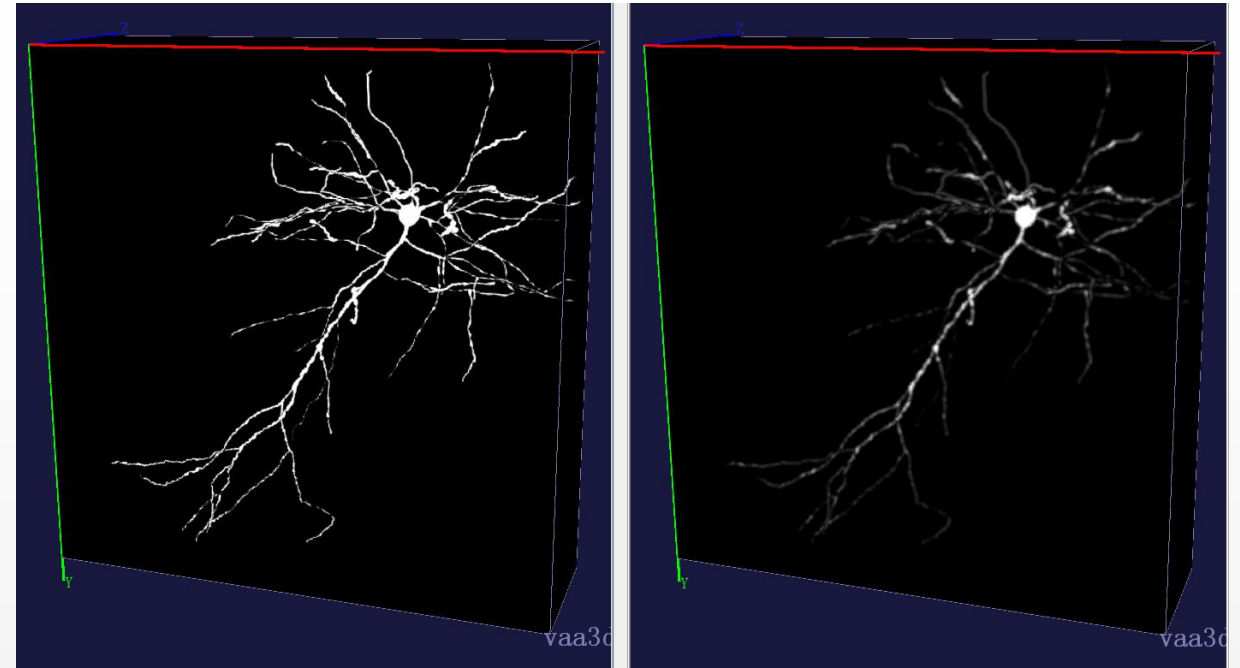
triangular mesh

- **Vaa3D builtin function:**

- Triangular mesh generation baesed on marching cube method

- label field surface is used for multi label segmentation result

- range surface is used for isosurface

- the range specified by double threshold
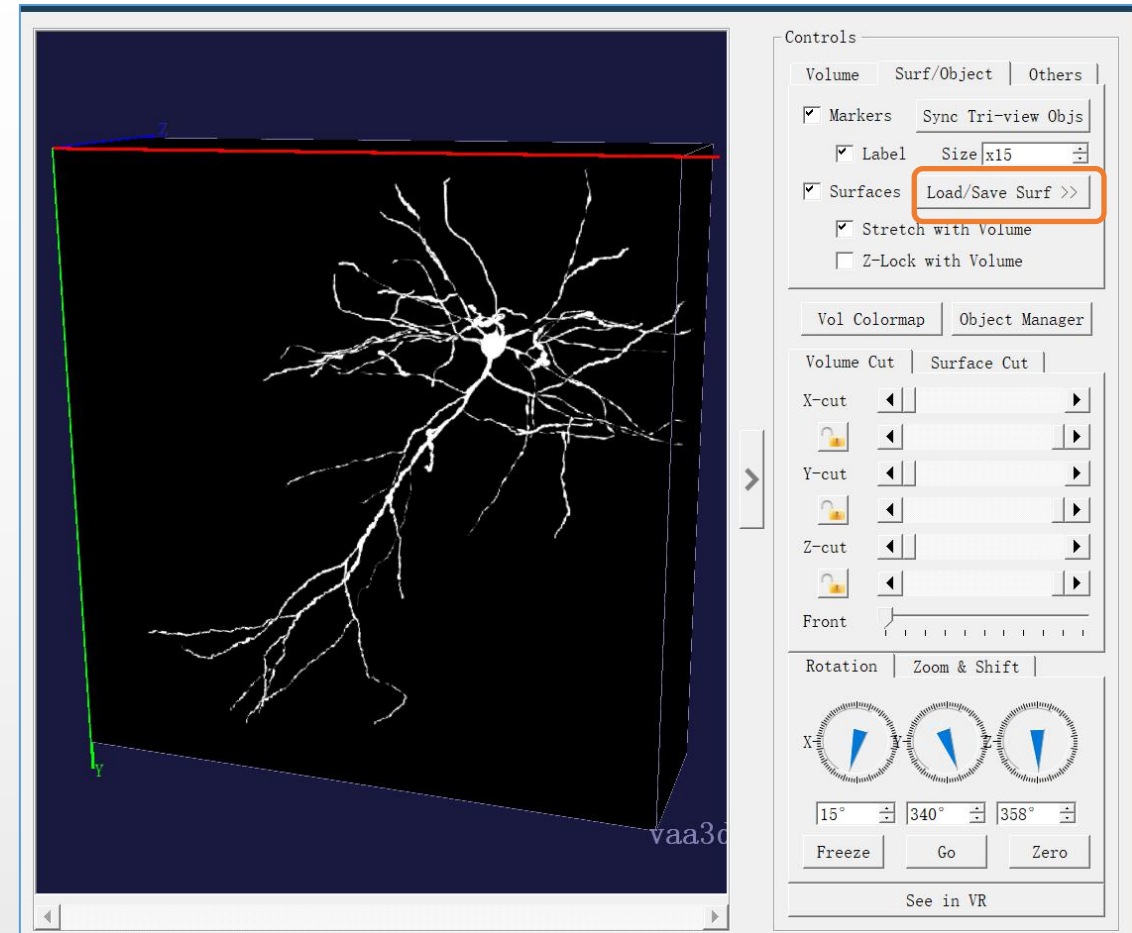
saved OBJ

- ***Vaa3D builtin function:***

- 3D View Controls-> Surf/Object-> Load/Save Surf-> Save …

- OBJ is a geometry definition file format in text format

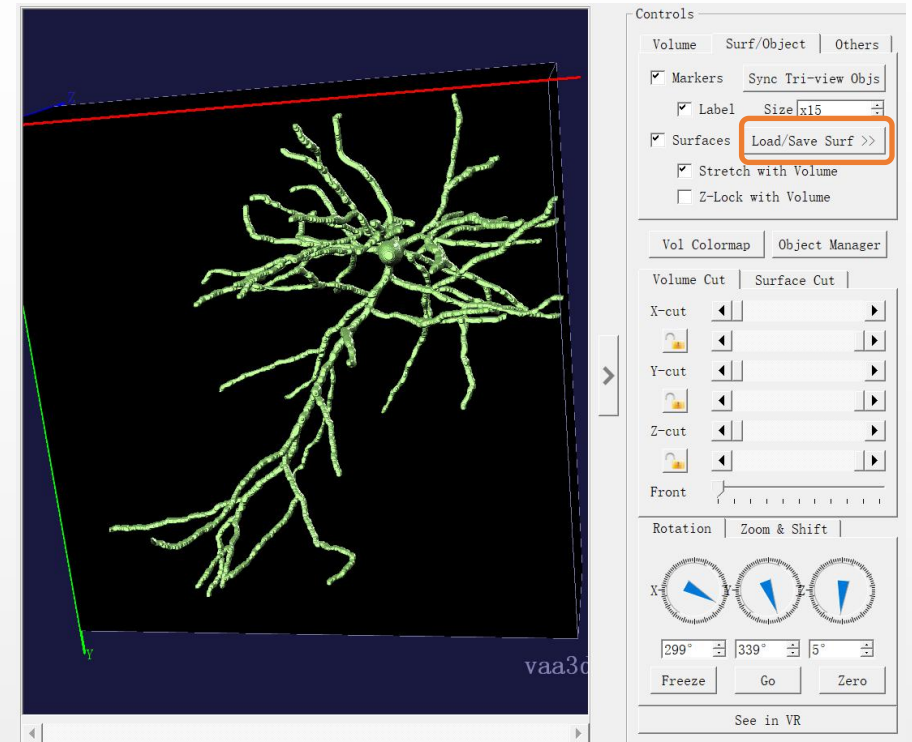- OBJ file format first developed by Wavefront Technologies. It can be exported and opened by various 3D image editing programs

MeshLab for mesh processing

- https://www.meshlab.net/

- open source system for processing and editing 3D triangular meshes

- merge close vertices (The output of marching cube has a large number of redundant vertices)

- set new coordinate origin

- set new coordinate scale

Mesh: aibs_9_stitched_connected_labeled_scaled.1000.obj
Vertices: 3,803,622
Faces: 1,267,874
Selection: v: 0 f: 0

Pipeline review

SWC → notepad excel / matlab → normalized SWC → Vaa3D plugin: neuron_utilities-> swc_to_maskimage_sphere_unit → voxelized image → Vaa3D plugin: image_filters-> Gaussian_Filter → smooth image

Vaa3D builtin: 3D View Controls-> Surf/Object-> Load/Save Surf-> Create ... → triangular mesh → Vaa3D builtin: 3D View Controls-> Surf/Object-> Load/Save Surf-> Save ... → saved OBJ → MeshLab filters-> cleaning and repairing-> merge close vertices → OBJ