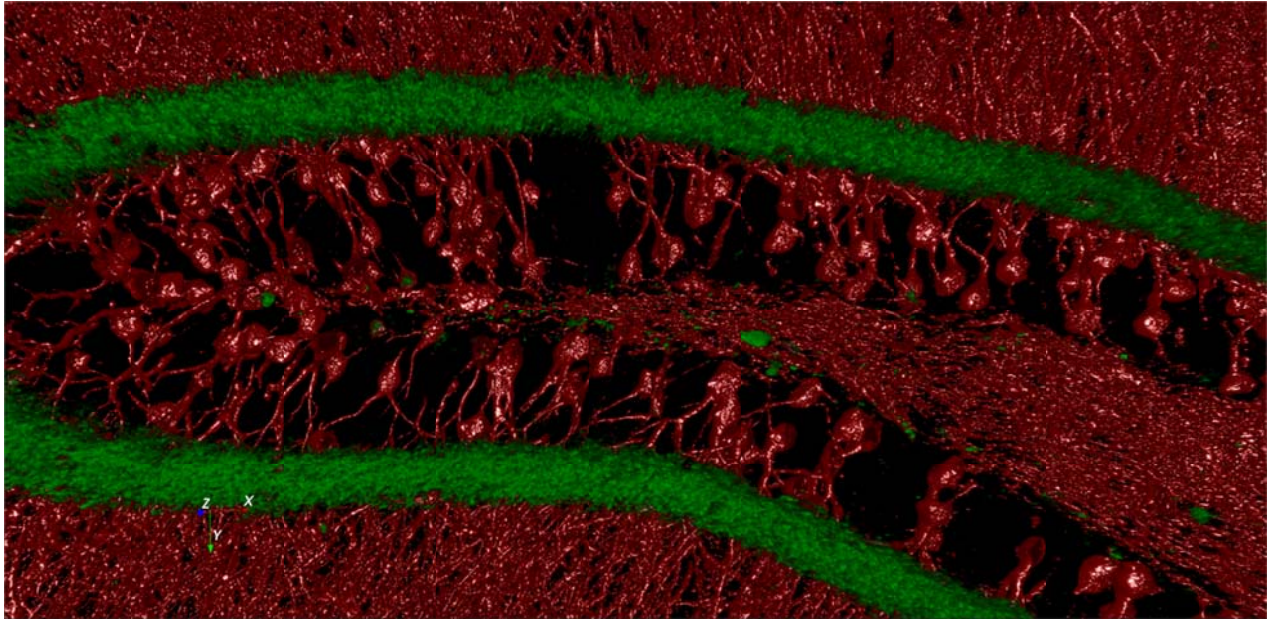


# DRVISION TECHNOLOGIES

## AIVIA 5.1

June 28<sup>th</sup> 2017, Bellevue, WA, USA



## OVERVIEW

We are extending Aivia 5's novel neuron analysis approach to provide greater capabilities for the detection, analysis, visualization and classification of neurons. With Aivia 5.1, we have made great progress in expanding the capabilities of the 3D Neuron Analysis recipe to support automatic and manual spine detection, and no soma images. Semi-automatic neuron tracing is now possible with 14 new features added to the Neuron Editor for detecting soma and spines as well as improving dendrite tracing performance. In addition, we are growing Aivia's analyses with the introduction of the 3D Cell Count recipe for detection and analysis of 3D objects. These new analysis capabilities are complemented with significant performance improvements in 3D objects rendering and a new dark mode to the software graphical user interface.

Summary of Aivia 5.1 developments:

- *3D neuron and spine analysis – 11 new features*
- *Automated 3D object detection and analysis – 11 new features*
- 3D classifier – 3 new features
- *Graphical user interface and general accessibility improvements – 16 new features*
- Neuron Editor – 14 new features
- 3D visualization performance and usability improvements – 10 new features
- 75 bugs fixed

## 3D neuron and spine analysis

- 3D Neuron Analysis recipe in Aivia 5 has been updated with new features to support additional image analysis requirements for spine detection and dendrite tracing on images without soma.
- One new preset and two new switchable procedures with parameters are added into the Neuron Analysis recipe to support additional use cases

### Soma Detection

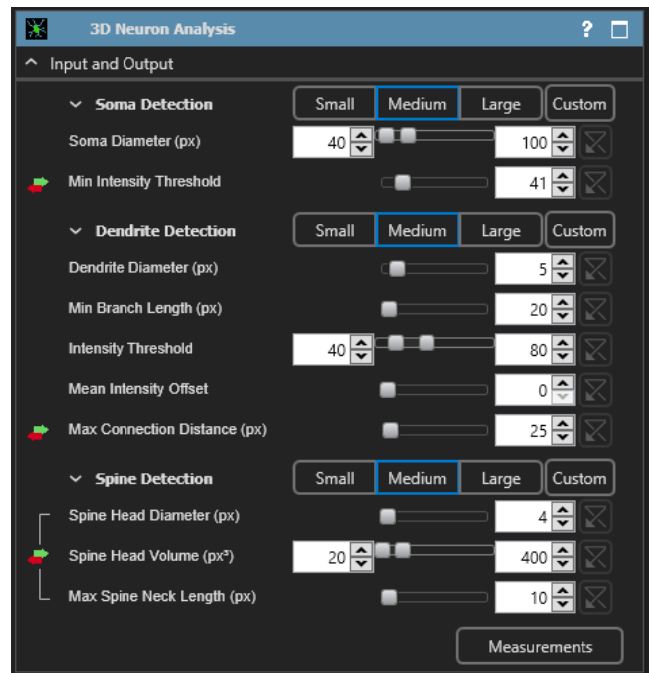
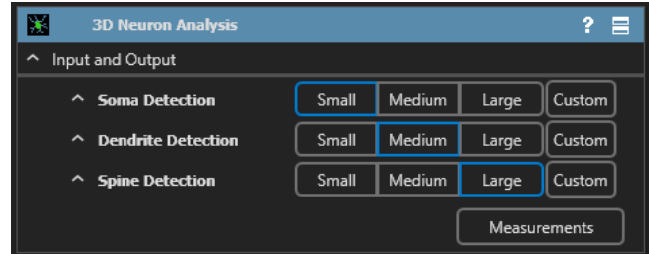
- Enable/Disable soma partition: activates soma partition for images with high neuronal density using 3D watershed function; it has one parameter
  - Min intensity threshold: defines the minimum soma intensity

### Dendrite Detection

- Enable/Skip soma detection: this option allows users to skip soma detection when tracing dendritic network that lacks a visible soma on the image; it has one parameter
  - Max Connection Distance: defines the maximum search range for connecting dendritic segments

### Spine Detection

- Enable/Disable spine detection: this option allows the users to enable (or disable) spine detection on fluorescent 3D images containing neurons with dendritic spines
  - Spine Head Diameter: defines the mean diameter of spine heads for detection
  - Spine Head Volume: defines the volume range of detected spine heads
  - Max Spine Neck Length: defines the maximum search range for spine detection



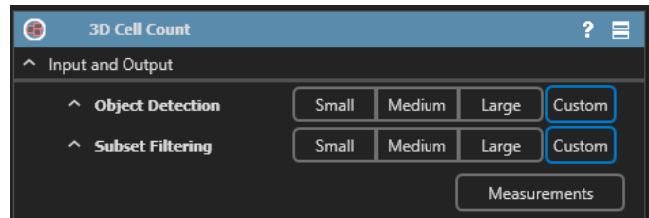
- 12 new measurements on the spine objects, including:
  - Volume, surface area, convex hull volume and diameter for whole spine
  - Statistics of spine tortuosity, ratios of spine volume, surface area and diameter, etc.

## 3D Cell Count

- Brand new analysis recipe which enables fast, automated detection of cells or other objects in 3D image stacks
- Two presets composed of four detection parameters are provided:

### Object Detection

- Intensity Threshold: specifies the minimum

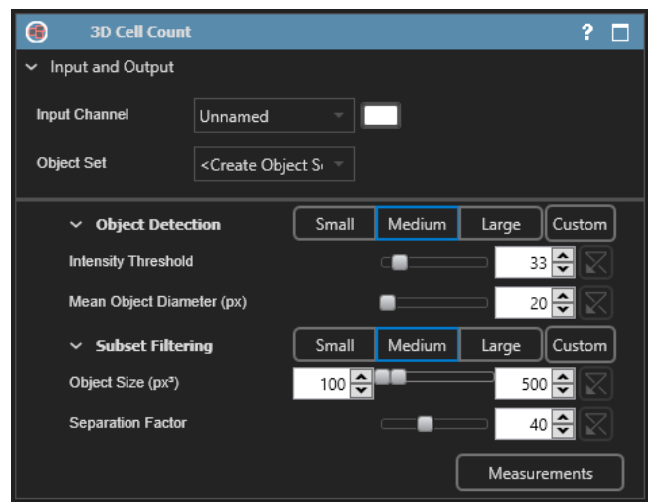


voxel intensity of the objects of interests for detection

- o Mean Object Diameter: specifies the diameter of a typical object on the image

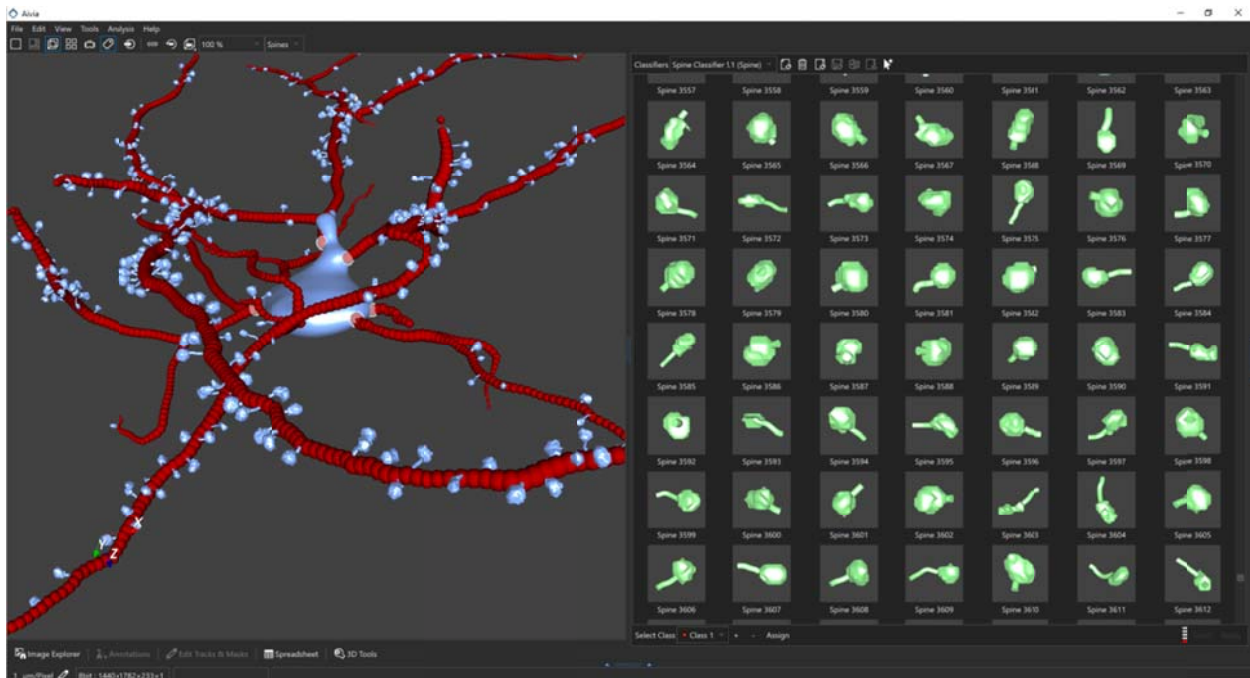
### Subset Filtering

- o Object Size: specifies the range of valid object size (in voxels) for the detection, removing everything that is smaller (or larger) than the specified values
- o Separation Factor: an abstracted value for specifying the aggressiveness to which the watershed function is applied to separate touching objects
- Five standard morphological measurements and five intensity measurements for the input channel is provided along with the total object count
- o Morphological: surface area, volume, convex hull volume and volume ratio
- o Intensity: min, max, mean, standard deviation and total



### 3D Classifier

- Machine learning-enabled classification of 3D spines, dendrite segments and arbors using random forest
- Thumbnails of individual spine, dendrite segment and arbor objects for classification



## Graphical User Interface and Accessibility

- Default dark GUI for Aivia to reduce eye strain when using the software; user can switch to light mode from the options menu
- New object selection modes for selecting whole cell, dendritic arbors, sub-arbors, segments, and individual spines
- Zoom to selected objects in 3D

## Neuron Editor

- Dendrite Pencil – new “enhance trace” option to smooth manual traces and determine dendrite radius automatically
- Point Deletion – streamlined workflow to allow one-click deletion of a point on a dendrite segment with live highlighting of the to-be-deleted point
- Add Spine – new editing tool for adding spines to analysis results; define spine head location by clicking on the 3D volume and the software automatically detects the shape of the spine head and automatically constructs a spine neck to connect the spine to the dendrite
- Add Soma – new editing tool for adding soma on the 3D volume by clicking

## Performance Improvements and Bugfixes

- We have made significant progress in improving surface rendering performance
- Speed improvements to existing tracking and relational analyses applications
- We have fixed 62 bugs to make Aivia more stable and user-friendly (less workarounds needed).

## Demo license and testing

Download Aivia from <https://www.drivetechnologies.com/download> – it includes the new 3D Cell Count recipe as well as 15 other applications – see more here <https://www.drivetechnologies.com/aivia>.

## Resources

**Video tutorials** - <https://www.drivetechnologies.com/tutorials> and via our YouTube channel, <https://www.youtube.com/channel/UCSZnnDkQltndrBfCmfkxyfw>

**How to tutorials (text)** – scroll to the “How To Guides” section on the tutorials page: <https://www.drivetechnologies.com/tutorials>

**Sample data sets** – under the heading of each recipe in the “Recipe Tutorials” sections located on the right side of the tutorials page: <https://www.drivetechnologies.com/tutorials>

## Get Aivia for your lab

Please contact us ([quyent@drivetechnologies.com](mailto:quyent@drivetechnologies.com)) for pricing and licensing options.