BehaviorToolbox

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This is a Quarto website.

To learn more about Quarto websites visit https://quarto.org/docs/websites.

Part I

Introduction

Part II

Image Processing

2 Contrast and Brightness Adjustment

These two filters are implemented with a single linear transform taking parameters "alpha" (α) and "beta" (β). Pixel values are multiplied by α to adjust contrast, then have β added to adjust brightness:

$$g(x) = \alpha f(x) + \beta$$

In effect the magnitude of α corresponds to the amount of contrast and the magnitude of β corresponds to the amount of brightness.

3 Image Sharpening

4 Contrast Limited Adaptive Histogram Equalization

5 Bilateral Filter

5.1 References

https://docs.opencv.org/4.x/js_filtering_bilateralFilter.html

https://docs.opencv.org/4.x/d4/d86/group___imgproc___filter.html#ga9d7064d478c95d60003cf839430737ed

https://homepages.inf.ed.ac.uk/rbf/CVonline/LOCAL_COPIES/MANDUCHI1/Bilateral_Filtering.html

Part III

Label Creation

6 Creating Keypoint Labels

7 Creating Mask Labels

Creating mask labels is done through the GrabCut tool. Currently it can be opened through the Tongue Tracking widget.

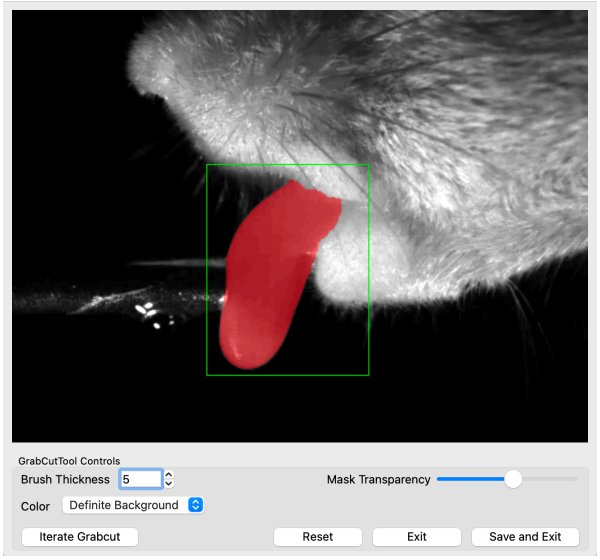

Figure 7.1: GrabCut Tool

7.1 GrabCut Tool Operation

7.1.1 Selecting ROI

To start creating a mask, left click and drag the mouse over the image to form a green rectangle as the region of interest. The objected intended to be masked should be completely within this rectangle. If a mistake is made the reset button returns the tool to the initial state.

The GrabCut algorithm works as such: the algorithm keeps track of the mask and for each iteration, attempts to refine it. In between iterations, the user can tweak the mask to provide feedback to the algorithm, which will be noted through subsequent iterations.

After drawing an ROI the "Iterate Grabcut" button becomes functional. Using it completes one iteration of the GrabCut algorithm. The first usage of this button will show the initial mask created by the algorithm. **Ideally the user should press this button throughout the editing process.**

- Opacity of the displayed mask can be adjusted with the transparency slider

7.1.2 User Feedback

In between iterations the user has access to a drawing bush whose radius can be adjusted. It is used to paint feedback for the GrabCut algorithm, which it will take into account upon pressing the "Iterate Grabcut" button. The brush has four colors:

- "Definite Background": Tells GrabCut the painted area is definitely not part of the mask.
- "Definite Foreground": Tells GrabCut the painted area is definitely part of the mask.
- "Probable Background": Suggests to GrabCut the painted area may not be part of the mask. GrabCut uses this information to create a better mask but may partially/fully disobey it.
- "Probable Foreground": Suggests to GrabCut the painted area is likely part of the mask. GrabCut uses this information to create a better mask but may partially/fully disobey it.

7.1.3 Saving and Exporting

The GrabCut tool may be exited at any time by pressing the "Exit" button. "Save and Exit" will exit the tool and save the mask into the main application and displayed in the media player. All created masks can be saved to disk using the "Save Drawn Masks" button in the Tongue Tracking widget.

Part IV

Behavior Modules

8 Whisker Tracking

8.0.1 Load Whiskers

Table 8.1: Supported Whisker File Formats

File Format	Description
Janelia	Binary format output by janelia whisker tracker
CSV	Each row represents a 2d point (x,y) along the whisker. The points should be arranged from follicle to tip
HDF5	

8.0.2 Load Keypoints

8.0.3 Trace Button

8.0.4 Length Threshold

Whisker segments below the length threshold will be discarded. Length threshold is in units of pixels

8.0.5 Whisker Pad Selection

The whisker pad location in pixel coordinates. Candidate whiskers are ordered so that the base of the whisker is nearest the whisker pad. Whiskers with bases beyond some distance from the whisker pad can also be discarded.

8.0.6 Head Orientation

The head orientation is the direction that the animal's nose is pointing in the image. The head orientation is used to determine the identity of the whiskers in the frame (most posterior whisker is 0, next most posterior is 1, etc).

8.0.7 Number of Whiskers Selection

8.0.8 Export Image and CSV Button

8.0.9 Face Mask

The face mask corresponds to the part of the image belonging to the face. This can be used in several ways

- Whisker bases can be extended to always connect to the face mask. This eliminates jitter that can occur because of fur
- Whisker bases can be clipped to ensure that the whisker does not enter the face mask.

8.0.10 Janelia Settings

8.0.11 Contact Detection

9 Tongue Tracking

The Tongue Tracking widget deals with operations related to the tongue.

9.1 Loading

Tongue masks can be loaded through the sparse HDF5 format or binary images (where white is part of the mask, black is not).

Jaw keypoint tracking can also be loaded through CSV format. The first column should indicate frame number, the next indicating x position and the next y position.

9.2 GrabCut Tool

Documentation on the GrabCut tool can be found here.

Part V

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10 Keypoint Video Labeling

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