GIMP for Image Labeling

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Image labeling Task

- Produce a “label image” that assigns each pixel one or many integer value(s)
- Hand labeling is inherently a painting task, so let’s use a painting program

Viet: “In your experience what is the best image labeling software?”

Xiaodi: “Photoshop.”

Eventualities

- Labeler will want to paint just a few pixels
- Labeler will want to select a region
- Labeler will want to zoom and pan the canvas
- Labeler will want to control blending to see labels overlayed original image

Do we write this functionality ourselves or use functionality already built into paint programs?

GNU Image Manipulation Program

- GNU, FOSS alternative to Adobe Photoshop
- Currently (v2.8) operates only on 8-bit RGB, grayscale, or indexed images
  - Use a color map to map between label integers to RGB values
- Written in C
- Has plugin functionality via C, Scheme, and Python (recent addition)

GIMP Features

- Canvas zoom and pan
- Pencil tool
  - Multiple brushes, variable brush sizes
- Free form and polygonal select tool
- Color wand select tool
- Color select tool
- Fill selection
- Selection morphology operators
- Foreground extraction tool
- Multiple blend modes

Demonstration

2008_000226.jpg

Technical Details

- Works with GIMP v2.8
- Toolbox is written in Python
- Interface built on top of GTK
- Functions written to:
  - Load/save label image from/to MAT array file
  - Load label-to-integer mapping from file
  - Load/save text comment
- Written to interoperate with Nam-Gyu's existing formats
  - Same MAT file format, same mapping format, same error/comment text format

Other Advantages

- Careful introduction of tools can create a bridge from beginner to intermediate
- Keyboard shortcuts allow users to transition from intermediate to expert users
- Image pixel array can possibly be extracted for modification using Python or external calls from Python
- Should be transparently cross-platform*

Disadvantages to GIMP

- Training required or assumes basic understanding of photo manipulation
- Has slightly different paradigms compared to Photoshop
  - Can be frustrating for expert Photoshop users
- Doesn’t support point labeling such as labeling vanishing points*

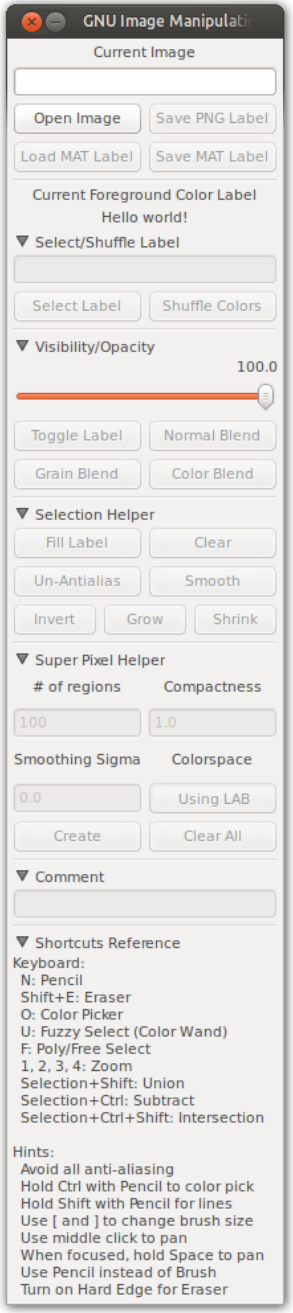
Disadvantages to Toolbox

- NumPy/SciPy are dependencies
  - NumPy is used for MATLAB like array manipulation
  - SciPy is used for .mat file I/O
- Current super pixel (SLIC) implementation is dependent on Scikit-Image
- Some limitations to plugin API
  - Cannot select tools for user
  - Assumes “batch mode”, creation of toolbox is a bit of a hack
  - Python API unfortunately has quite sparse documentation

Workflow

1. Open GIMP 2.8
2. Create a new blank image
3. Open Toolbox > Labeling
4. Open image using toolbox
5. Edit label
6. Save using toolbox

Awkward due to what GIMP considers a plugin



Unfinished Work

- Portability to other operating systems (Windows and Mac OS X)
  - Xiaochen tested it on his Mac OS X system
- Invalid label sanity check (due to color shuffling, etc.)
- Support multiple layers of labels
  - Requires change to MAT format
  - Needed to support Dataset One
- Proof-of-concept for external calls via pixel buffer passing
  - Call MATLAB programs to operate on image, etc.

Unfinished Work

- Tutorial
- Format documentation
- Alternative label formats
- Previous/Next buttons for quick navigation
  - Maybe an image navigator or file list of some sort?
- Configuration file to support default blend mode, etc.

Github Repository

https://github.com/vietjtnguyen/gimp-image-labeling-toolbox