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EECS 332
MP1
Connected Component Labeling

Programming Language:

- Python 2.7.6 with the following dependencies
  - matplotlib
  - numpy

Input:

- A binary image

Output:

- A color coded image denoting each separate contiguous region
- The total number of separate regions

Method:

First, a new array is initialized to the same size as the image. This array will be used to store the region labels. Next the algorithm scans left to right, top to bottom, until it finds a "bright" pixel. It then checks for existing labels on the pixels above and to the left and performs one of the following actions:

If neither neighbor has a label:

- Create a new region label, label that pixel, and add the new region to the equivalence table.

If only one of the neighbors has an existing label OR both have the same label:

- look up the neighbors value in the equivalence table and apply that label to the new pixel.

If both neighbors have labels that are different:

- label the current pixel with the lowest of the two labels.
- update the equivalence table for the higher region to match the lower region since they are now determined to be part of the same region.

Color Coding:

Once all regions are determined, each region is assigned a shade of red spaced evenly across the 0-255 spectrum.

Size Filter:

If desired, the program will filter out regions based on the number of included pixels. The minimum number of pixels for a valid region is determined by the variable "threshold" and the value can be set in the first line of the main() function. Setting it to 0 is equivalent to no size filter.

SAMPLE INPUT/OUTPUT

Image 1: test.bmp – No size filtering

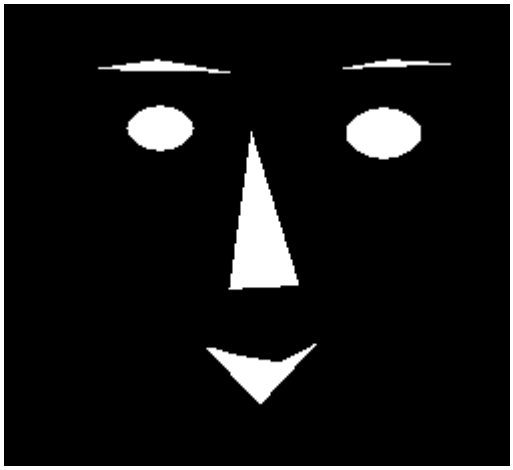
Input

Output

```
There are the following 1 regions:
Region 1   Size: 3666 pixels
Regions under 0 pixels have been filtered out
```

Image 2: face.bmp – No size filtering

Input



Output

```
There are the following 1 regions:
Region 1   Size: 3666 pixels
Regions under 0 pixels have been filtered out
```

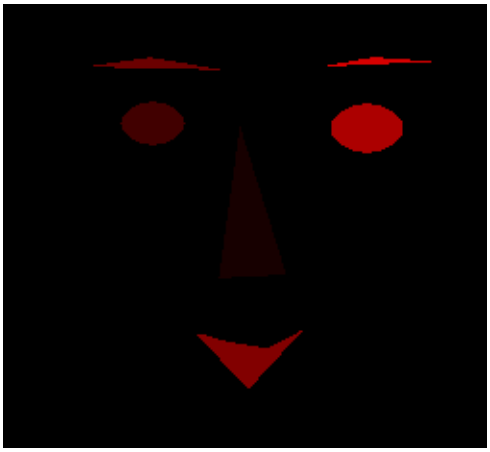


Image 3:gun.bmp – No size filtering

Input

Output

Image 4: gun.bmp – Filtered for regions greater than 250 pixels

Output

```
There are the following 4 regions:
Region 1   Size: 47 pixels
Region 4   Size: 1913 pixels
Region 8   Size: 223 pixels
Region 20   Size: 46 pixels
3 regions under 250 pixels have been filtered out
```