

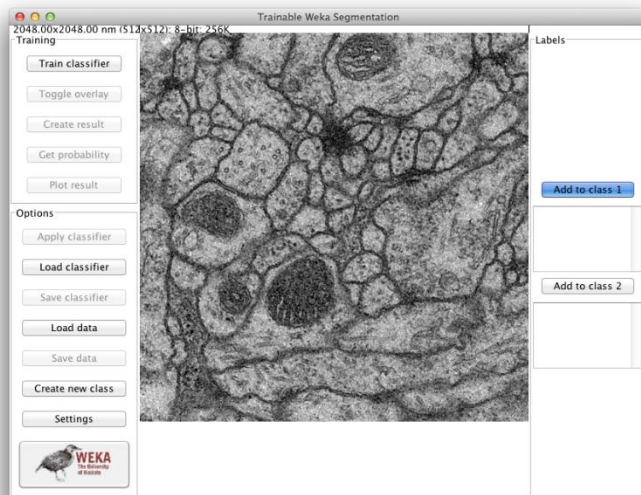


Modular Machine Learning and Classification Toolbox for ImageJ

1. Executive summary

ImageJ is an open source Java based image processing program extensively used in life sciences. The project aims at developing an ImageJ plugin which provides state-of the art image classification and segmentation based on modularized filtering approach. The starting point of development is the existing Trainable Weka Segmentation plugin.

2. Context



ImageJ¹ is a public domain Java image processing program extensively used in life sciences. The program was designed with an open architecture that provides extensibility via Java plugins. User-written plugins make it possible to solve almost any image processing or analysis problem or integrate the program with 3rd party software.

Weka (Waikato Environment for Knowledge Analysis)² is a collection of machine learning algorithms for data mining tasks. Weka contains tools for

data pre-processing, classification, regression, clustering, association rules, and visualization. It is also well-suited for developing new machine learning schemes. The algorithms can either be applied directly to a dataset or called from your Java itself.

The Trainable Weka Segmentation (TWS) is a ImageJ/Fiji plugin³ and library that combines a collection of machine learning algorithms with a set of selected image features to produce pixel-based segmentations. TWS was developed with the main goal of providing a general purpose

¹ <http://rsbweb.nih.gov>

² <http://www.cs.waikato.ac.nz/ml/weka/index.html>

³ http://fiji.sc/Trainable_Weka_Segmentation



workbench that would allow biologists to access state-of-the-art techniques in machine learning to improve their image segmentation results. It is part of the standard Fiji (ImageJ) distribution.

2. Motivation:

The current disadvantage of the TWS plugin is that the filters are fixed and the input parameters are hard-coded in the GUI. This limits the expandability and therefore the practical utility of the platform. The filter set is assembled ad hoc and some of the implementations are suboptimal. The aim of the project will be to redesign the existing code base and provide an extendable end user platform.

3. The Project

3.1. Project description:

The project will start by examining and refactoring the existing TWS plugin with the purpose to make it manifestly modular and able to incorporate pluggable functionality. The immediate objectives of the development are to

1. Add additional filters developed by members of the Belgian INCF Node
2. Modularize filter integration including automatic filter configuration options
3. Expose additional learning algorithms, such as the Support Vector Machines, currently available in Weka.
4. Add metadata export options, related to used filters, machine learning algorithms, models and applied parameters.

The candidate is expected to propose a specification and detail the scope of the planned work.

3.2. Guidance and support

Mentors will provide guidance in machine learning and ImageJ integration for the candidate for developing the plugin.

4. Minimal set of deliverables

- 1) Requirement specification - Prepared by the candidate after understanding the functionality
- 2) System Design - Detailed plan for development of the plugin and test cases
- 3) Implementation and testing - Details of implementation and testing of the plugin



5. The candidate

Required skills: Experience with Java,

Desired skills: experience with ImageJ, machine learning preferably WEKA

Mentors: Dimiter Prodanov, INCF Belgian Node; (backup) Daniel Sage, EPFL

Contact info: dimiterpp@gmail.com