

Active Segmentation Toolbox for ImageJ

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Project details:

What is the project about?

This project is about to provide the general purpose environment that allows biologists and other domain experts to use transparently state-of-the-art techniques in machine learning to improve their image segmentation results.

ImageJ is a public domain Java image processing program extensively used in life sciences.

Active Segmentation plugin is the redesign of existing Trainable Weka Segmentation (TWS) of ImageJ. The main functionality of the platform was already developed in the context of GSOC 2016 but the platform is still under development. In last Google summer of code, the major focus was on integrating generic filter families and specifically on one family of filters i.e. Gaussian Scale Space.

The Active Segmentation provides generic functionality and user friendly interface so that the user can include the state of the art filters and machine learning frameworks from the WEKA library:

- *Active learning.*
- *Multi-instance learning designed by third party in a robust manner*

In this Google summer of code we need to expand the existing functionality of the Active Segmentation plugin. The Generic framework can be used for segmentation, classification and object detection but in last Google summer of code the Segmentation has been completed, we need to extend this platform to provide functionality like classification and object detection.

Why is it important?

In the context of enhancing image segmentation results will allow biologist and other domain experts to get more and clear details from the images. Their learning experience gets enhance.

How will you handle the project? Detailed description of your planned approach.

Current Active segmentation platform support segmentation of the images, we need to extend this platform to provide classification of images.

Classification can be done by incorporate learning from entire images presented as instances. We can use zernike moments for image Classification. Zernike moments which are useful tools due to their orthogonality and rotation invariance property. However, direct computation of these moments is very expensive. Zernike Moments can be expressed as a function of Geometric Moments (GMs) which can be used for fast calculation calculation of Zernike moments. There are many good paper which computes these moment very efficiently and quickly upto order 12.

In this ROI based image classification approach, We can calculate exact Zernike moment magnitudes which can be used to define a feature space representing the image set.

Object of interest within each image, can then be represented in terms of a feature vector. These feature vector can be input to standard classification techniques.

Initially we can try to use Machine learning algorithm LVQ of WEKA library for classification purpose and see how the results come.

- ***Learning Vector Quantization (LVQ)***

- *As described in "[LVQ_PAK: The Learning Vector Quantization Program Package](#)" by Kohonen, Hynninen, Kangas, Laaksonnen and Torkkola (1996)*
- *and in: Teuvo Kohonen. [Self-Organizing Maps](#). Third ed. Berlin Heidelberg: Springer-Verlag; 2001. (Thomas S Huang; Teuvo Kohonen, and Manfred R. Schroeder. Springer Series in Information Sciences; 30).*
- *Provides the following implementations: LVQ1, OLVQ1, LVQ2.1, LVQ3, OLVQ3, Multiple-pass LVQ, Hierarchical LVQ*

Timeline of Project

Order in which I would implement various features are:

Phase 1 (1st May to 31st May)

- *Getting more familiar with Current Active segmentation plugin.*
- *Purpose necessary design changes in Active Segmentation to get learning from entire image features.*

- *Bonding with mentor and discuss flow of the project.*

Phase 2 (1st June to 25th June)

- *Develop a proof of concept which computes zernike image moments(Based on ROI) and discuss with mentor.*
- *Extract features from entire images using zernike image moments.*
- *Learn and implement LVQ algorithm in current tool for classification*

Phase 3 (26th June to 20th July)

- *Testing the new functionality.*
- *Add Additional filters and statistical features to the current Active segmentation plugin.*
- *Remove bug issues.*

Phase 4 (20th July to 30th August)

- *Update the existing Graphical user Interface for above changes.*
- *Update the meta-data export functionality to handle the new set of features.*
- *Apply purpose method for detection.*
- *Test and remove bug issues.*

Plan for communication with mentors

- *I can contact my mentor on weekly basis via Hangout or Skype call whatever suitable.*
- *I can maintain a log(Weekly basis) for To-Do of the week and what has been done on that week.*

Candidate details:

why do you want to do this project?

- I started my journey in Digital Images world with a course of Image analysis in my college then i got to know how we can manipulate these digital things and make things easier for society. After doing this course i get too much interested in this field so that i have taken courses like computer vision, Multimedia security and Machine learning.
- I have Intermediate level of java programming skills as i have done most of the code in this language only.
- I am following this organisation from last year but in last year i don't have enough matching skill set so i hadn't apply but now i found 2- 3 projects very interested in this organisation and "Active Segmentation Toolbox for ImageJ" drawn my attention as i have a basic experienced in imageJ application and required skills set needed for this project.

Tell us about something you've worked on in the past that would make you a good candidate for this project

I have all required skill set for this course and moreover i am very intersting in this project to enhance my learning experience in neuroscience.

I have taken courses like:-

- Signals and Systems
- Advance Programming(Java)
- Image Analysis
- Computer vision
- Machine Learning(I have done this course online)
- Multimedia Security

Is this the only project that you will apply for?

- No i am also applying for Teammates.

Working time and commitments - will you be working full time on this?

- I have no summer commitments so far and am willing to start early in case of semester overlap. Google Summer of code retains top priority as of now.

Do you have any other plans for the summer (school work, another job, planned vacation)?

- No i don't have any other such plans in summer.

Past Experience

- **Driver Inattention Monitoring System(Team Project)**
 - I worked on Blink detection for efficient fatigue detection in driver's face.
- **Image Stitching**
 - Compute a panorama image by given set of images by extracting SIFT features from images.
- **Small Course Assignments**

- Design an image segmentation based algorithm to identify which product customer is choosing (by using K-mean clustering algorithm).
 - Implement the BOG using SIFT to classify vehicles and non-vehicles from the dataset available.
 - Object Tracking using Lucas Kanade algorithm.
- **Developed a social networking Website in Java**
 - It allows users to post content (photos and text) and a user can comment or like a post of other user.

CV

- [Link to the CV](#)