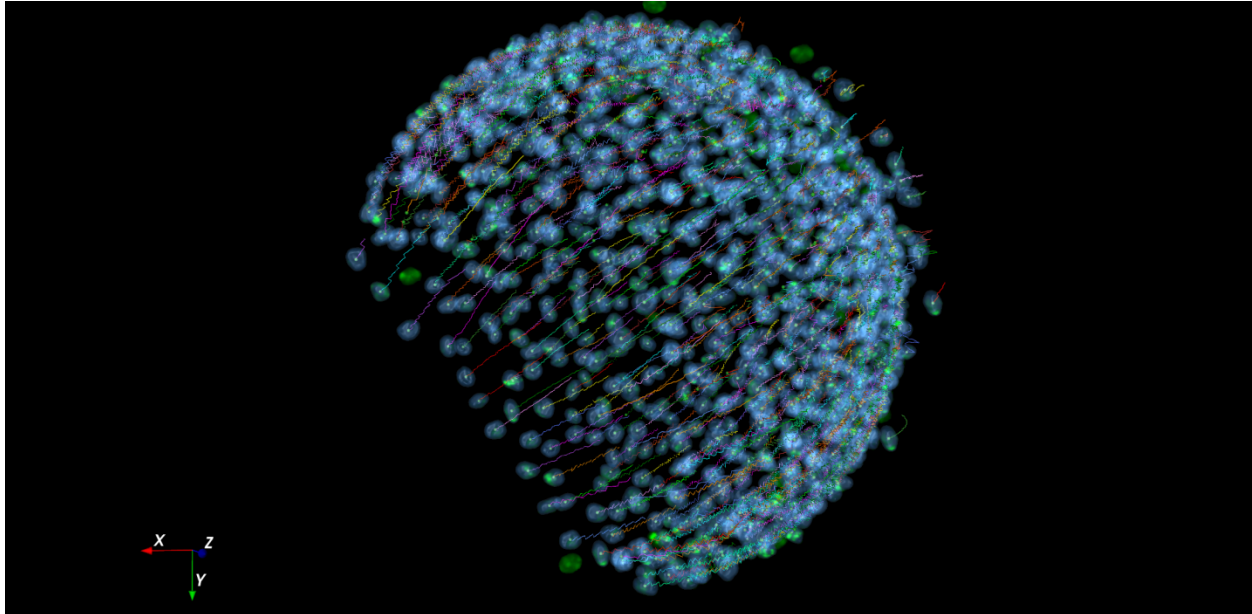


DRVISION TECHNOLOGIES

AIVIA 7

March 1st 2018, Bellevue, WA, USA



OVERVIEW

DRVISION has further expanded its application range, has drastically boosted its surface rendering performance and further enhanced its high-performance volume rendering engine. Aivia 7 introduces 3D Object Tracking and Lineage Tracing to our growing collection of image analysis solutions including new ways of visualizing both the tracks and the objects. An all-new Track and Lineage Editor in Aivia 7 lets you easily edit the analysis results in 2D and 3D datasets. To better support 3D/4D applications we have redesigned Aivia's surface generation and rendering pipeline. Surface rendering in Aivia 7 is 13x faster than in Aivia 6. Also, interacting with 3D objects and adjusting their display is now instantaneous (163x faster than before). We have added native support for HDF5-based files (e.g. H5 and IMS) so that Aivia can use the multi-res multi-block data within those files which enables Aivia to achieve good volume rendering performance without converting (ultimate high performance is only achieved after converting to aivia.tiff). Finally, we have made the aivia.tiff file smaller (lossless compression) and faster compared to Aivia 6.

Summary of Aivia 7 developments:

- *3D Object Tracking* – 17 new features
- *Track and Lineage Editing* – 16 new features
- *Fast Surface Rendering* – 8 new features
- *New Display Settings* – 12 new features

- Additional Files Supported – 7 new features
- Recipe and general Aivia improvements – 15 new features
- 71 bugs fixed

3D Object Tracking

- Brand new analysis recipe using the same algorithm as 3D Object Analysis recipe to detect objects of interest, then tracks their motion.
- Track point matchmaking uses a dual-score system taking into account the motion and morphology of the objects and matched using a fast, hybrid Hungarian algorithm and greedy match approach.
 - Motion score is based on location of the object on current time point relative to its previous trajectory
 - Morphology score is based on similarity in intensity and volume of the object between the current and previous time points.
- Tracking algorithm has optional mode for keeping track of objects that splits in two – and keeps track of the relationship (i.e. lineage) between the mother and daughter objects

Detection

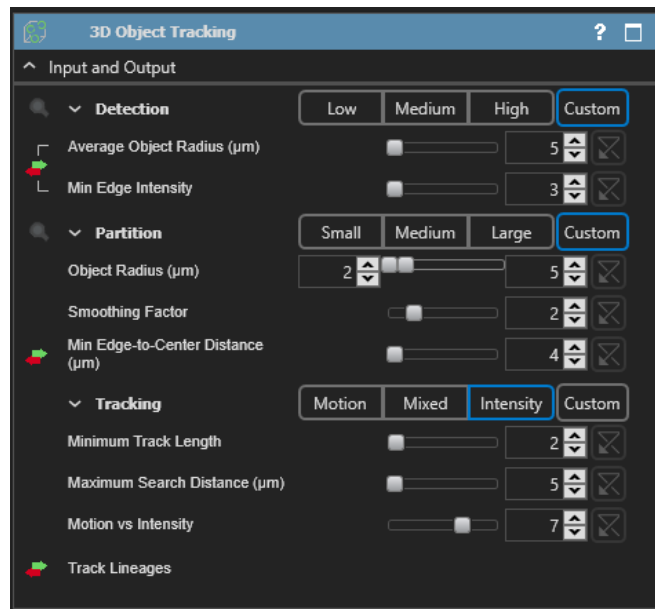
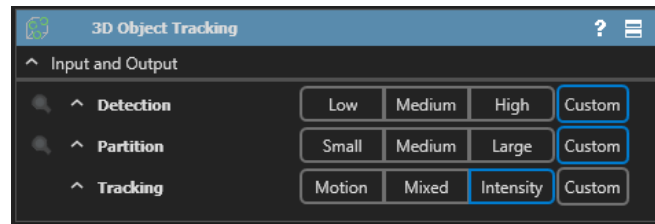
- Average object radius: specifies the average size of objects in image for background removal
- Min edge intensity: defines the minimum voxel intensity to segment on the image

Partition

- Object radius: defines the size range of the segmented objects to be included in the final results based on its radius
- Smoothing factor: specifies the aggressiveness of the smoothing algorithm on the result 3D surfaces
- Min edge-to-center distance: defines the minimum separation distance between the centroid of two touching objects

Tracking

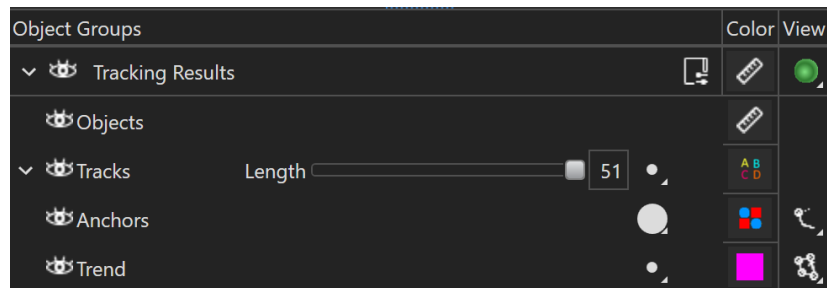
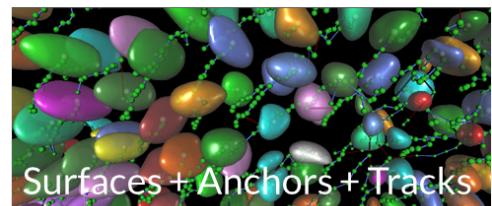
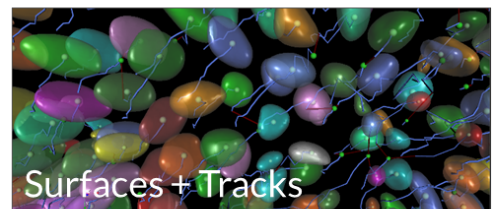
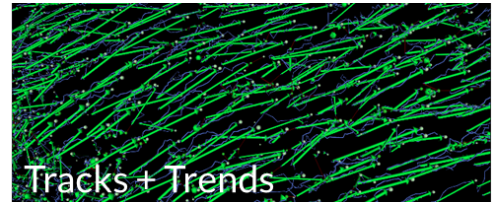
- Minimum track length: specifies the minimum number of time points for a track
- Maximum search distance: specifies the search radius from current time point to next time point for matching detected object track points
- Motion vs intensity: specifies the relative weighting factor between motion score and intensity (morphology) score for track point matchmaking
- Track Lineages: options for keeping track of track relations when an object splits in two
- 21 measurements on the analysis results, including:



- Volume; surface area; surface area-to-volume ratio; average, min, max, total and standard deviation of intensity for 3D surfaces
- Total time; first frame; last frame; average velocity; path length; acceleration magnitude; velocity magnitude; velocity angle; X; Y; Z for tracks
- Current track count and total track count

New Display Settings

- New display settings (see below) for object tracks in 2D and 3D with new ways of visualizing the tracks on the image
 - **Objects:** 2D outlines or 3D surfaces of the detected objects
 - **Tracks:** lines showing the path that the tracked object traveled over time with option to adjust the maximum number of previous time points to show
 - **Anchors:** points indicating the bounding box centroid of the object over time; show only the centroid position at the current time point or for all previous time points
 - **Trends:** vectors indicating the general direction that the object is traveling to
- The track rendering engine has been rewritten from Aivia 6 to make track display load faster and bring additional visualization features shared across 2D and 3D displays
- Color object outlines, surfaces, tracks, anchors and trends by measurements (see above)

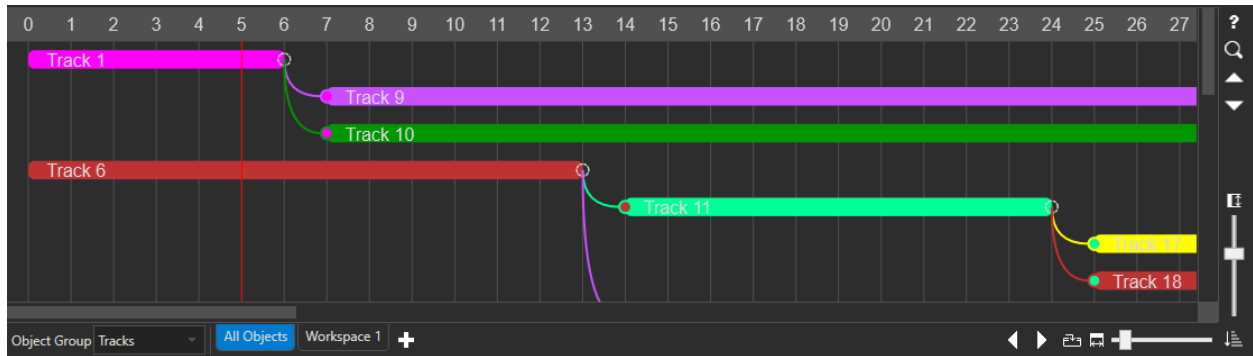


Track and Lineage Editing

Edit tracks and lineages with the brand new Track Editor view

- Workspaces
 - Create multiple workspaces for displaying a subset of object tracks, simplifying the editing process by allowing user to focus on a smaller group of tracks or lineages
- Tracks that are not in the current workspace can be hidden in 2D and 3D view
 - Track sorting
 - Three sorting options to help you organize each workspace
 - Selection

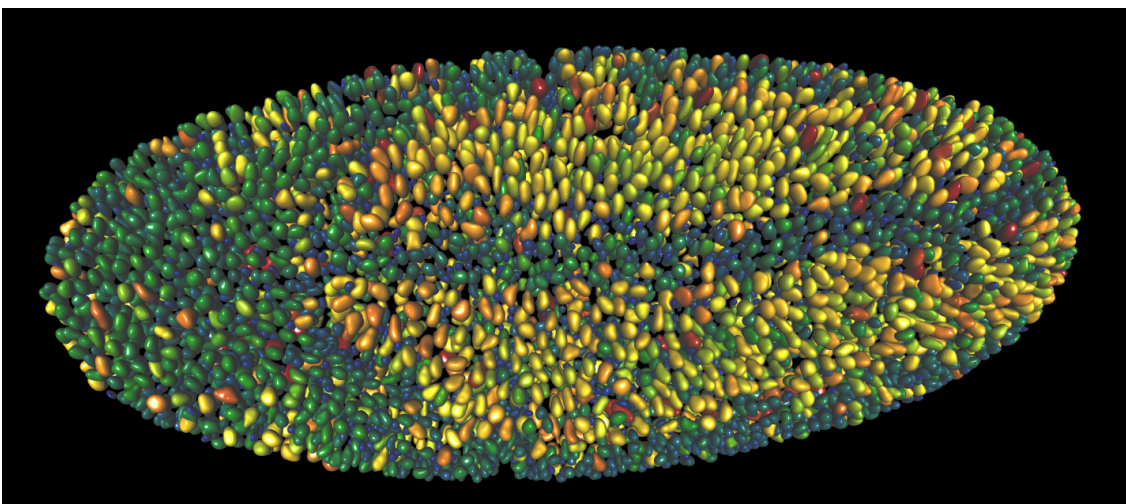
- First frame present
- Measurement



- Multiple section options
- Select tracks from the 2D/3D views, Spreadsheet, Track Editor or ChartsDrag and drop editing
 - Intuitive control scheme that allows all editing actions to be achieved by left-click or opening the context menu with a right click
 - Drag-and-drop track point to empty space to split
 - Drag-and-drop track point to another track brings up options for connecting the tracks or creating lineages
 - Clicking on the lineage connection points brings up options for disconnecting lineages and hiding children tracks for easier editing

Fast Surface Rendering

- Caching of created meshes (so that the second playback of a time series happens much faster than the first one)
- Dedicated thread for the generation of mesh data. Thus, no other Aivia processes compete with the generation of meshes for hardware resources leading to superior mesh creation performance.
- Advanced optimization of mesh data packaging prior to loading to the GPU. This results in faster upload speeds and lower memory usage (on the GPU)
- Typically, Aivia 7 is 13x faster than Aivia 6 (and several other tools currently available) at rendering surface data. This is ideal for exploring surfaces in large, complex datasets.



- **Key performance metrics (comparison vs Aivia 6)**
 - 12x faster rendering of 1st time point
 - 13x faster rendering of full time series (first playback)
 - 28x faster rendering of full time series (second playback)

Aivia.tiff improvements

- Lossless file compression decreasing the converted file size from 2.3x original in Aivia 6 to 1.8x original
- Multi-resolution pyramid now supports downsampling in Z
- Save analysis parameters (from recipes) into the Aivia TIFF file
- Key performance indicators (comparison vs Aivia 6)
 - 1.9x faster offline conversion to Aivia TIFF
 - 1.7x faster full time series volume rendering
 - 1.4x faster aivia.tiff file>open to interactive rendering
 - 1.3x smaller aivia.tiff
 - 1.3x faster online conversion to aivia.tiff

Additional File Type Supported

- Aivia can make direct use of the multi-resolution / multi-block pyramid structures of HDF5 format files for display
 - H5 files – Luxendo / Bruker.
 - IMS files – Bitplane / Bruker / Oxford Instruments
- Native file loading support
 - SLD files – Slidebook (3i)
 - OME-TIFF with companion file – Aurox

Additional features and improvements

- Major improvements to the neuron tracing algorithm and usability of the 3D Neuron Analysis recipe
- Follow 3D cell (zoom mode). Turning it on makes the 3D View follow the selected cell or cell – ideal for track editing and movie making.
- Additional mesh (3D surface) measurements for all 3D recipes
 - Centroid X, Y, Z; Surface Area to Volume Ratio; Bounding box height, width and depth; Sphericity; and Equivalent Spherical Diameter
- Analysis results (i.e. objects) generated using Aivia analysis recipes will retain the analysis parameters used to generate the results
 - Parameters are saved to the Aivia TIFF file
 - Export parameters as an XML file to share the analysis settings with colleagues that has Aivia
- Related object sets generated from the same recipe now output as an object group with ability for user to modify the display of the related object sets together
- We have fixed 71 bugs to make Aivia more stable and user-friendly (less workarounds needed).

Demo license and testing

Download Aivia from <https://www.drivetechnologies.com/demo> – it includes all the features listed above plus all the functionality previously introduced. See more details here <https://www.drivetechnologies.com/aivia>.

Resources

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

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 in the Aivia Wiki homepage:
<https://aivia.wikispaces.com>

Aivia Wiki (reference manual) - <https://aivia.wikispaces.com/>

Get Aivia for your lab

Please contact us (quyent@drivetechnologies.com) for pricing and licensing options.