Report of MP1

1. Connect Component Labeling

The Connected Component Labeling (CCL) algorithm identifies and labels connected regions in binary images. Iteration, recursion, and sequence methods can all implement this algorithm. Regarding the neighborhood (connected component), there are 4-connected (each pixel has up to 4 neighbors: upper, lower, left, right), and 8 connected (each pixel has up to 8 neighbors: upper, lower, left, right, upper left, upper right, lower left, lower right).

Binary images usually contain two-pixel values: 0 (background) and 1 (foreground). In this case, a connected region is an area composed of adjacent foreground pixels connected to each other to some extent.

2. Algorithm Description

In this project, we focus on unbaled binary images, we select use sequential CCL with 4-connected way. Based on sequential CCL, we only need to traverse the image twice to complete it. The entire process is divided into 4 steps.

1. Read in and scan the image (First Scanning): Scan the entire image from left to right, top to bottom.

2. Marking: When encountering a foreground pixel (pixel value is 1), check its neighbors (Upper node & left node). If the neighbor has no label, a new label is assigned; if the neighbor has one or more labels, the smallest label is assigned and the equivalence relationship (E_table) is recorded.

3. Analyze equivalence relationships (Second Scanning): After the first scan, analyze the equivalence relationships of all records(E_table), and update the labels in the image during the second scan.

4. Output: Output the labeled connected components.

3. Result analysis

These four pictures are test_result.jpg, face_result.jpg, gun_without_filter_result.jpg, gun_result.jpg,

Label according to the difference in light and shade in the picture. There is one label for test and 6 for face. For the gun picture, there are 4 labels without filter points, but only one after using size filter.