Python Documentation

version

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Contents

CALISTO

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Overview

This software is used to select points of an image that have common characteristics. These characteristics may be:

- The light intensity
- The color

The software uses two images:

- The original image,
- An Image "overlay".

An overlay image is an image which has the same size that the original image. Each point of the overlay corresponds to a point of the original image. In the "overlay", there is a set of selected points that have the same color. A color in the overlay is a label.

There is a particular color: the "background" color. All points of the overlay that have "background" color will be ignored by the subsequent analysis. All other points that have not the "background" color are the objects of the image. Then in the overlay there are areas with colored points separated by "background" points like island (the objects) and sea ("background").

For the display, the "background" is transparent. It means that if a point of an overlay has that color, the software displays the point of the image located below. **In addition, the software can give to the overlay points a partial or total transparency**. Then user can see the real image under the labels.

The software saves those two images in a file type ".ddm". You can use the software "Diadem" if you want to analyze objects on these images.

How to make a label:

There is two ways to produce labels:

- By image processing: manual or automatic Thresholding
- Manually with the painting module. With this module you can paint the overlay of an image directly with the mouse. This can be very useful to close a border for example.

How to save labels:

As labels are in the overlay images, they are saved with the image in a file whose extension is ".ddm." It is used by the software "Diadem".

How to define an area of interest:

An " **area of interest** " or "ROI" limits the future analysis to a part of the surface of the picture. This surface is called "ROI".

In short:

An overlay is an image over the image. By default the overlay image is totally transparent. The user creates labels in this image. Then the image may contain areas of different colors. Each color defines a portion of the surface of the image. The labels are limited inside the "ROI".

Functions :

Summary

Modules :

Each module has a window that contains functions, parameters and a display area of image. The windows are grouped in a "Navigator". The windows not used are displayed by their name in the area "properties". Click on a name to display the window.

Functions:

They are presented in the left side windows.

The functions are grouped by topic. Each group has a name. The first group is always visible. Other groups may be hidden by clicking on the double arrow.

Under the function groups there is a group of parameters (properties).

Image Processing

Automatic Thresholding:

Function: This feature works on the intensity histogram of the image. It seeks automatically the best thresholds (it means: the thresholds that separate objects points and background points of the image). The background must be the greatest part of the image. If this is not the case, this function will select the background as object. Use the command "swap background" to reverse the selection. **Parameters**: color pixels selected.

Change color:

- **Click on the value area**: An arrow appears at the end of the value area.
- **Click on the arrow**: Choose the color.

Manual Thresholding.

Definition:

You can create multiple sets of pixel in an image. It is the role of the dialog "**Thresholding Manual.**" To create a set of pixels, it is necessary to define a channel first.

Defining a channel:

Select an existing Channel in the list box.

Select how to combine this channel with existing channels (Operation).

Choose whether you want to use hysteresis (With Hysteresis).

Choose color display channel (Fillcolor);

Note : operation are applied in predefined order : first to last channel.

Functions :

Creating a channel:

Using the '**More**' button. This button displays a small yellow cross. By clicking on this button a channel is added.

Showing properties of a channel:

Click on the list of channels. Select the desired channel. The properties of this channel appear below.

Defining the characteristic used by a channel.

A point of the image as some characteristics : color (**red, blue, green values**), intensity, …. After having selected a channel choose the characteristic to be used for this channel. The histogram corresponding to this characteristic is displayed at the top of the dialog. In the histogram, there are two vertical lines which symbolize an interval. All the points of the image corresponding to this interval are marked by a particular color in the overlay image.

Click on a straight line and use the mouse to move a vertical line. The selected points change. You can also use the arrows "position" to move them more precisely.

Set color of background.

Click on "**Background**" property and choose the color.

Set transparency of the overlay.

The "Opacity Level Overlay" determines the value of transparency:

- **10**: no transparency (original image is completely invisible and only the overlay image is visible).
- **0**: total transparency (overlay is completely transparent, only image is visible).

Delete Canal

- Select the channel to be deleted in the list of channels.
- Click on the button with a red cross.

Reload

- Reloads image file. All changes are lost.

Image Filters

- These functions work only on the overlay image.

Clear overlay

- Set all the points of the overlay to transparent color.

Reload Overlay

Reloads overlay image from file. All changes are lost.

Overlay Filters

These functions apply on image overlay only. They have no action on the image itself.

Functions :

Fill Hole

This function finds objects which contain holes inside (it means point with transparent color). So this command selects those points and adds them to the object.

Delete border Objects

Removes objects that touch the border of the image.

Delete Small Objects

Removes small objects.

Object Bounds

Symbolizes objects with their borders instead of there surfaces.

Swap Background <-> Objects

Objects become the background. The background becomes the object. All the labels are changed in the background color, and the background becomes one label.

Morphological Filters

All these functions run on multi-label overlay. Each label is processed independently.

Opening, closing

This feature gives good result for outlines slightly opened.

Thinning

Makes objects outlines as slim as possible. The final thickness is 1 point. This can be very long if the outlines are very large areas.

Pruning

Pruning reduces unnecessary branches on the outlines.

Convex Hull

Transforms each object of the overlay in a convex object. The objects are definitely transformed.

Properties

- " **Auto threshold color** ": Color of the selected points.
- " **Gaussian filter** " kernel sizes of the Gaussian filter. Smooth effect grows with the value of this parameter. Warning: the borders of the image are not treated like the rest of the image. These algorithms require an image area around a point, this is not the situation on the side of the image. The area affected by this phenomenon has a thickness equal to the value chosen for the parameter.
- **Overlay opacity level**: The value 0 gives full transparency (no longer the overlay is visible, whole image is visible), a value of 10 gives no transparency (no longer see the image, one sees only the overlay image).

ROI Editor

Definition:

This module is used to define the image area where treatment will be applied. To define this area, the operator uses geometric templates.

Possible templates are: Rectangle, Ellipse, Polygon, free curved.

Only one template is in use at a time.

A template acts like a stamp. Select a template, modify interactively the sizes and position of this template with the mouse. Then chose any of the following orders:

- **Clear "ROI"**: erase the "ROI" (if it already exists)
- "**New ROI**": make a print of the template in the overlay. This creates the "ROI" if there is none in the image. If there is still a ROI, it will delete it and replace it by the new one. To modify an existing ROI use the logical combination command.

Deleting the template: Select the template by clicking on it with the right mouse button and select the "delete" command.

It is possible to make successive prints to design complex "ROI". This combination is done with logical operators. Their functions are clearly indicated by there names: Complement, Exclude, Intersect, Union, Xor.

Saving "ROI"

They are recorded automatically when you save the image in ".ddm" file.

Paint Editor

Definition:

This module is used to manually edit the image of labels.

It consists in five tools.

Get a color: THE PROBE

Definition

The probe is used to retrieve the color of a point of the image.

Use

- Select the probe icon.
- Click on a point of the overlay: probe gets the color.
- The selected tool becomes the "bucket fill" .

Fill with a color: the bucket fill

Definition

Fill an object with a color.

Note: an object is defined by an outline closed. It is in the overlay. If the outline is not closed, the whole image is the color of "bucket fill."

Use

- Select tool "bucket fill"
- Click on the left: the object takes the color of bucket fill.
- Clicking the right button: the object takes the transparent color (it disappears).

Draw with a color: the brush and the segment

Definition

These tools are used to manually modify, close or open outlines.

Close outline

- Select one of two tools.
- Draw on the overlay with the **left mouse button.**

Open outline (clear)

- Select one of two tools
- Draw on the overlay with the **right mouse button.**

Property

You can change the color and width of line.

Warning: a color represents a label. If you change by yourself color in the overlay, the modified pixel will belong to another label (and then another object) or you will create manually new objects!

Zoom

It is a display mode. In this mode user can see with a great precision the Thresholding result and modify overlay by hand very easily.

Indices and tables

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