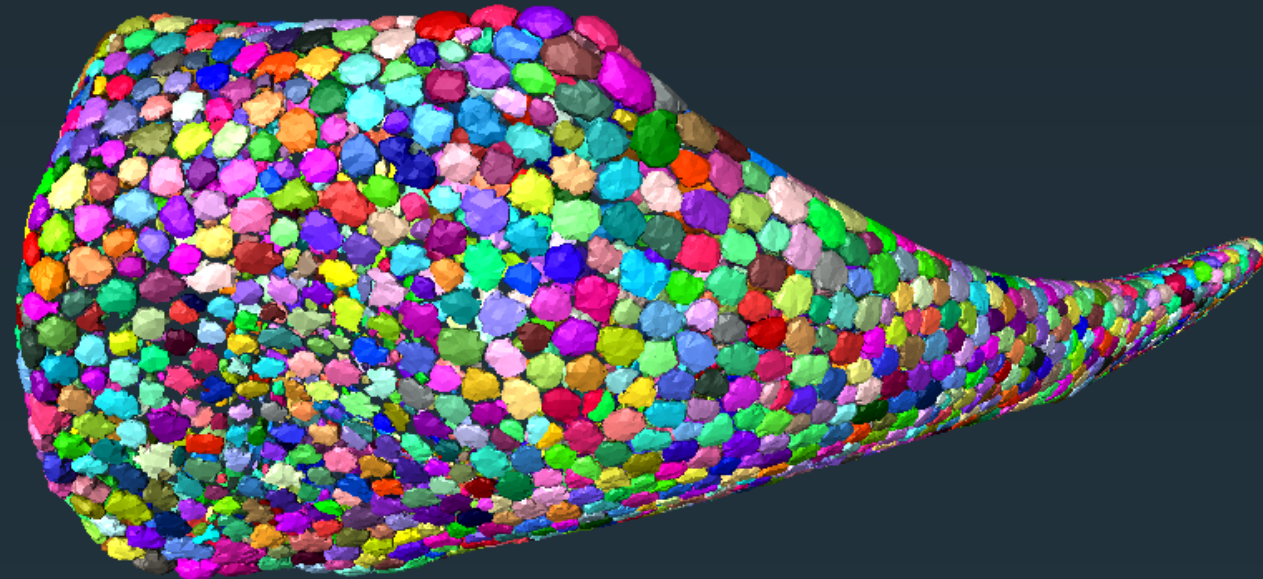


# Object Separation Recipe using the Random Walk Distance Map

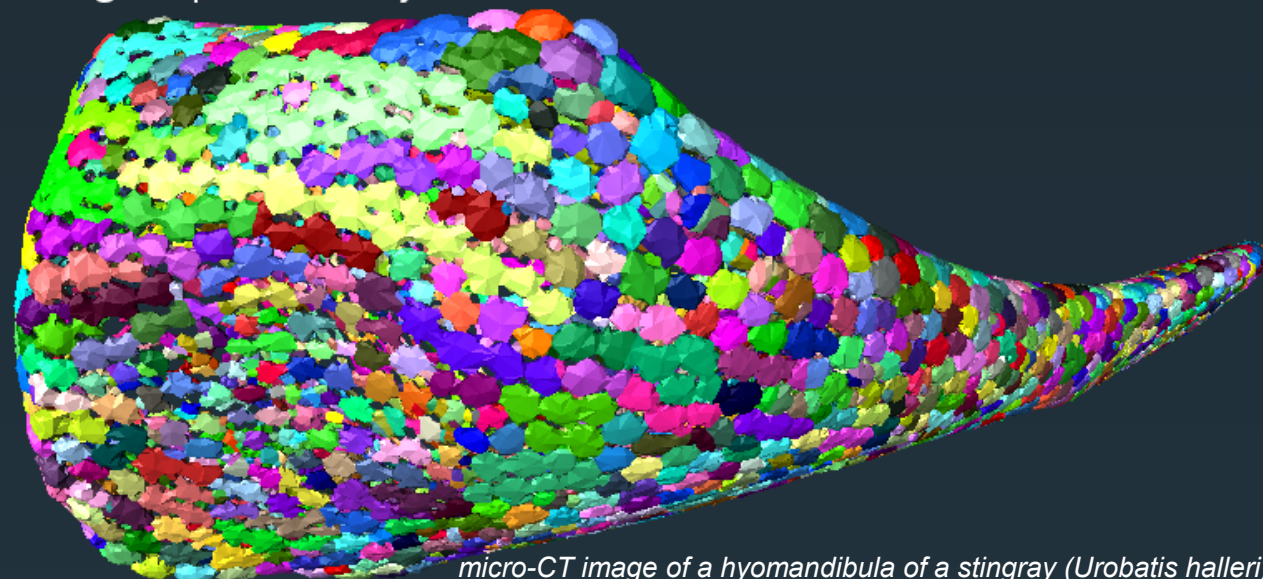
Comparison with classical Separate Object

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Using Random Walk Distance Transform



Using Separate Object



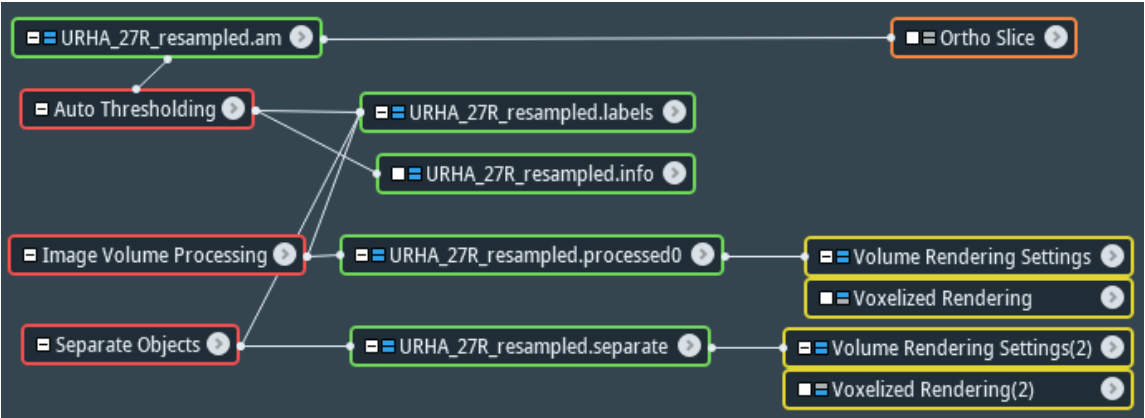
*micro-CT image of a hyomandibula of a stingray (Urobatis halleri)*

*Data courtesy: Mason Dean & Ronald Seidel (MPI Postdam-Golm), David Knoetel (Zuse Institute Berlin)*

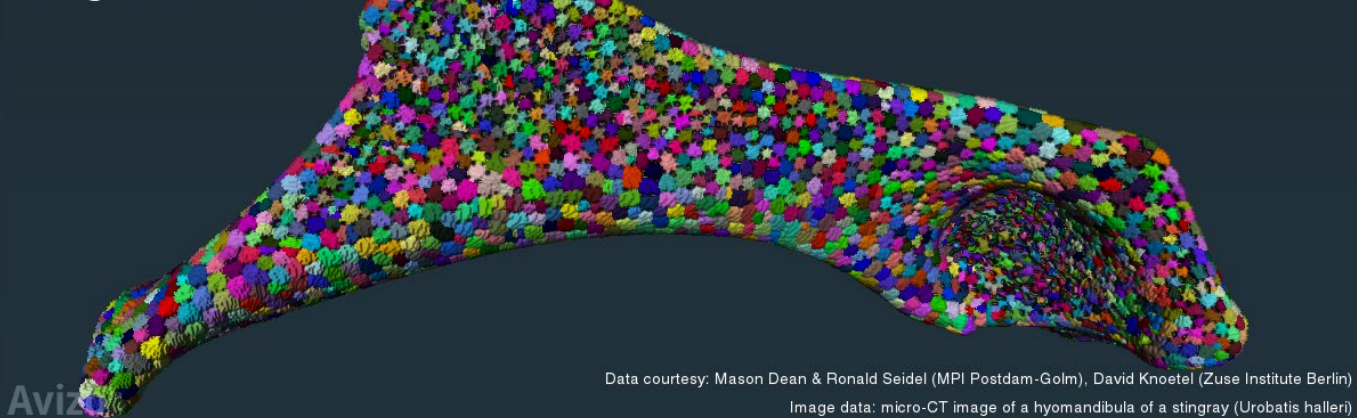
- This Xtra proposes a recipe for Object Separation relying on the Random-Walk Distance Map.
- Why?
  - Object Separation workflows typically rely on a Euclidean or Chamfer Distance map, for the detection of local extrema to identify the center of individual objects, and a watershed transform to identify splitting lines. In Amira-Avizo and PerGeos Software, the Separate Object realizes such a workflow
  - However, such workflows are producing best results on clean segmentation of spherical objects but tend to yield over and/or under-splitting when the segmentation is noisy and when the shape of objects becomes elongated, flat, or non-convex.
- The Random-Walk Distance Map is less sensitive to noise in the segmentation, or to the shape factor of the objects, and has been shown to provide more robust results for object separation in:

Baum, D., Weaver, J., Zlotnikov, I., Knötel, D., Tomholt, L., Dean, M. (2019).  
High-Throughput Segmentation of Tiled Biological Structures using Random Walk Distance Transforms.  
Integrative and comparative biology. Volume 59, Issue 6,  
<https://doi.org/10.1093/icb/icz117>.

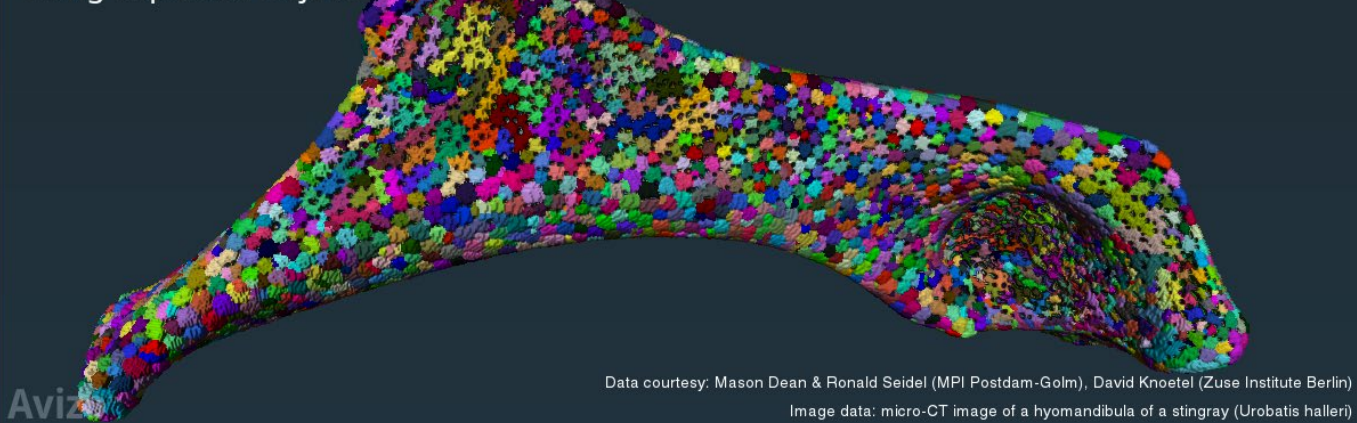
# Overview of the workflow and proposed recipe



Using Random Walk Distance Map



Using Separate Object



# Object Separation Recipe

Objective: Partitioning a binary image of a connected set of objects into individual objects

- Input: binary image of connected objects
- Random-Walk Distance Map
- H-Extrema Watershed
  - *Marker Extent*: criterion to define local maxima, and hence the center of individual objects.
    - Smaller values mean more splits, larger values will result in fewer objects. This parameter is tunable when playing the recipe.
  - The recipe uses the output type: 'line' which generates the separation lines between objects
- AND NOT Image: removes the separating lines from the input binary image
- Labeling: labels individual objects, now that they are separated
- Expand Labels: reconstructs the connection between objects
- Mask: makes sure all background voxels of the original binary image remain background after 'Expand Labels'
- Output: label image of connected objects, split according to the algorithm

