

Soma format representation in NeuroMorpho.Org as of version 5.3

In response to ongoing discussion in the research community

(<http://www.neuron.yale.edu/phpbb/viewtopic.php?f=13&t=2161&sid=78f9eec7d3d47e96af3500e9c6dcd734>), NeuroMorpho.Org is updating the soma format in the standardized reconstruction files (CNG.swc). As of v5.3, all NeuroMorpho.Org somata previously represented as a single point (a 'sphere') will be represented by three 3D points describing a cylinder. This update minimizes confusion and maximizes compatibility with other resources. The conversion was agreed upon and coordinated with the developers of NEURON (<http://www.neuron.yale.edu/neuron/>), L-Measure (<http://cng.gmu.edu:8080/Lm/>), and NeuroML (<http://www.neuroml.org>). As always, the original files will remain unchanged and available for download.

Soma representation in the original neuronal reconstructions contributed to NeuroMorpho.Org received so far fall into the following five categories:

1. Single contour (80%)
2. Soma absent (8%)
3. Multiple contours (5%)
4. Multiple cylinders (4%)
5. Single point (3%)

These representations as well as their conversion into a standardized *three-point soma cylinder* are described below.

1. Single contour

A single contour displays the outline of the soma in the original file (e.g. Figure 1).

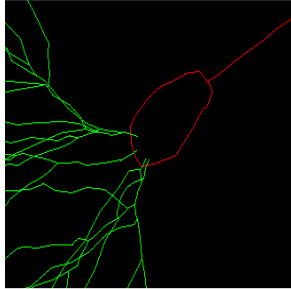


Figure 1: l44b.ASC– Wittner

Somata represented as a single contour in the original files are converted into a *three-point soma cylinder* (Figure 2) represented as type=1 in the SWC files. The first point constitutes the center of the soma, with coordinates (x_s , y_s , z_s) corresponding to the average of all the points in the single contour. An *equivalent radius* (r_s) is computed as the average distance of each point of the single contour from this center. The first point is assigned parent ID -1 as is standard for the root in the SWC format. The second and third soma points, as well as all starting points (roots) of dendritic and axonal arbors have this first point as the parent (parent ID 1). The x and z coordinates as well as the radius of both the second and third soma points are the same as that of the first point. The y coordinates of the second and third points are shifted by $-r_s$ and $+r_s$, respectively (Figure 2). The surface area of this soma cylinder equals the surface area of a sphere of radius r_s .



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1 1  $x_s$   $y_s$   $z_s$   $r_s$  -1
2 1  $x_s$   $y_s-r_s$   $z_s$   $r_s$  1
3 1  $x_s$   $y_s+r_s$   $z_s$   $r_s$  1
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Figure 2. **Three-point soma representation.** Red lines represent the skeleton of the soma (three points, two compartments, one cylinder). Green and pink lines are the initial portions of (basal and apical) dendritic trees. White lines represent virtual “wires” to connect all trees to the center of the soma.

2. Soma absent

Reconstructions lacking a soma are not altered from their current representation in NeuroMorpho.Org.

3. Multiple contours

In these reconstructions the original files represent the soma as a stack of contours displaced in the direction perpendicular to their planes (e.g. Figure 3).

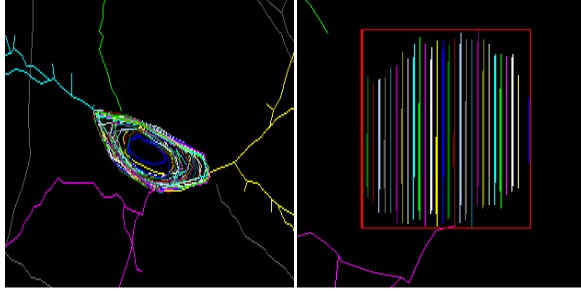


Figure 3: AKO60sdax2lay.DAT – Cauli

Multiple contours are transformed into a three-point soma, as in case #1. In this case, however, the center coordinates and radius (x_s , y_s , z_s , r_s) are computed as average from the points of all the contours.

4. Multiple cylinders

Original files in which the soma is represented as multiple cylinders (e.g. Figure 4) remain unchanged.

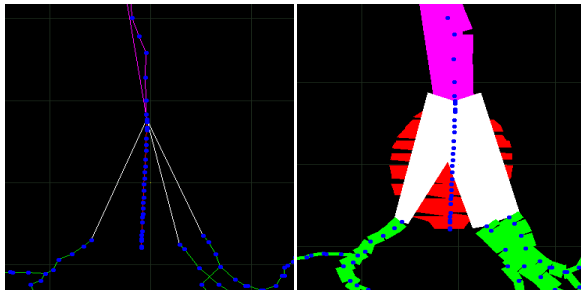


Figure 4: ri05.swc - Spruston

Special case: Certain original files represent the soma by both a single contour and a series of cylinders. In these cases, the contour information is discarded and the cylinder representation is preserved unchanged (Figure 5).

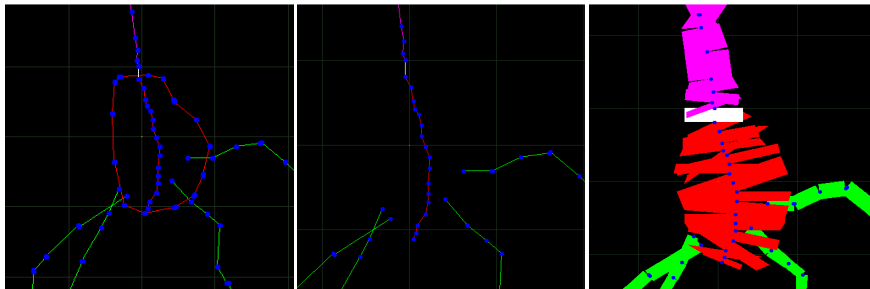


Figure 5. I22.asc - Turner. Note the presence of both a somatic contour and the multiple cylinder skeleton (left). Contour is discarded and cylinder is preserved in skeleton (middle) and area (right) projection.

5. Single point

Somata represented as a single point in the original files (e.g. Figure 6) are also converted into the three-point representation described in #1. In this case, the coordinates and radius of the original soma point remain as the coordinates and radius of the first soma point (the center of the cylinder). The second and third soma points are identical except for their IDs, parent IDs, and the radius-length shift in the negative and positive y -direction, respectively, as described in #1.

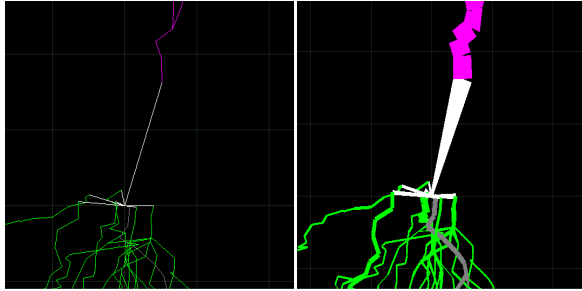


Figure 6. cell1zr.txt – Barrionuevo.

Please address questions and comments to nmadmin@gmu.edu