March 9, 2018

CellOrganizer basics

Robert F. Murphy
Ray & Stephanie Lane Professor of Computational Biology and
Professor of Biological Sciences, Biomedical Engineering and Machine Learning
External Senior Fellow, Freiburg Institute for Advanced Studies
Honorary Professor, Faculty of Biology, University of Freiburg, Germany

Carnegie Mellon University
Computational Biology Department

MBioS
An NIH Biomedical Technology Research Center

The main functions (API)

- img2slml
- slml2img

LEARNING A MODEL – IMG2SLML

img2slml

- Main inputs
  - a collection of OME-TIFF files
  - an options block
  - an output path
- Main outputs
  - parameterizations of each cell (through file system)
  - model

Image requirements

- Images to be used to learn models are in OME-TIFF format
- All channels for each field are in the same file
- The resolution (microns per pixel or voxel) must be specified

Cell segmentation

- Each file must contain
  - A single cell (no need for segmentation)
    - or
  - A channel that contains a mask to isolate one cell
    - or
  - Regions of interest, one per cell

2D Model Classes and Types

Class	Type	Depends on	Produces
vesicle	gmm	nuclear_membrane & cell_membrane	vesicle
nuclear_membrane	medial_axis		nuclear_membrane
cell_membrane	ratio	nuclear_membrane	cell_membrane
framework	diffeomorphic		cell_membrane, nuclear_membrane

3D Model classes and types

Class	Type	Depends on	Produces
vesicle	gmm	nuclear_membrane & cell_membrane	vesicle
nuclear_membrane	cylindrical_surface		nuclear_membrane
cell_membrane	ratio	nuclear_membrane	cell_membrane
framework	diffeomorphic		cell_membrane, nuclear_membrane
network	microtubule_growth	nuclear_membrane & cell_membrane	microtubule
protein_distribution	morphing		protein spatial distribution
standardized_voxels	standardized_map_half-ellipsoid		
csgo	half-ellipsoid		

Options block

- Model class and type
- Model type specific settings
- Output settings (name, id, filename)
- Helper options (debug, verbose, etc.)

SYNTHESIZING AN IMAGE – SLML2IMG2

slml2img

- Main inputs
  - a model file
  - an options block
  - an output path
- Main outputs − one or more
  - Images
  - SBML spatial geometry
  - Blender object files