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SPARC_MapCore_HumanVagusNerve_Segmentation

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Protocol status: Working
We use this protocol and it's working

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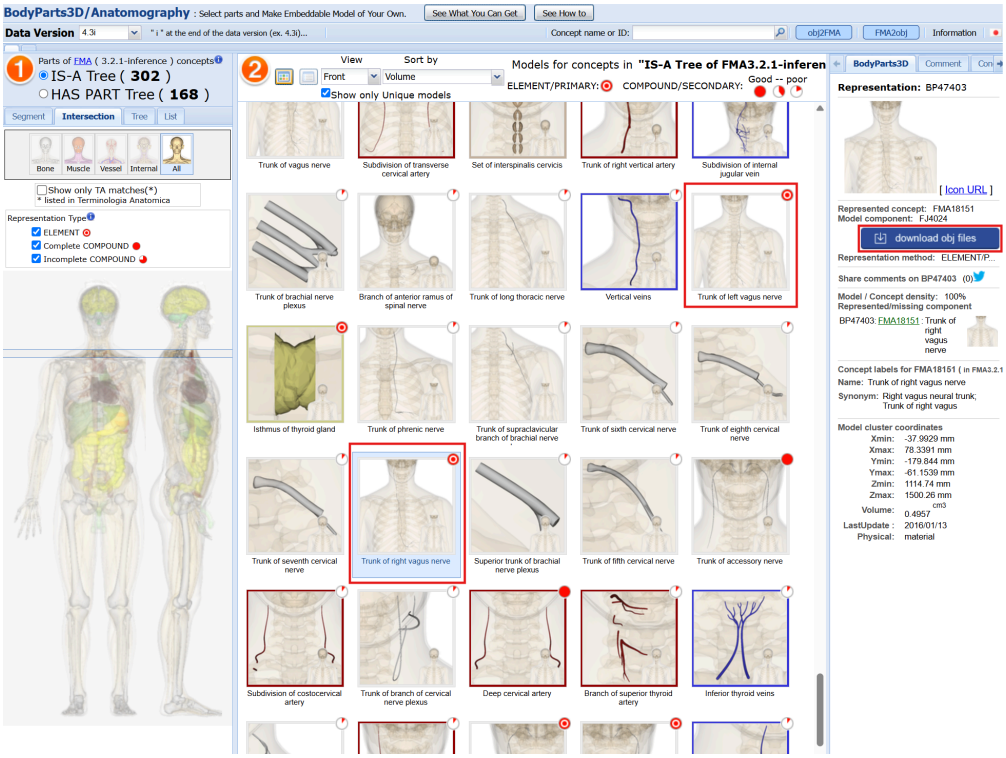
Abstract

The protocol describes the process of creation of the left and right vagus nerves segmentation used to quantify human vagus nerve morphology. The initial model is based on the 3D contours of left and right vagus nerve trunks made using modified clinical 3D images or scanned plastic models as per https://lifesciencedb.jp/bp3d/info_en/index.html#Data_types

Materials

- MAPClient Mapping Tools

1 We downloaded vagus nerve files (Trunk of left vagus nerve; Trunk of right vagus nerve) from **https://lifesciencedb.jp/bp3d/** (data version 4.3i). These .obj files only contain trunk data with some not annotated branches.



Example screenshot of the database with vagus nerves files.

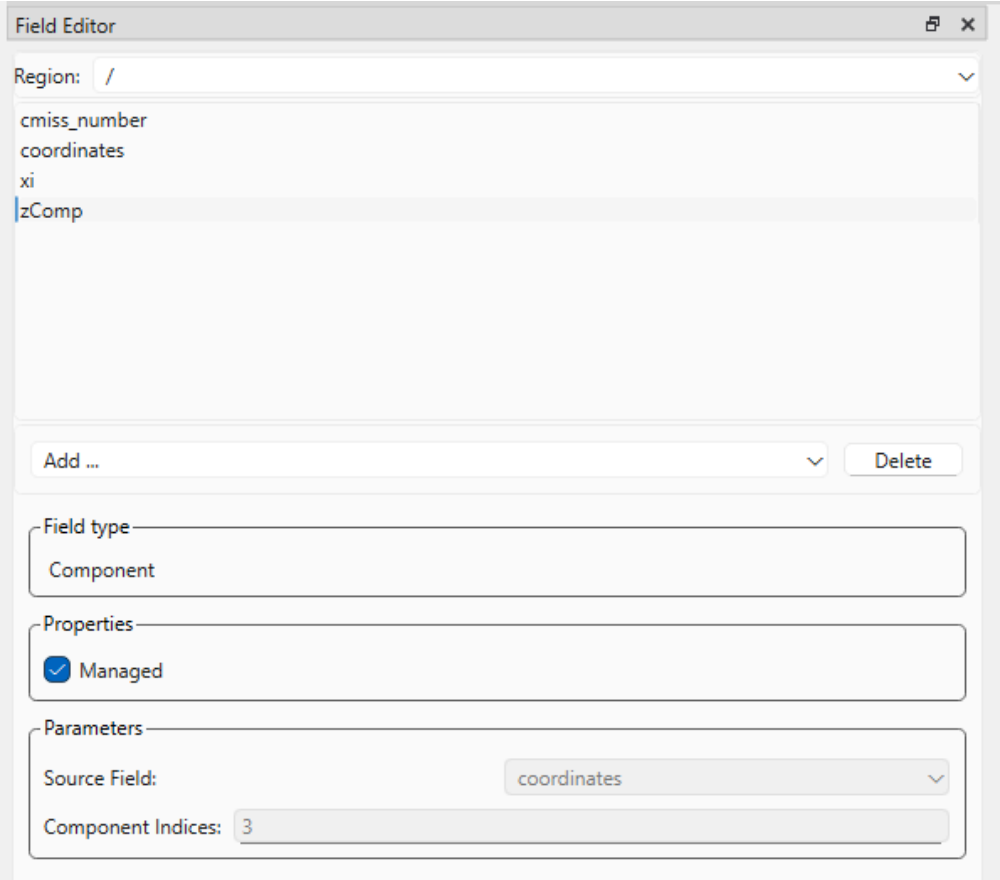
2 We converted the .obj files to .exf format using **Scaffold Mapping Tools** plugin **Convert_Data_to_Zinc**.

3 We created and extracted contours of the trunk and its branches from the converted data using the **ArgonViewer** plugin in the Scaffold Mapping Tools as described below.

Load the converted .exf file into the plugin.
In the **FieldEditor** tab add a new field named zComp by selecting the **Add** button and choosing **Component** from the dropdown list.

Under **Parameters**, choose **Source field**: coordinates and **Component Indices**: 3
Under **Create**, add **Name**: zComp

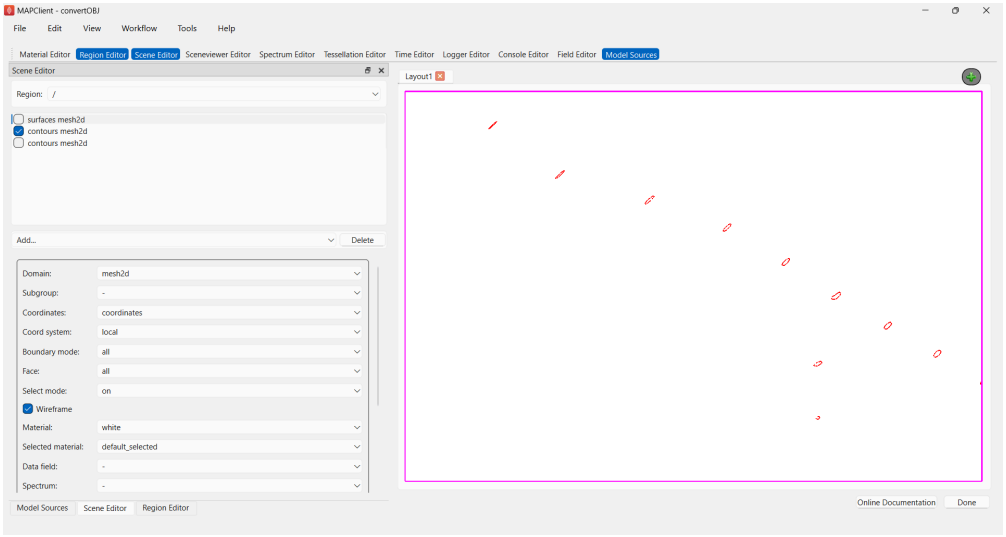
Press Create button and make sure that zComp field appeared in the field list similar to the image below.



In the **SceneEditor** tab add a new contour by pressing **Add** button and choosing **contours.**
The following settings should be applied:
Domain: mesh2d
Material: red
Data field: zComp
Tesselation field: zComp

Under **Contours**,
Scalar field: zComp
Range number: 40
Isovalues: 900, 1500

The example below shows the created contours for the right vagus trunk.



These contours are exported using the **Argon Scene Exporter** plugin.
For more guidance please refer to the documentation:

- Argon Viewer: https://abi-mapping-tools.readthedocs.io/en/latest/mapclientplugins.argonviewerstep/docs/index.html
- Argon Scene Exporter: https://abi-mapping-tools.readthedocs.io/en/latest/mapclientplugins.argonsceneexporterstep/docs/index.html

4 From created contours we manually segmented and recorded the centroid points for the trunk.

5 We annotated and recorded the following anatomical levels on a 3d human body model with organs that allowed us to identify the levels:

- left / right level of superior border of jugular foramen on the vagus nerve
- left / right level of inferior border of jugular foramen on the vagus nerve
- left / right level of inferior border of cranium on the vagus nerve
- left / right level of C1 transverse process on the vagus nerve
- left / right level of angle of the mandible on the vagus nerve
- left / right level of greater horn of hyoid on the vagus nerve
- left / right level of carotid bifurcation on the vagus nerve
- left / right level of laryngeal prominence on the vagus nerve
- left / right level of superior border of the clavicle on the vagus nerve
- left / right level of jugular notch on the vagus nerve
- left / right level of sternal angle on the vagus nerve
- left / right level of 1 cm superior to start of esophageal plexus on the vagus nerve
- left / right level of esophageal hiatus on the vagus nerve
- left / right level of aortic hiatus on the vagus nerve

6 We manually annotated nerve and nerve branches starting, waypoint and ending points on a 3D human body model based on conducted **literature review** and saved them as an **an anatomic map**. The vagus nerve branch annotation points were extracted from the map using ‘left vagus nerve’ and ‘right vagus nerve’ as keywords. The coordinates and annotation of the vagus branch points were then consolidated in an .exf file.

7 The annotated vagus branch points (Step 6), and the converted trunk centroid files (Step 4) were merged together by creating a connected 1d network layout mesh in a single **.exf file**, one for right and one for left side. The anatomical levels (Step 5) were added as marker points.