



# COMPUTER-ASSISTED GENERATION OF GROUND REFERENCE DATA



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## PROJECT SUMMARY

We are engaged in a project to produce a 30m impervious land cover map of the entire Earth for the years 2000 and 2010 based on the Landsat Global Land Survey (GLS) data set. The GLS data from Landsat provide an unprecedented opportunity to map global urbanization at this resolution for the first time, with unprecedented detail and accuracy.

We will map Landsat GLS data into impervious versus non-impervious using a regression tree. This regression tree will be trained by ground reference data generated from very high spatial resolution commercial satellite data at 1 m or so resolution. Previous work has shown that photo-interpretation of high resolution data at 1 m resolution will generate an accurate 30 m resolution ground reference when coarsened to that resolution.

## THE HSEGLEARN TOOL

Because the quality of the input training data are critical, we have developed an interactive software tool, called HSegLearn, to facilitate the photo-interpretation of very high resolution imagery data. HSegLearn takes as its input a hierarchical set of image segmentations produced by the HSeg image segmentation program. HSegLearn lets an analyst specify pixel locations as being either positive or negative examples, and displays a classification of the study area based on these examples.

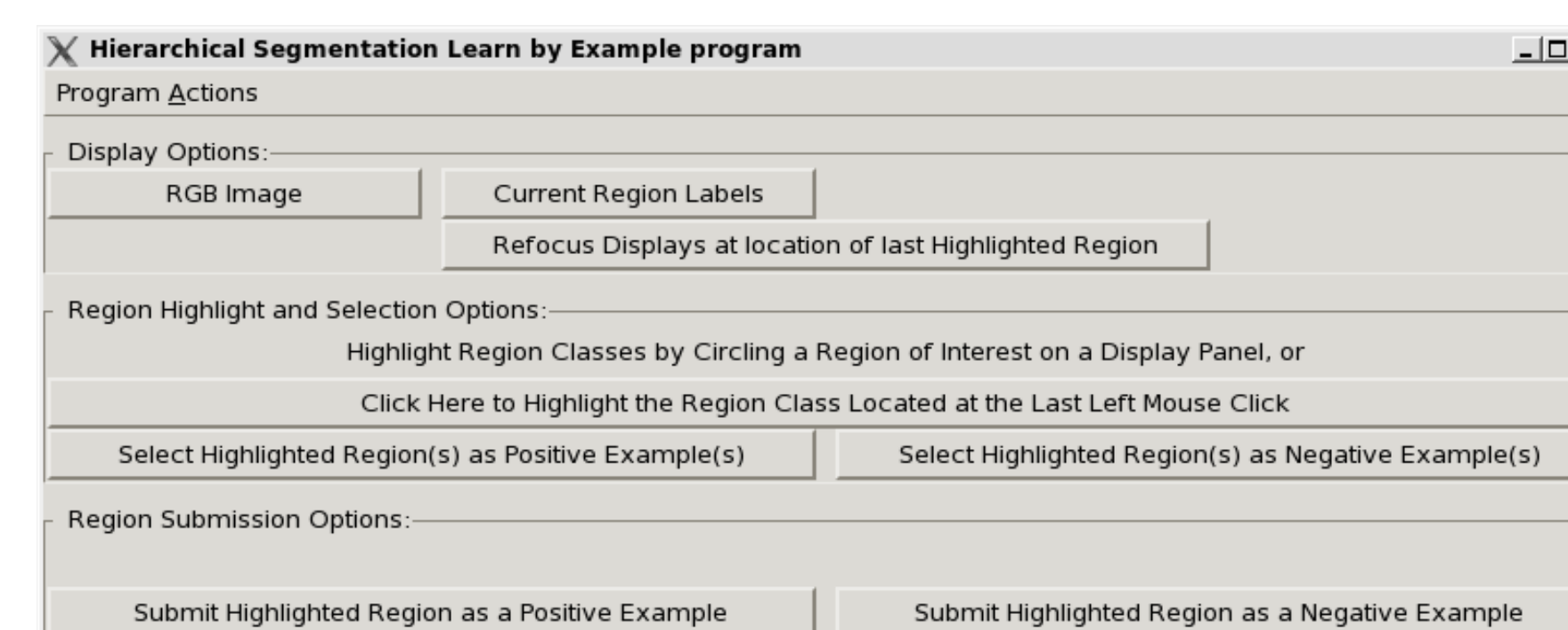
For our study, the positive examples are examples of impervious surfaces and negative examples are examples of non-impervious surfaces. HSegLearn searches the hierarchical segmentation from HSeg for the coarsest level of segmentation at which selected positive example locations do not conflict with negative example locations and labels the image accordingly. The negative example regions are always defined at the finest level of segmentation detail. The resulting classification map can be then further edited at a region object level using the previously developed HSegViewer tool.

## HIERARCHICAL SEGMENTATION (HSEG)

HSeg is based on best merge region growing segmentation. HSeg produces a segmentation hierarchy which consists of a set of several image segmentations at different levels of detail in which the segmentations at coarser levels of detail can be produced from simple merges of regions at finer levels of detail.

The key unique aspect of HSeg is its tight intertwining of region growing segmentation, which produces spatially connected region objects, with non-adjacent region object aggregation, which groups sets of region objects together into region classes. HSegLearn takes advantage of this region object classification to extend its positive and negative example labeling throughout the entire image based on just a few examples.

## USING HSEGLEARN TO GENERATE GROUND REFERENCE DATA



The HSegLearn GUI (above) allows an analyst to select region classes for highlighting and to submit highlighted region classes as positive or negative examples.

An RGB rendition of a portion of the input image data (right).

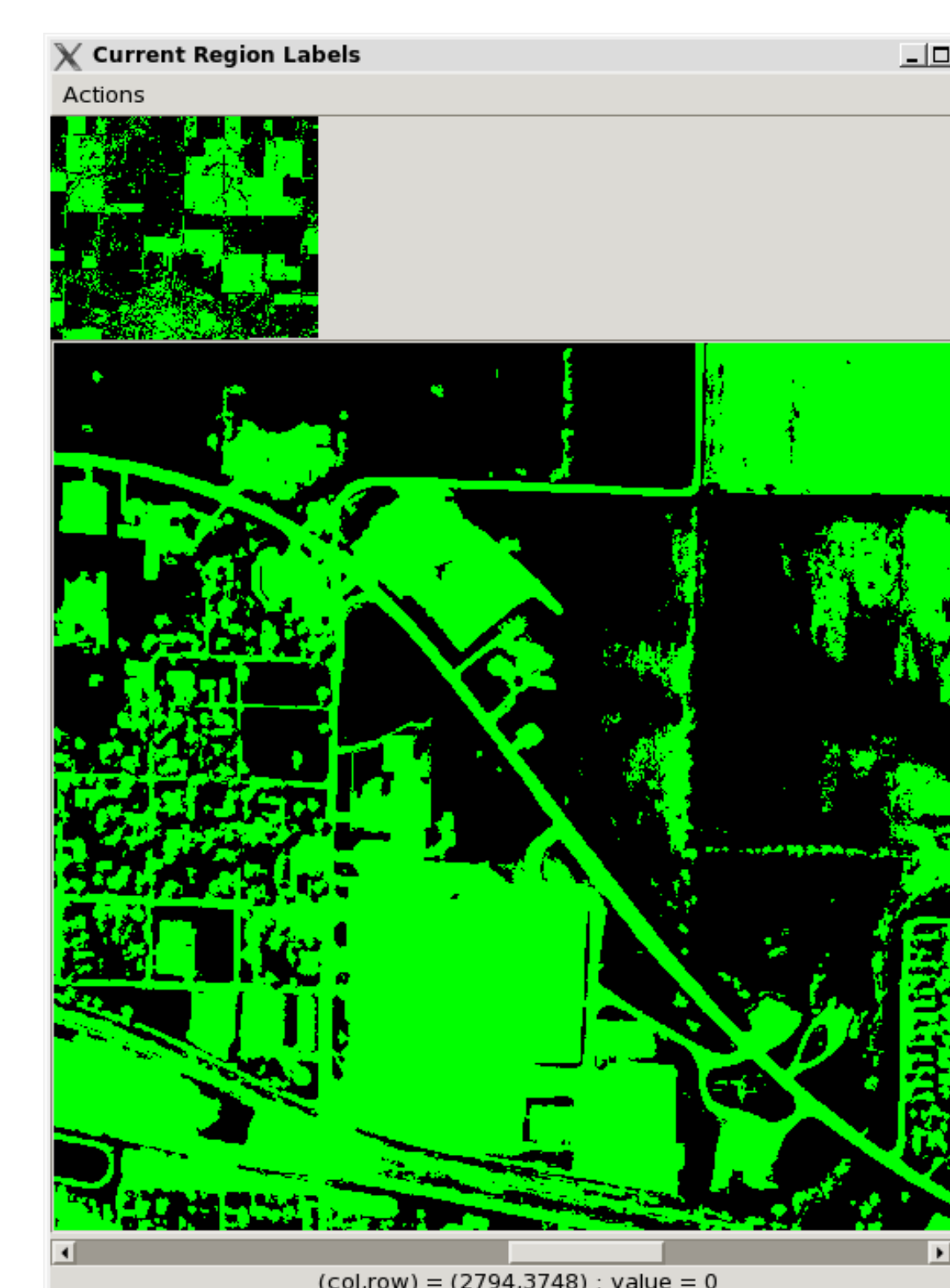
A progression of highlighting and submitting positive and negative examples is provided below. Just a few submissions of positive and negative examples results in an impervious (green) versus non-impervious (red) labeling.



Portion of Quickbird Image over Centralia, MO, USA



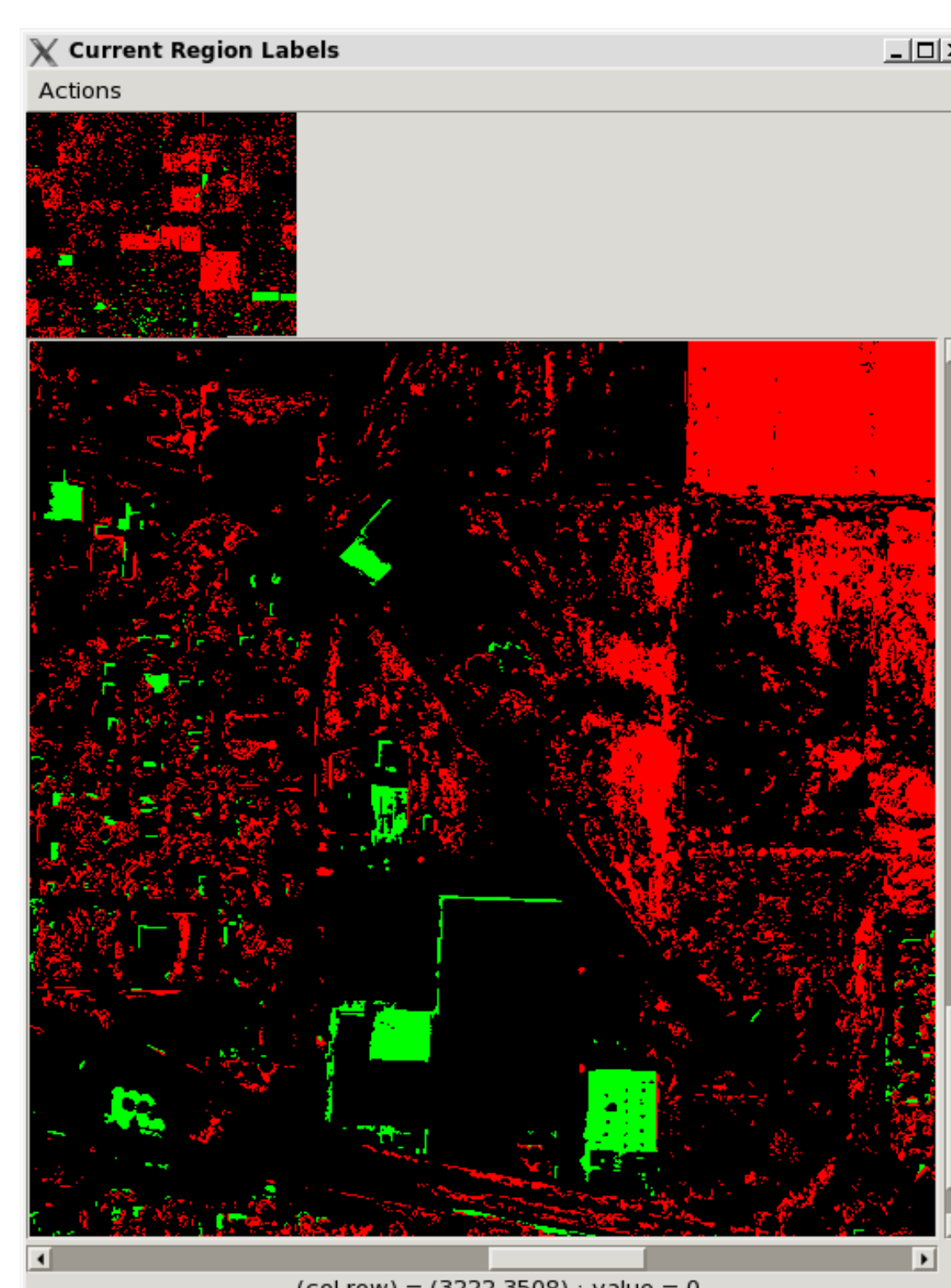
Highlight brown roofs.



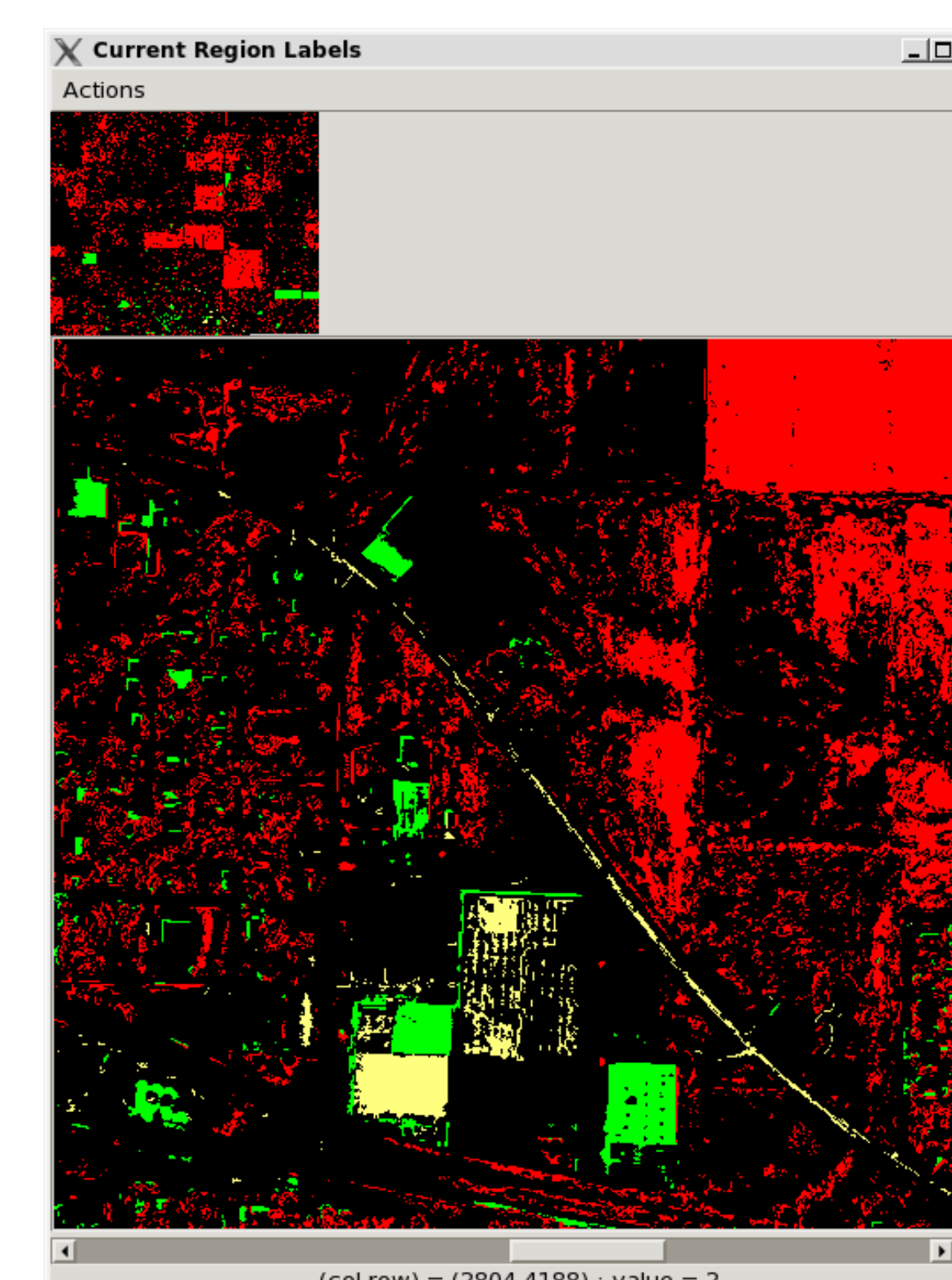
Submit brown roofs (positive).



Highlight negative examples.



Submit negative examples.



Highlight positive examples. (Roof, parking lot, road)



Submit positive examples.