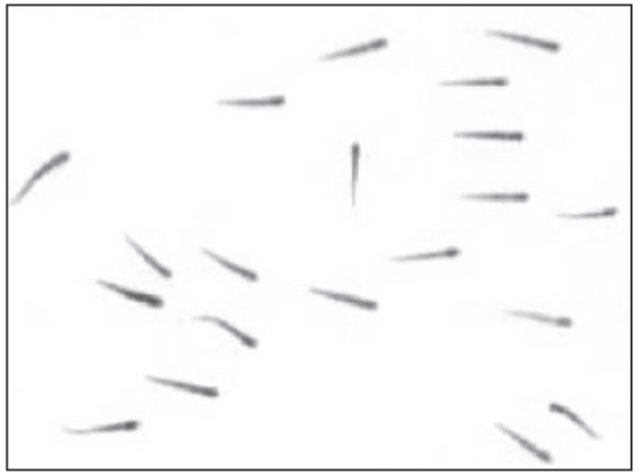
Region labeling and counting

How many fish in this picture?

- Which pixels belong to the same object (region labeling)?
- How large is each object (region counting)?



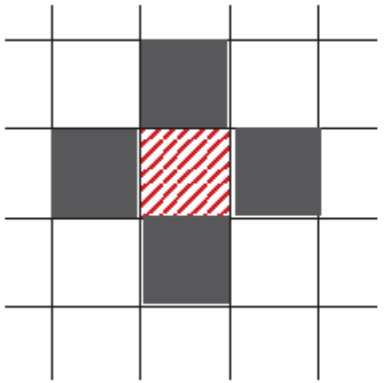
Original Fish image

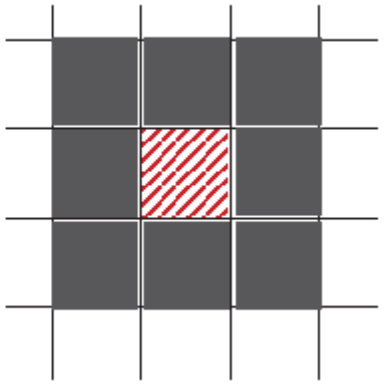
After thresholding

4-connected and 8-connected neighborhoods

- Definition: a region is a set of pixels, where each pixel can be reached from any other pixel in the region by a finite number of steps, with each step starting at a pixel and ending in the neighborhood of the pixel

4-neighborhood



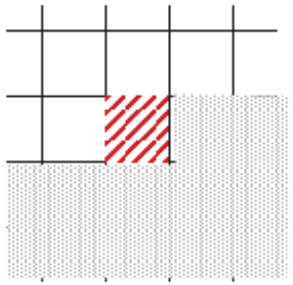


8-neighborhood

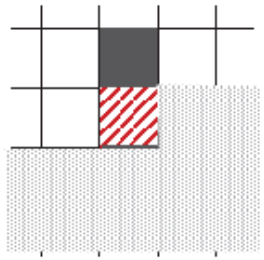
- Typically, either definition leads to the same regions, except when a region is only connected across diagonally adjacent pixels.

Region labeling algorithm (4-neighborhood)

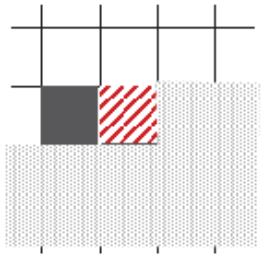
- Loop through all pixels $f[x,y]$, left to right, top to bottom
- If $f[x,y]=0$, do nothing.
- If $f[x,y]=1$, distinguish 4 cases



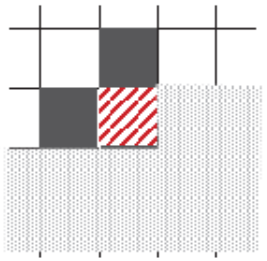
Generate new region label



Copy label from above



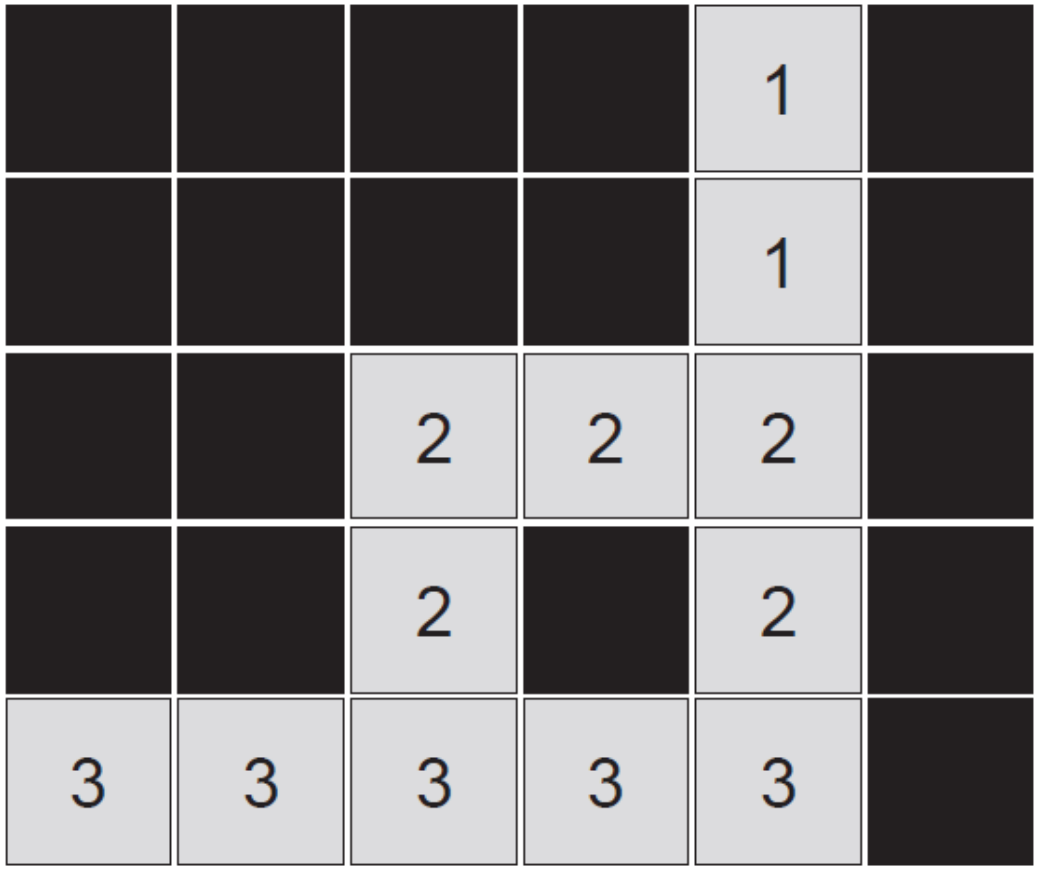
Copy label from the left

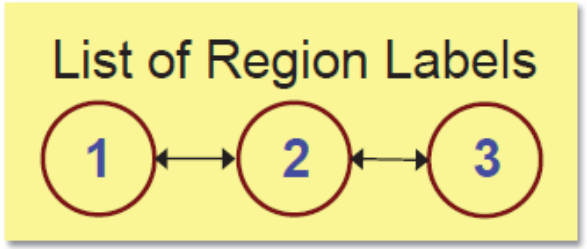


Copy label from the left. If labels above and to the left are different, store equivalence.

- Second pass through image to replace equivalent label by the same label

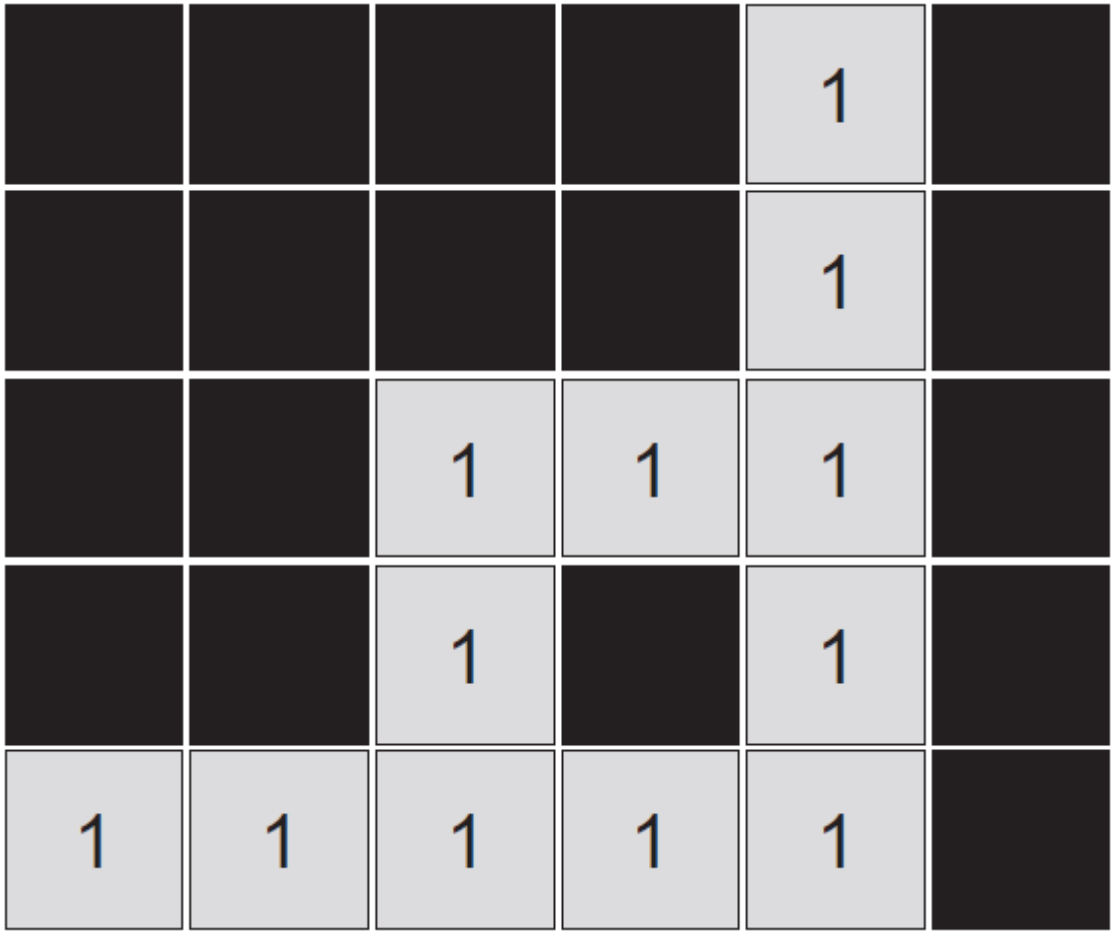
Region labeling example (4-neighborhood)





All three labels are equivalent, so merge into single label.

Region labeling example (4-neighborhood)

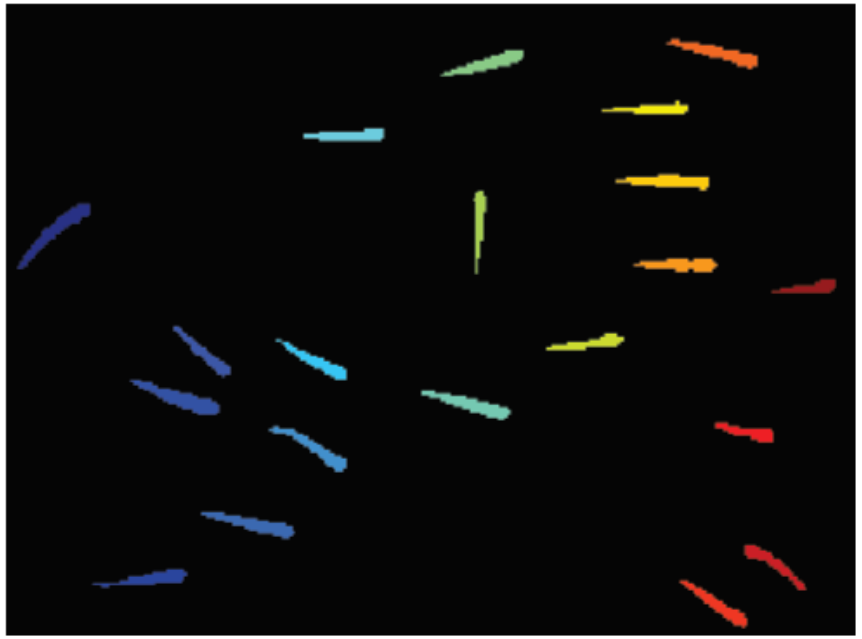


List of Region Labels

1

Example: region labeling

Thresholded image



20 labeled regions

Region counting algorithm

- Measures the size of each region
- Initialize *counter*[*label*]=0 for all label
- Loop through all pixels *f* [*x*,*y*], left to right, top to bottom
  - If *f* [*x*,*y*]=0, do nothing.
  - If *f* [*x*,*y*]=1, increment *counter*[*label*[*x*,*y*]]