Mcahine Vision HW2 Report

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Dependencies

```
python = ">=3.9,<4"
opencv-python = "^4.9.0.80"
alive-progress = "^3.1.5"
matplotlib = "^3.8.3" # optional, for visualing the histogram
```

Run

```
python 110590004_hw2.py
```

Question 1

Grayscaling and Binarization

- Use $(0.3 \times R) + (0.59 \times G) + (0.11 \times B)$ to convert the RGB image to grayscale image.
- Implement Triangle algorithm to binarize the grayscale image.
  - ▸ Apply smoothing in the histogram to get a better threshold.
  - ▸ If the `matplotlib` is installed, the histogram and threshold will be shown in `debug` folder.
  - ▸ Thresholds: `img_1`: 234, `img_2`: 218, `img_3`: 239, `img_4`: 230.

N-Connected Component Labeling

- Use disjoint set to handle the color's labels grouping and query.
- The principle is to greedily fill colors, if a neighbor has color then fill the same color, otherwise assign a new color.
- For the case that a pixel has multiple neighbors with different colors, assign one of the colors to the pixel and union the rest of the colors.
- Finally, create a mapping from label to n random color, where n is the number of components.
- From 4 connected to 8 connected, there are more neighbors to check, but the principle is the same.

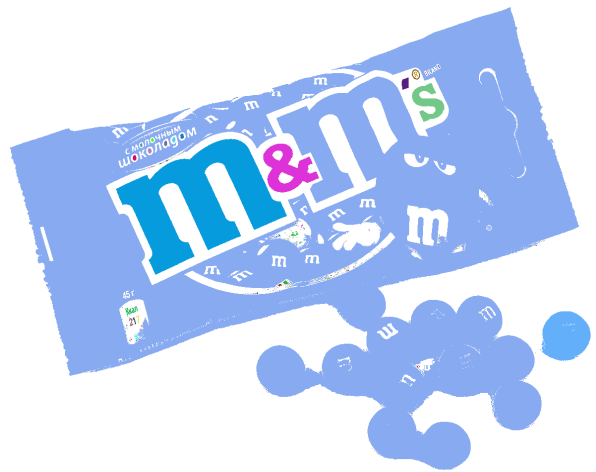# Result

4 Connected

Figure 1: `img_1`, 5 components

Figure 2: `img_2`, 424 components

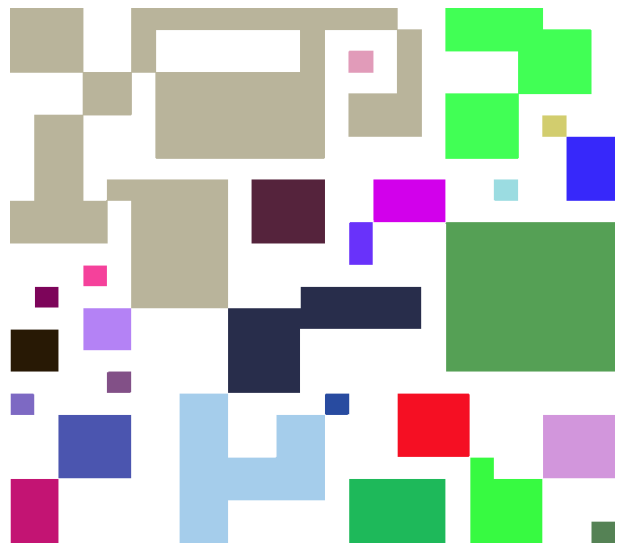

Figure 4: `img_4`, 26 components

Figure 3: `img_3`, 36 components

8 Connected

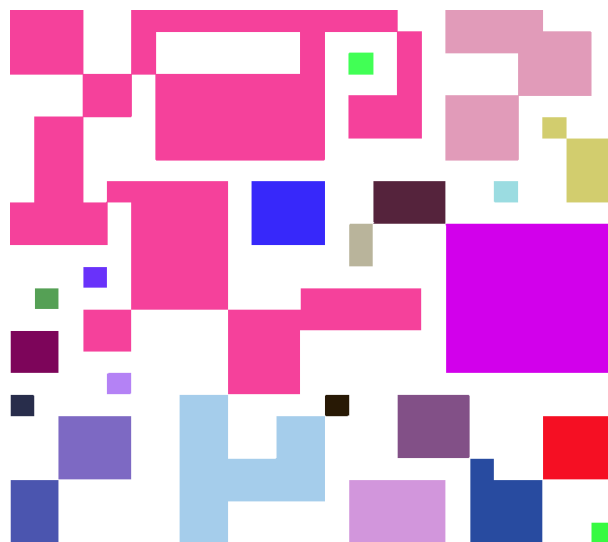Figure 5: `img_1`, 5 components

Figure 6: `img_2`, 236 components

Figure 7: `img_3`, 31 components

Figure 8: `img_4`, 23 components