

## INTRODUCTION

Dermoscopy is a non-invasive diagnostic technique for the *in vivo* observation of pigmented skin lesions. Currently, there is a great interest in the development of computer-aided diagnosis systems that can assist the clinical evaluation of dermatologists [1, 2].

The development and validation of these algorithms requires a reliable ground truth database of manually segmented images.

As the ground truth databases have to be created by expert dermatologists, there is a need for the development of annotation tools that could make this task easier and practicable for dermatologists.

In this work, we present a new annotation tool for manual segmentation of dermoscopic images.

## ANNOTATION TOOL DESCRIPTION

This interface allows performing the manual segmentation of dermoscopic images and storing the result of segmentation. Its main tools are:

- Image upload and display;
- Manual segmentation (of the lesion or other regions of interest);
- Region labeling;
- Boundary reshaping;
- *A posteriori* boundary edition;
- Multi-user ground truth annotation and segmentation comparison;
- Storage of segmented image.

The interface was implemented in a MATLAB® environment (7.9.0 R2009b).

## CONCLUSION

A new annotation tool for manual segmentation of dermoscopic images is presented.

This tool allows building up a ground truth database with the manual segmentations both of pigmented skin lesions and of other regions of interest.

As future work some experimental results will be performed in order to validate this tool, including: the analyze of the required times, user satisfaction, and also the comparison of our tool with other annotation tools beyond the ImageJ.

## ACKNOWLEDGMENTS

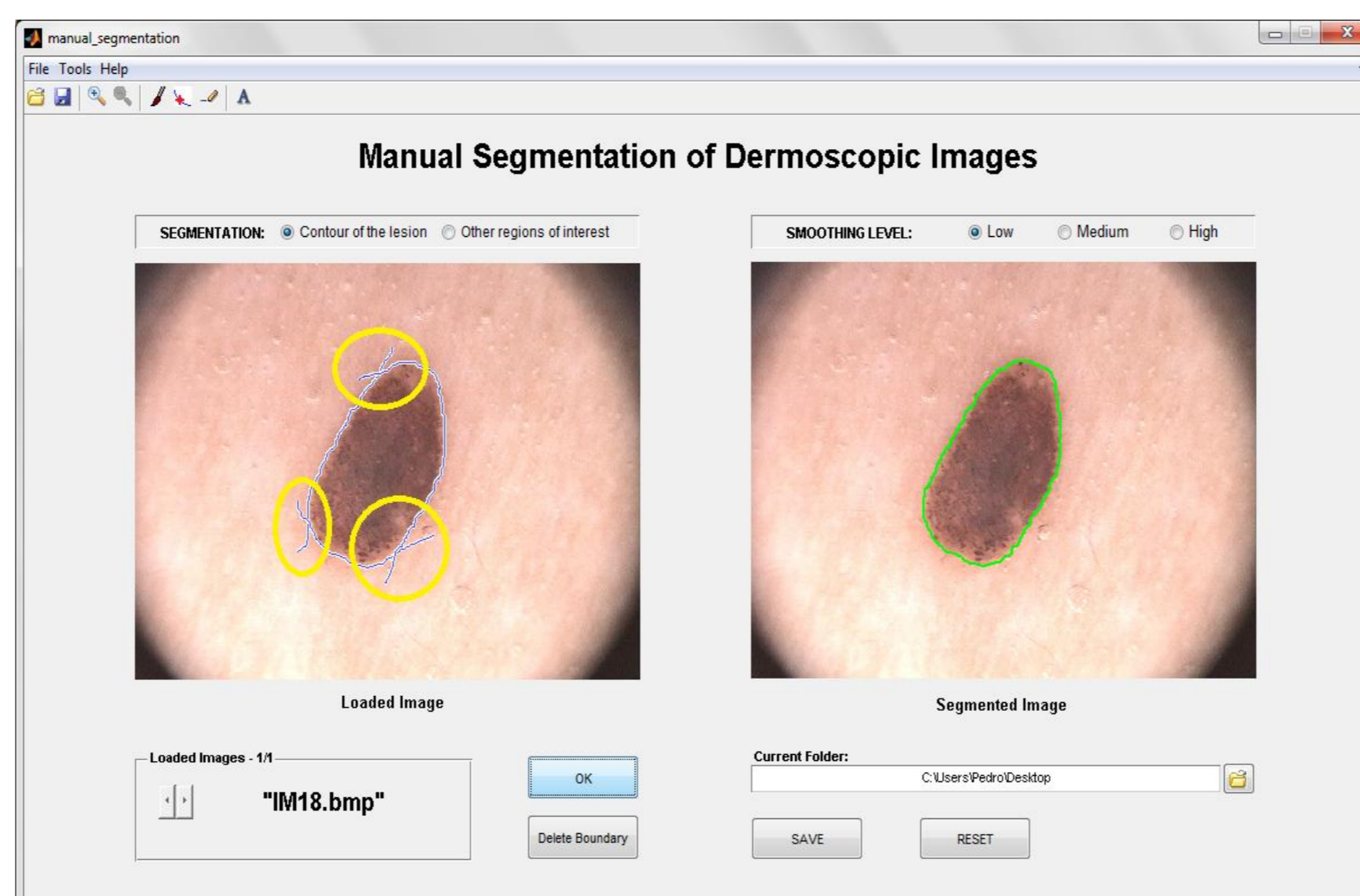
The authors would like to thank Fundação para a Ciência e Tecnologia who partially funded this research through the project ADDI (reference PTDC/SAU-BEB/103471/2008), and to the other members of the project team.

## REFERENCES

- [1] G. Argenziano *et al.*, "Dermoscopy, an interactive atlas." EDRA Medical Publishing, 2000. [ONLINE]. Available at: <http://www.dermoscopy.org>.
- [2] M. Silveira *et al.*, "Comparison of segmentation methods for melanoma diagnosis in dermoscopy images," IEEE Journal of Selected Topics in Signal Processing, vol. 3, pp. 35-45, 2009.

## MAIN FUNCTIONALITIES OF THE ANNOTATION TOOL

### Manual segmentation

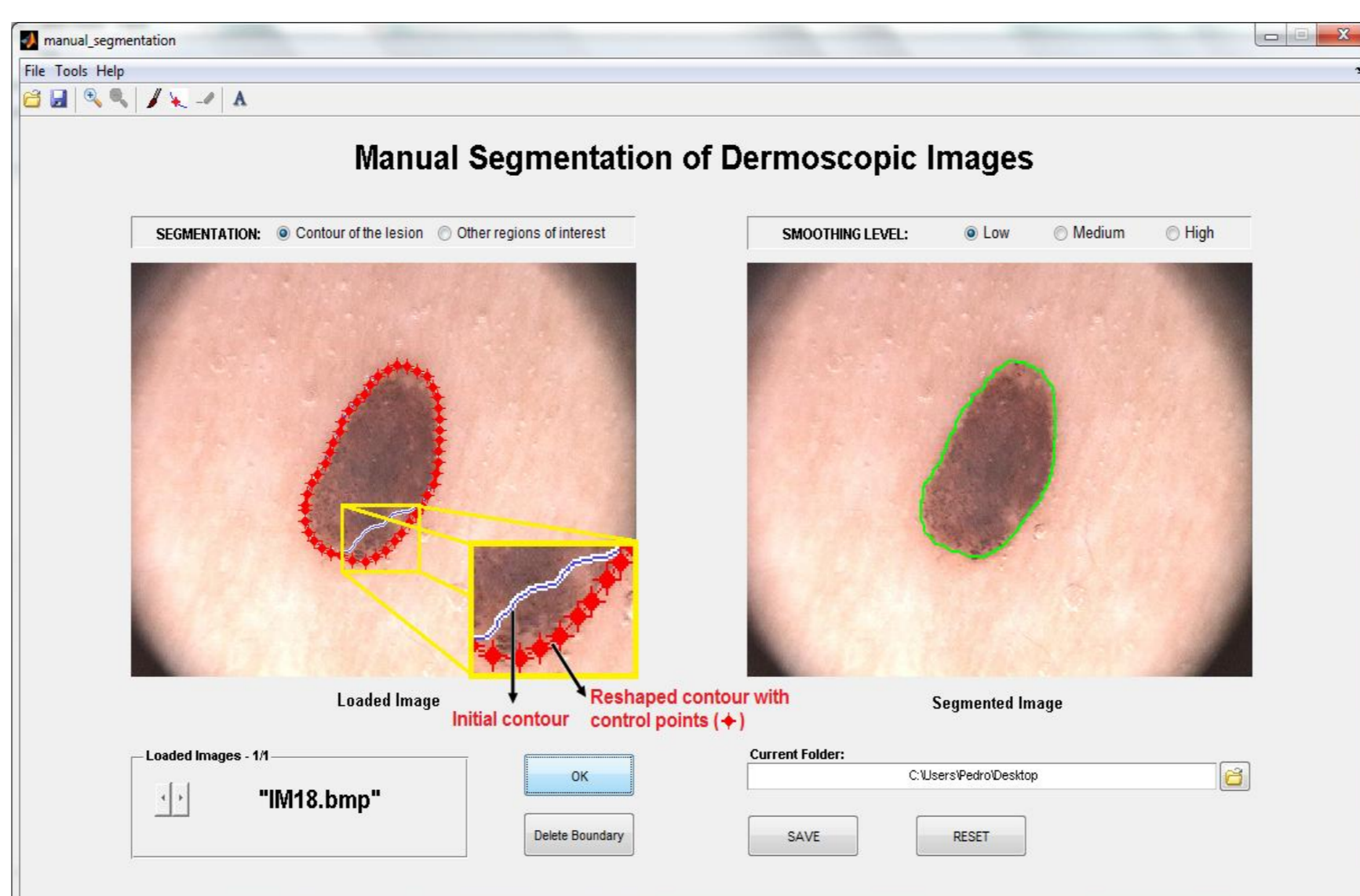


This tool allows drawing a freehand region of interest on the loaded image. When the user interrupts the contour drawing, the contour remains open, but there is the possibility of resuming drawing until the user completes and closes the contour.

To obtain the final contour from the initial one (drawn by user), a binary mask of the initial contour is first created, and then a morphological filter is applied to this binary mask.

### Boundary reshaping

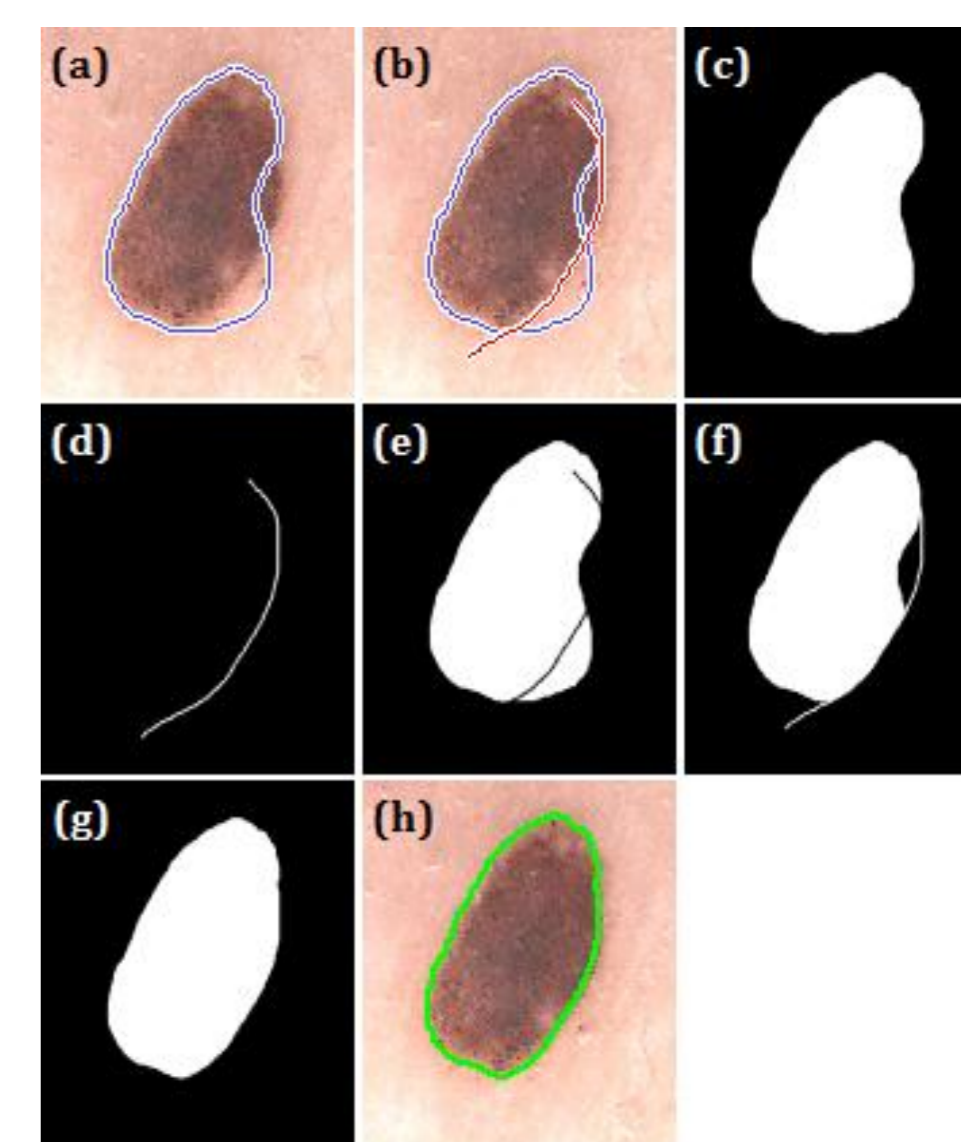
#### Pointwise boundary reshaping



This method should be used to make small adjustments in the contour, because the reshaping is done point-by-point.

The boundary automatically turns red with some control points, from which it is possible to change the shape of the contour (simply click and drag the control points to their new positions).

#### Local boundary reshaping



This method must be used to make great adjustments to the initial contour. It allows to draw a line to define the new shape of the contour. The line must intersect the initial contour at least in two points to form a closed contour.

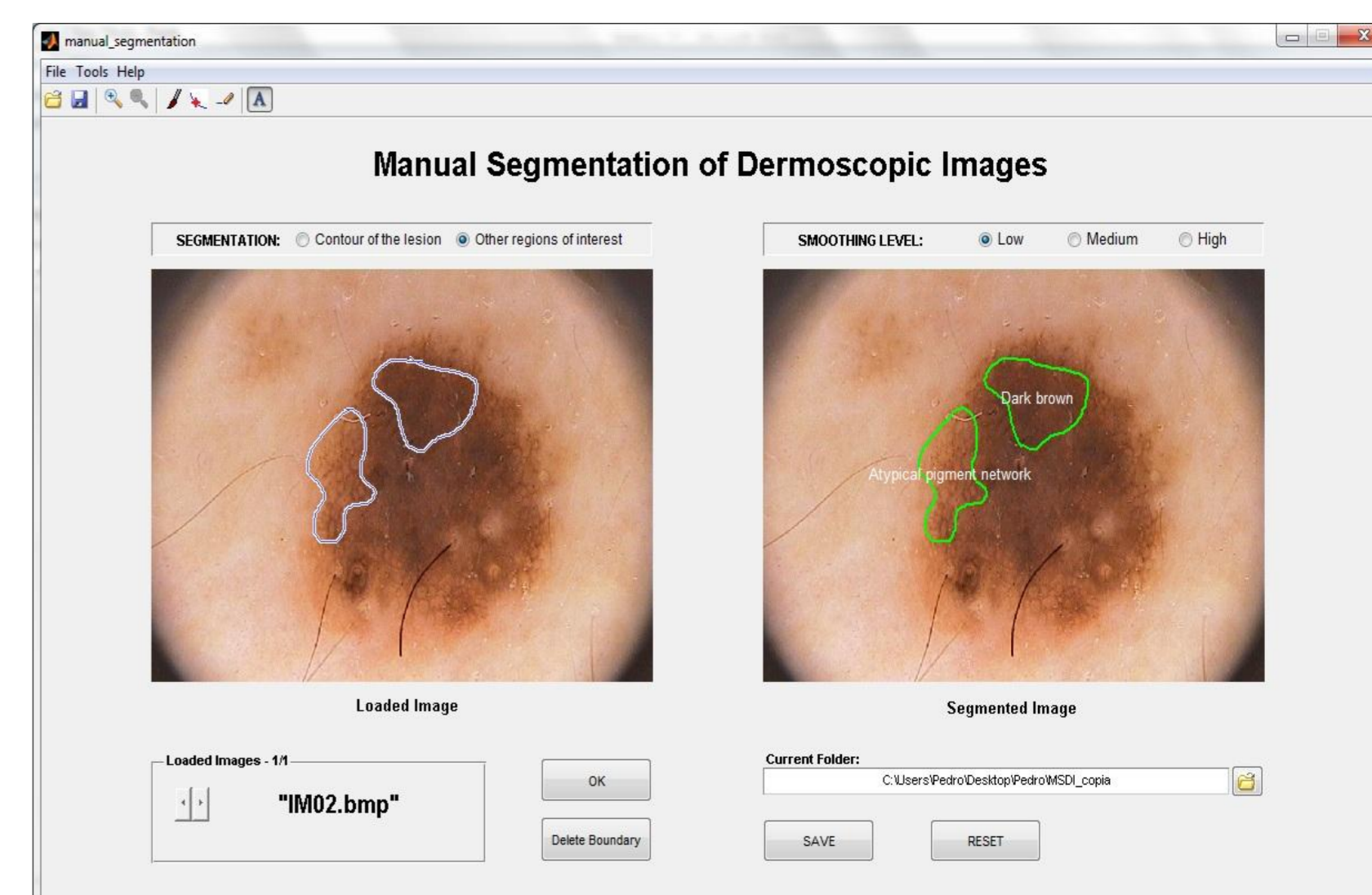
The final contour is obtained through a set of logical, arithmetical, and morphological operations.

### Region labeling (segmentation of other regions of interest)

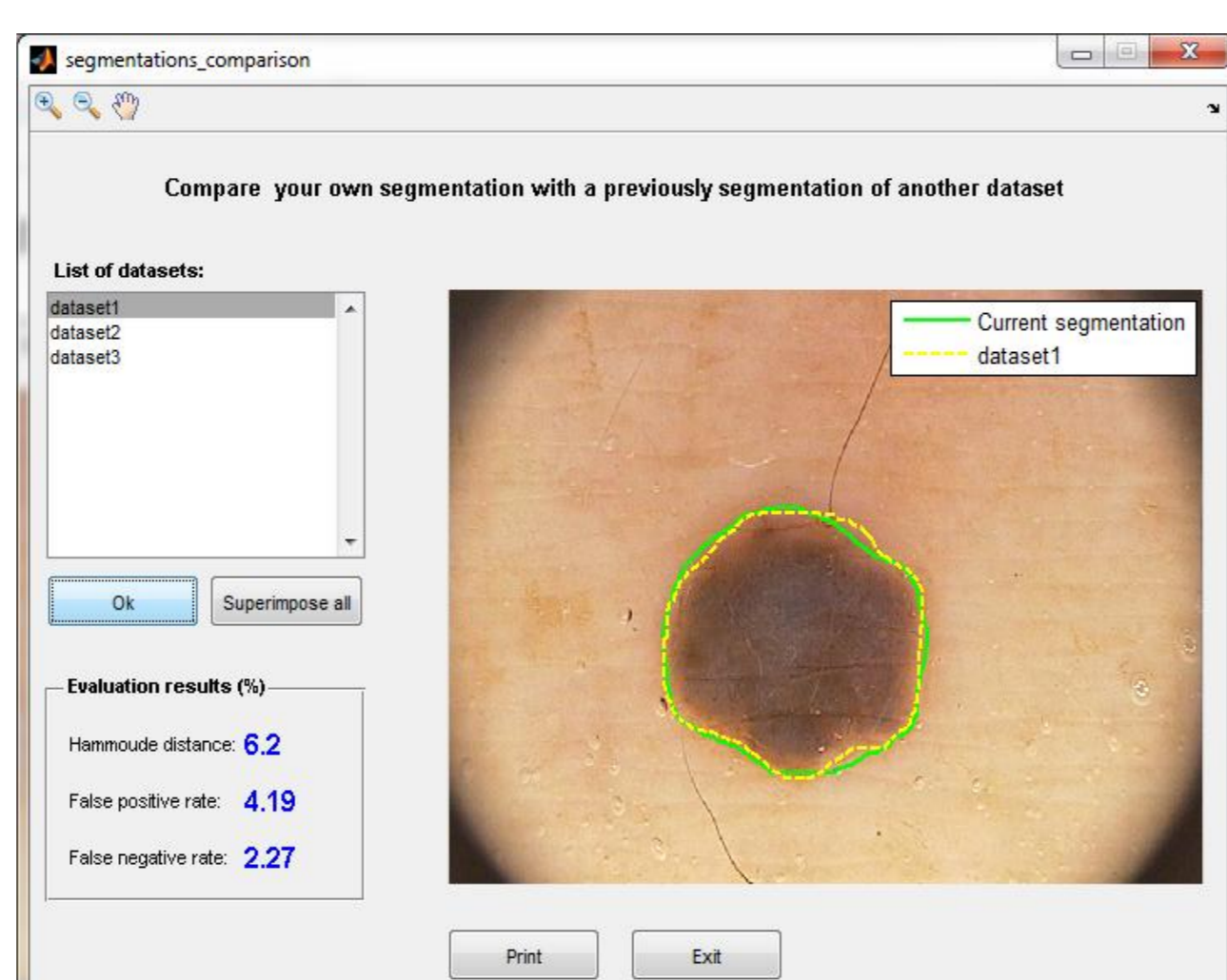
This tool allows segmenting multiple regions on the same image, and labeling each segmented region.

For this purpose, the user should move the pointer over the desired segmented region and click on it.

This produces another window where a number of default labels are available for selection (the main dermoscopic features, and the six typical colors that can be present in a dermoscopic lesion).



### Multi-user ground-truth annotation and segmentation comparison



Each user can set up and build his own manually segmented images dataset. Thus, with this tool it is possible to collect annotations and segmentations of the same image by different users.

Moreover, it is possible to make the comparison between segmentations of different users for the same image. To accomplish this purpose visual and quantitative comparisons are both presented.