1. Introduction

• The problem of image segmentation, i.e. partitioning an image into multiple segments, remains unsolved.

• In recent years, methods incorporating machine learning techniques into the process have emerged as powerful tools, improving the accuracy of detected boundaries or labeled areas.

• We propose a wide bridge between the machine learning and the image processing worlds.

• We benefit from combining two of the most popular and powerful platforms of each respective field: the Fiji toolkit, mainly used for biomedical image processing but with a wider spectrum; and the Waikato Environment for Knowledge Analysis (WEKA) suite.

• Integrated in the same graphical interface, they provide a novel and completely open-source framework to use, evaluate, combine and compare any available learning algorithm to perform general-purpose image segmentation. The source and binary code is completely available and runs on any modern computing platform.

2. Machine learning based segmentation

• Extract image features using pre-defined and custom filters at different scales:
  • Border detectors: Laplacian, Sobel, difference of Gaussian, Hessian eigenvalues, Gabor, etc.
  • Texture filters: minimum, maximum, median, mean, variance, entropy, structure tensor, etc.
  • Noise reduction filters: Gaussian blur, bilateral, Anisotropic diffusion, Kuwahara, Lipschitz, etc.
  • Membrane detectors and other custom filters.

• Convert each pixel to a feature vector compatible with WEKA.

• Use supervised and unsupervised learning routines to classify (or cluster) each vector.

3. Intuitive Graphical User Interface

• For basic users:
  • Interactive training-testing until achieving satisfying segmentation.
  • User-defined classes (background/foreground, parts of cells, etc.).
  • Results presented as final segmented areas or probability maps.

• For advanced users:
  • Access to all available WEKA classifiers and clusterers.
  • Feature selection.
  • Direct interaction with WEKA and Fiji toolboxes.
  • Evaluation of all methods performance.

4. Library use

• Image macro language compatible.

• GUI and methods are separate.

• Easy integration with other plugins and scripts.

References
