

MIB 2: an updated version of the open-source platform for segmentation and analysis of multidimensional datasets

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Understanding the structure - function relationship of cells and cell organelles in their natural context requires multidimensional imaging techniques. As the performance and access to such techniques are improving, the amounts of collected data are growing exponentially posing a question about processing, visualization, and analysis of these large datasets. Quite often the detailed analysis of data is impossible without segmentation of objects of interest. Usually the segmentation is the most time consuming and challenging part of the image analysis routine.

To address this problem we developed a free user-friendly software package (Microscopy Image Browser¹, MIB, <http://mib.helsinki.fi>) for effective segmentation and image processing of multidimensional datasets from both light and electron microscopy. Use of MIB improves and facilitates the full utilization of acquired data and enables quantitative analysis of morphological features. MIB is available for major operation systems as standalone or Matlab-compatible version. When used with Matlab, MIB can be used as a platform for implementation of own image processing and analysis routines.

Here, we present an updated version of MIB, which was completely rewritten in order to improve its functionality, expandability and performance. MIB 2 combines stability and ease of use with an interactive approach for image segmentation (Fig. 1) by providing various manual and advanced semi-automatic workflows (Fig. 2). The well documented API allows to implement own Matlab routines as plugins to customize MIB for specific needs of any research project and complement its basic functionality.

References:

1. I. Belevich, M. Joensuu, D. Kumar, H. Vihinen and E. Jokitalo, Microscopy Image Browser: A platform for segmentation and analysis of multidimensional datasets, PLoS Biology 2016 Jan 4;14(1):e1002340. doi: 10.1371/journal.pbio.1002340.

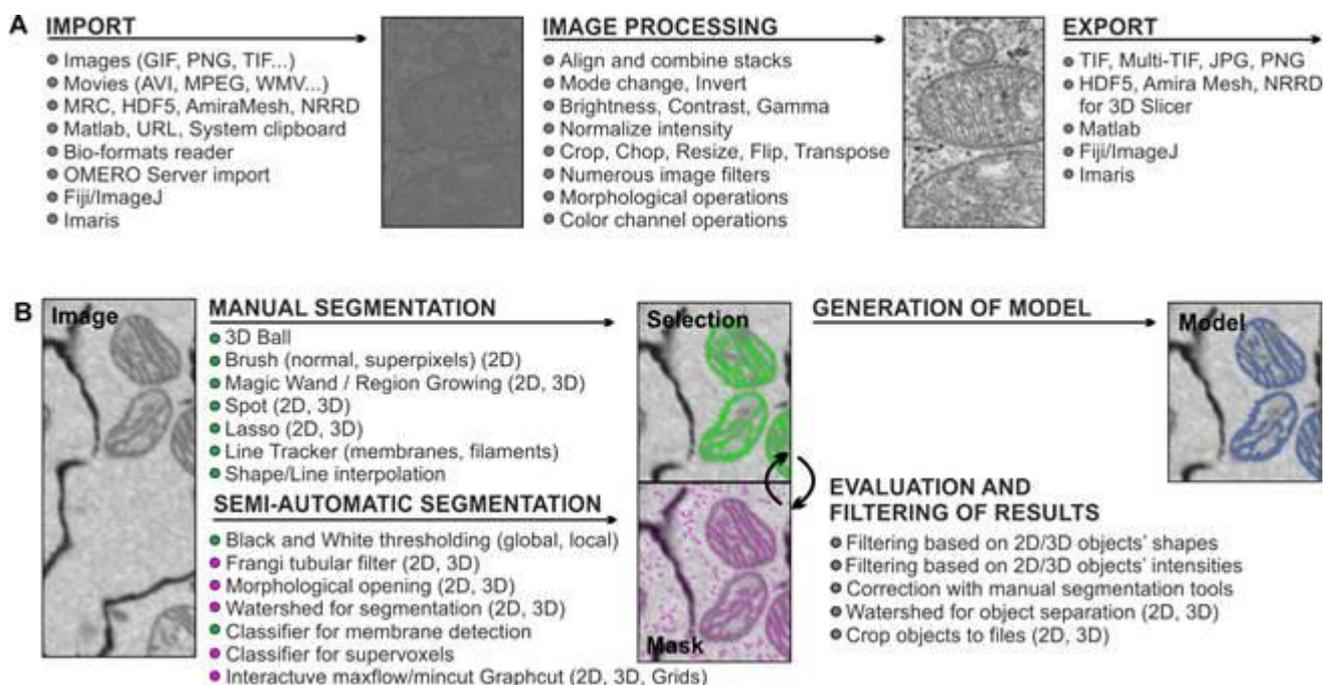
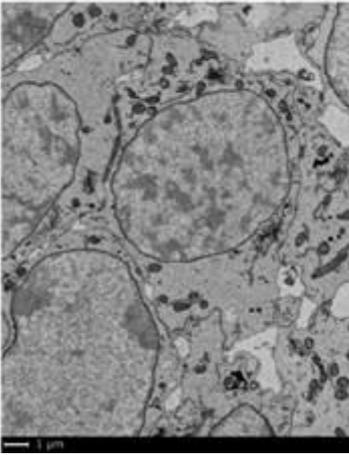
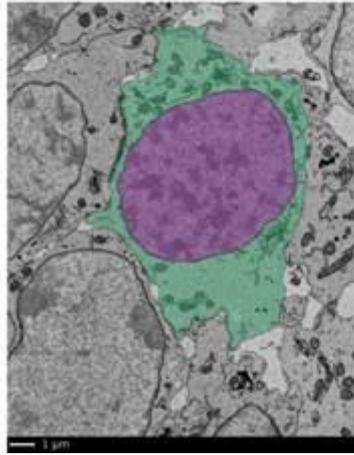


Figure 1. A. Image from multiple sources can be imported to (left column), processed (middle column) and exported from MIB. **B.** Image segmentation workflow usually comprises a combination of several approaches. Datasets can be segmented iteratively using various manual and semiautomatic tools combined with quantification filtering of results in order to generate a model.

A. Raw dataset



B. Segmentation of nucleus and cytoplasm



C. 3D visualization of the resulting model

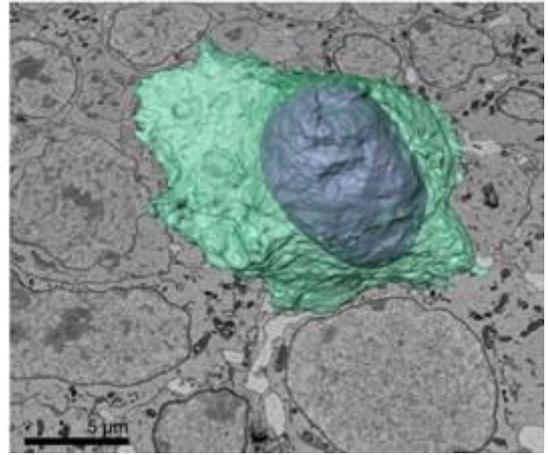


Figure 2. A segmentation of molar teeth cells from embryonic mice. **A.** A slice from 3D dataset taken with serial block face scanning electron microscopy. **B.** A model overlay showing results of image segmentation done in MIB using the Graphcut tool. Use of the semi-automatic Graphcut tool allowed us to perform the segmentation within few minutes. **C.** The final 3D model of the segmented cell visualized in Amira. The presented image is part of a collaboration project with Jacqueline Moustakas-Verho, University of Helsinki.