Senior Project, Spring 2019

Interactive FIJI/ImageJ2 Plugin
for Biological Image Segmentation
Case Study: Wound Healing Analysis

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Wound Healing Analysis

- *Cell migration analysis for drug research, cancerous cell analysis, etc.*
- A layer of grown cells is cut, and a cell imaging system is used to produce a series of images of the healing "wound".
- To capture subtle properties of the process, large amounts of images must be taken for analysis, but segmenting them by hand is infeasible.
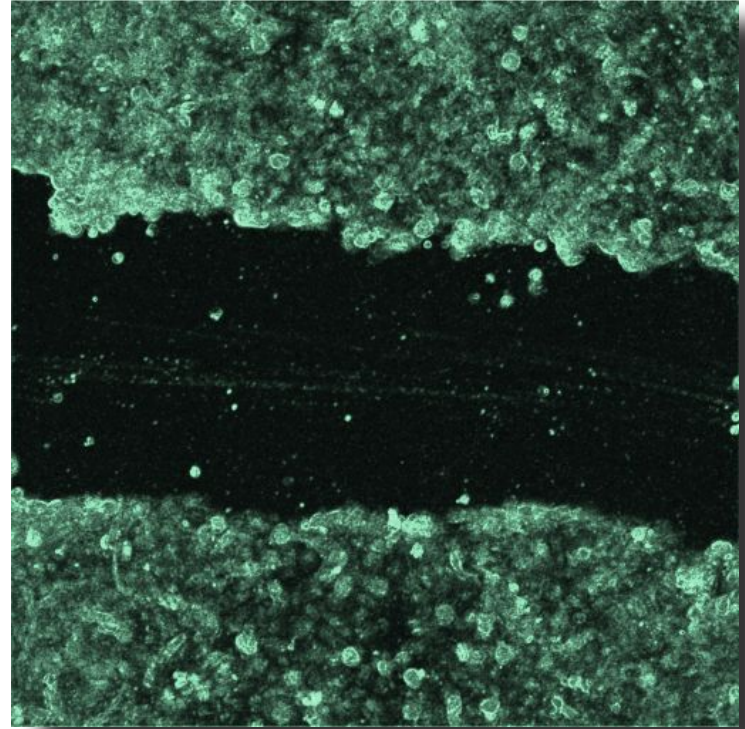

A chunk of a dataset, processed-for-display
(cell monolayer, empty space)
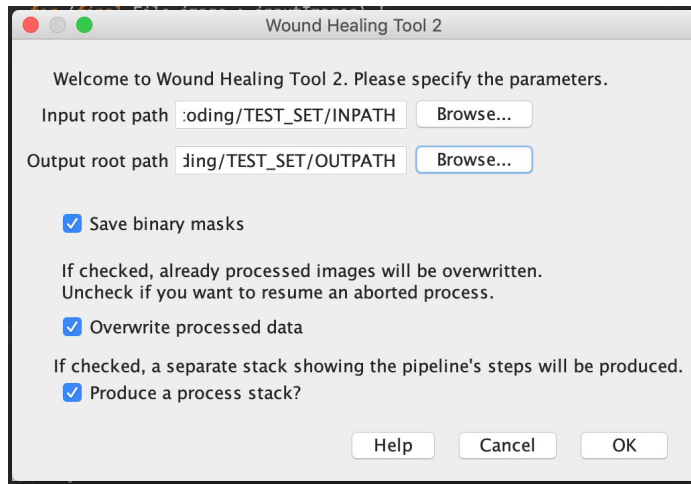
What is being developed

Plugin for FIJI/ImageJ2:

- Image Segmentation Module
- Interactive Pipeline Selection Framework
  - Graph UI - build your own pipeline
  - Pipeline performance and accuracy testing
- Quantification Module (minor milestone)
  - Analysis of wound healing velocity
  - Statistical representation of the resulting time series
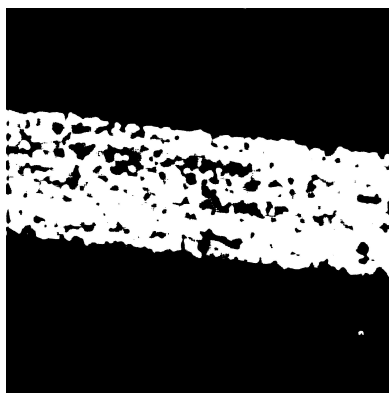

Image Segmentation
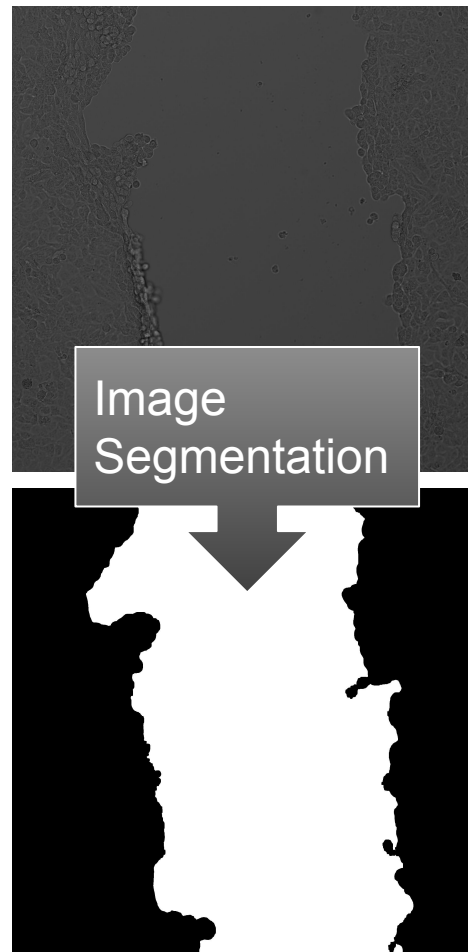
Work Done in Fall 2019

- Image processing module with all core functionality

- Functional and user-friendly UI that allows for different dataset loading schemes

Wound Healing Tool 2

Welcome to Wound Healing Tool 2. Please specify the parameters.

Input root path `:oding/TEST_SET/INPATH` [Browse...]

Output root path `ding/TEST_SET/OUTPATH` [Browse...]

☑ Save binary masks

If checked, already processed images will be overwritten.
Uncheck if you want to resume an aborted process.
☑ Overwrite processed data

If checked, a separate stack showing the pipeline's steps will be produced.
☑ Produce a process stack?

[Help] [Cancel] [OK]

Initial image → Interim state algorithm result → Current algorithm result

Graph-based Pipeline Selection UI/UX

- Easy-to-use tool that tremendously extends the possibilities of the plugin

- The branching nature of graph-like pipelining will allow for **visual construction** of various processing pipelines

- Will allow for **comparison of different combinations of operations** based on metrics like computational costs or accuracy
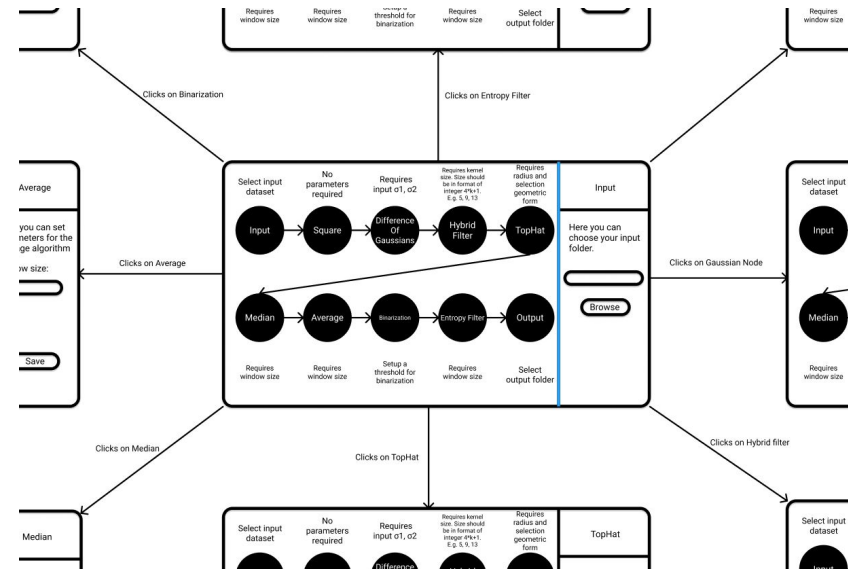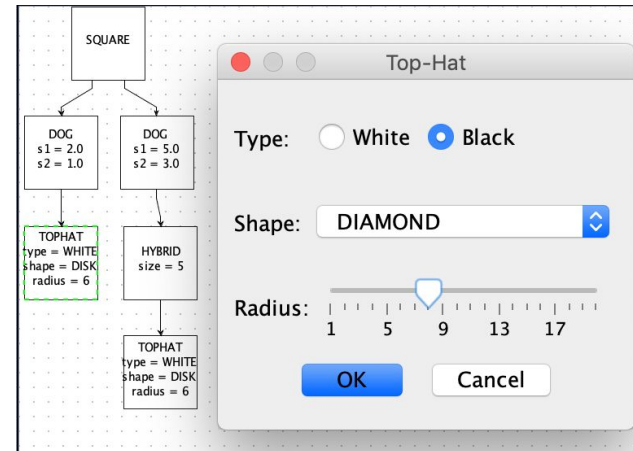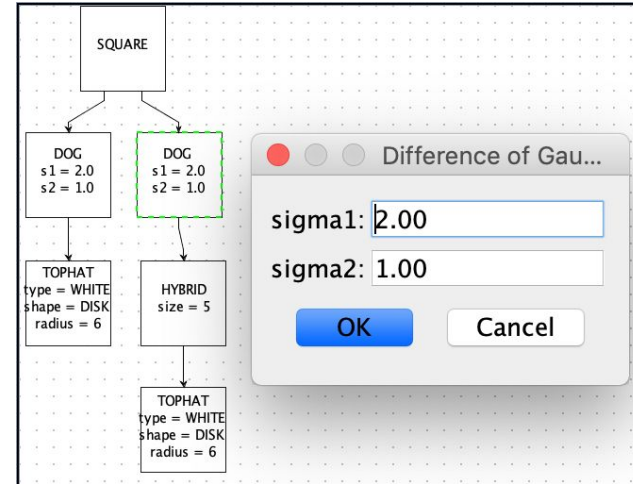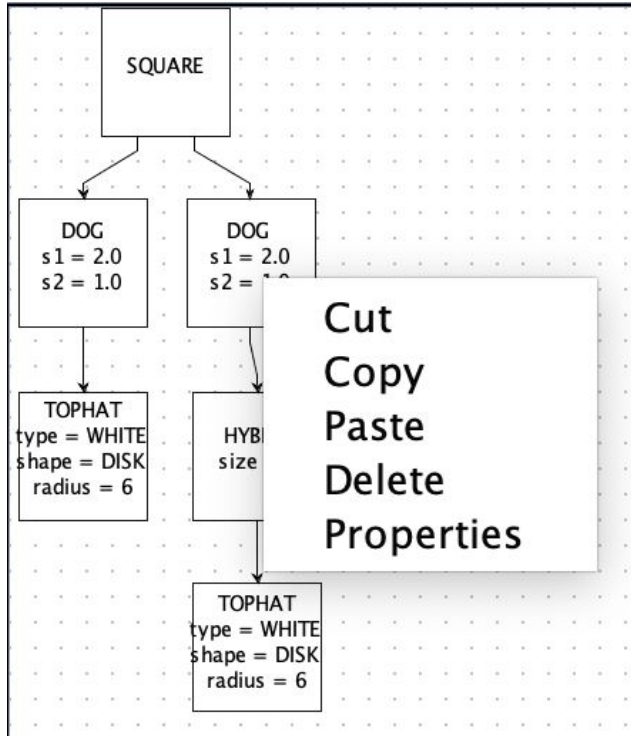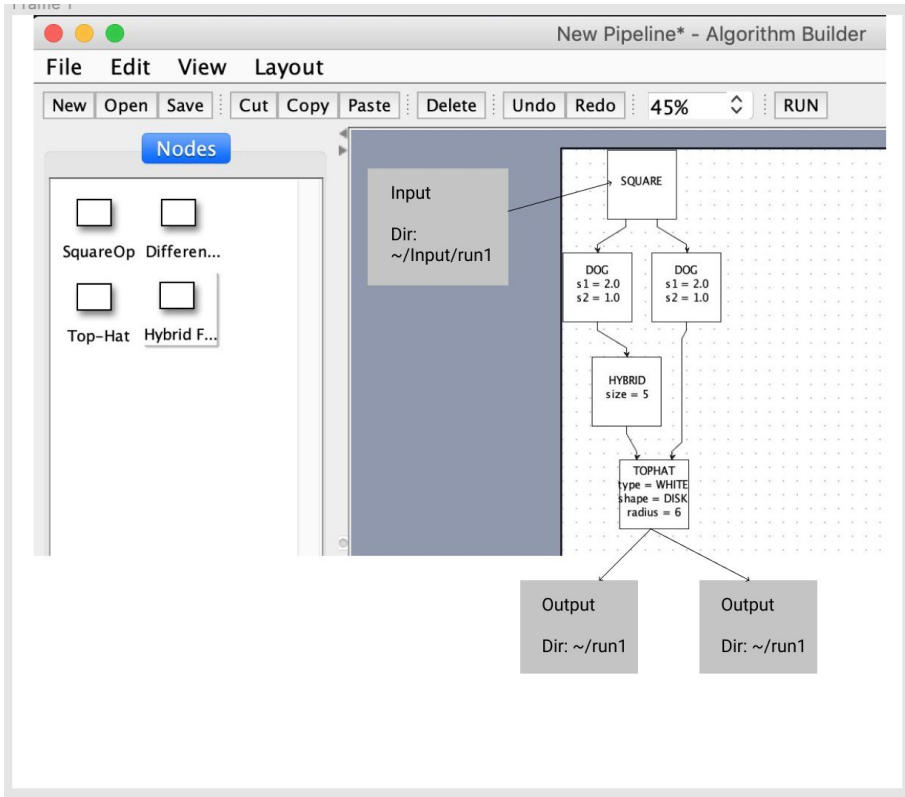
To-Do This Semester

- **Interactive Graph-based pipeline selection**

- Visual graph editor via Swing and JGraphX

- Nodes are tunable operations, edges are data flow

- Each path of the directed acyclic graph will represent **a single algorithmic pipeline**
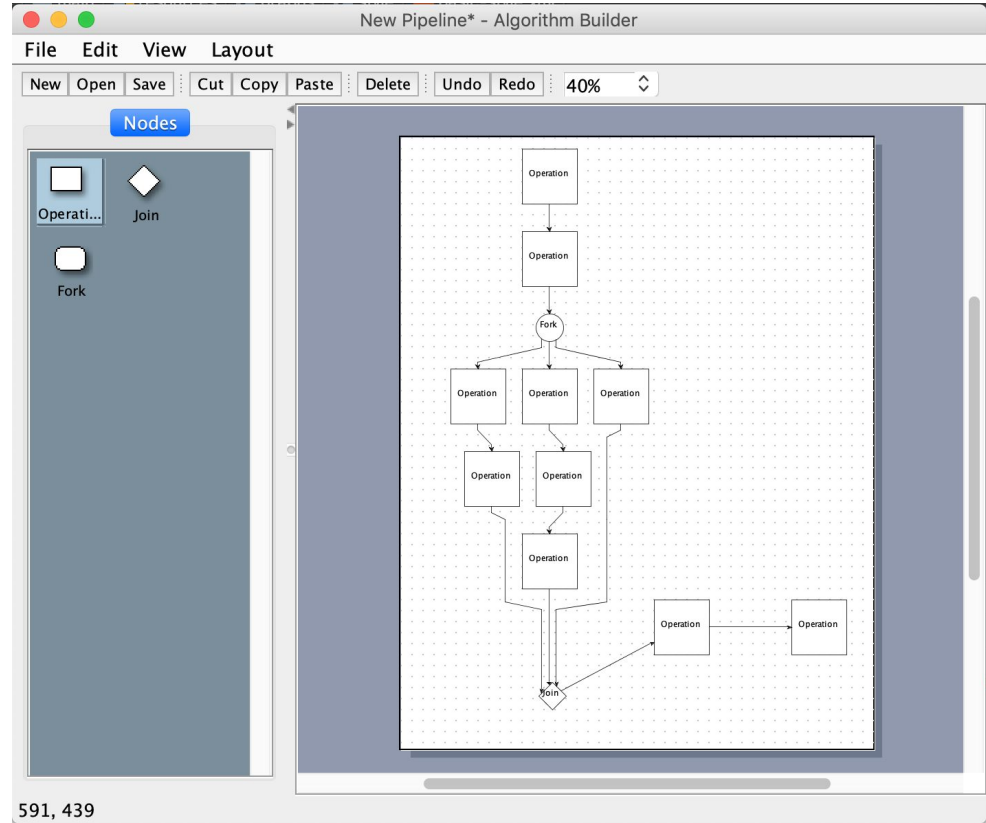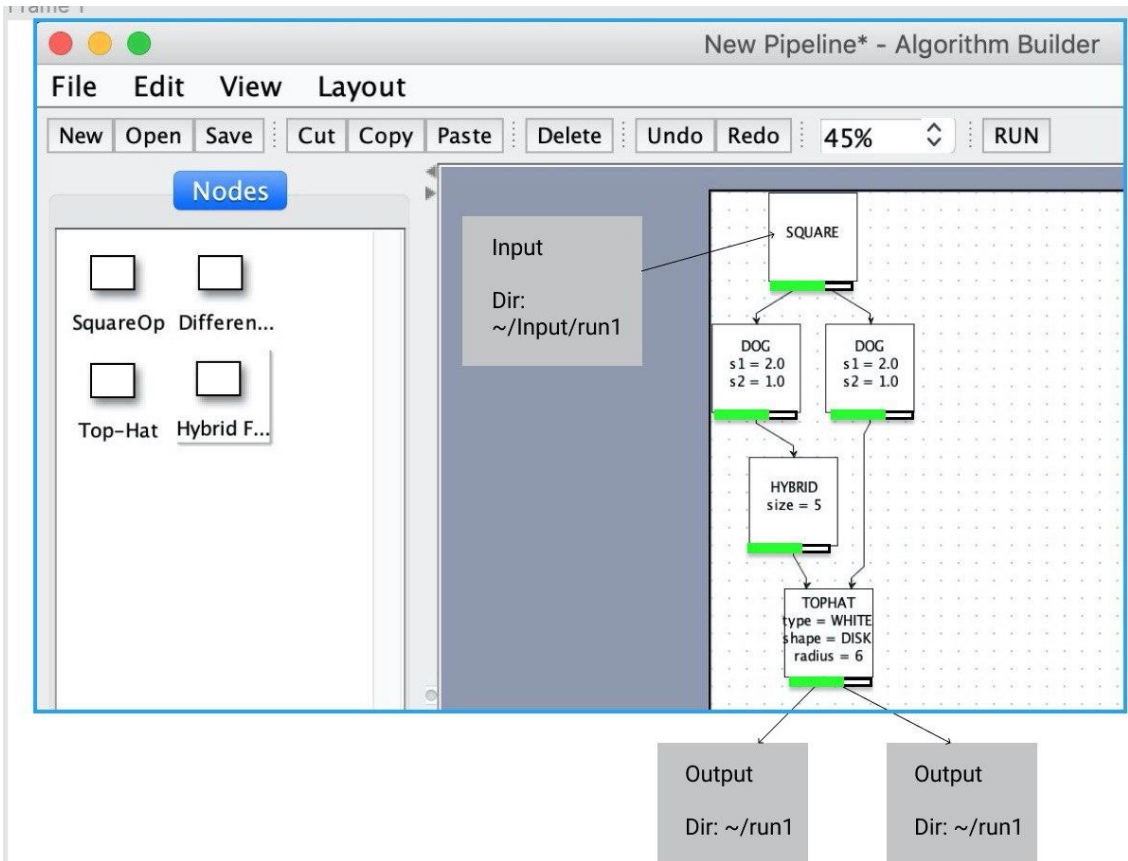
Each node is an operation with customizable parameters
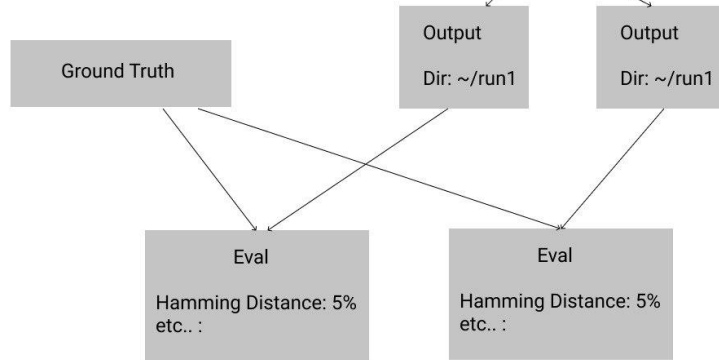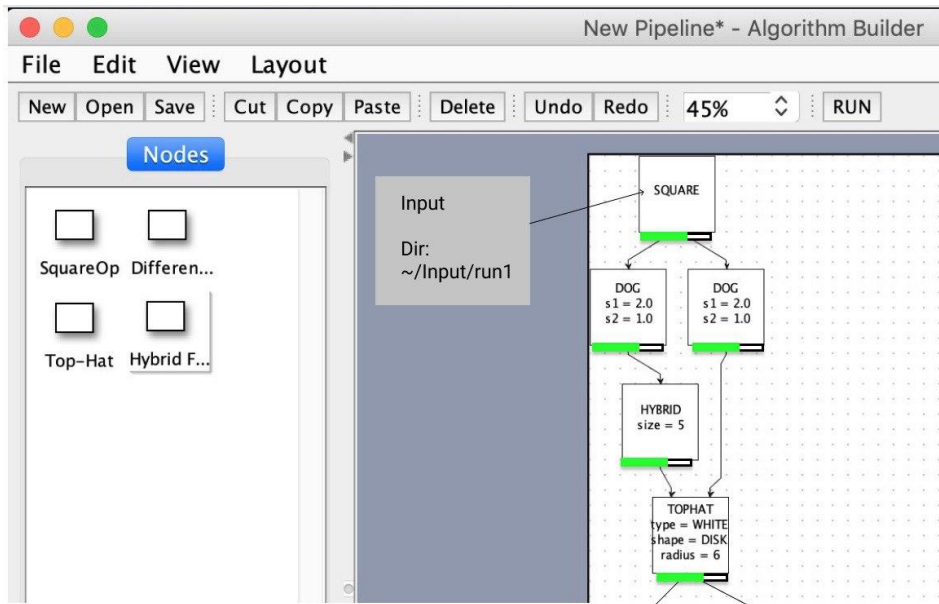
Desired Workflow

Step 1:

Construct the graph, specify the parameters, click "RUN"

The graph will be validated and its information will be transferred to the plugin

Step 2:

The image processing module parses the graph and performs the processing accordingly.

Step 3:

If needed, performance evaluation (Hamming Distance of binary masks) could be done with a ground-truth dataset

Thank you!