機器視覺

HW 2

資工三 109590049 林敬翰

1. Convert the color image to a binary image.

Code：

```
Mat ConvertToGray(Mat img) {
    Mat gray = Mat::zeros(img.size(), CV_8UC1);
    for (int i = 0; i < img.rows; i++) {
        for (int j = 0; j < img.cols; j++) {
            Vec3b rgb = img.at<Vec3b>(i, j);
            gray.at<uchar>(i, j) = 0.3 * rgb[2] + 0.59 * rgb[1] + 0.11 * rgb[0];
        }
    }
    return gray;
}

Mat ConvertToBinary(Mat img, int threshold) {
    Mat grayimg = ConvertToGray(img);
    Mat binary = Mat::zeros(grayimg.size(), CV_8UC1);
    for (int i = 0; i < grayimg.rows; i++) {
        for (int j = 0; j < grayimg.cols; j++) {
            uchar n = grayimg.at<uchar>(i, j);
            if (n > threshold) {
                binary.at<uchar>(i, j) = 0;
            }
            else {
                binary.at<uchar>(i, j) = 1;
            }
        }
    }
    return binary;
}

Mat BinaryReConstruct(Mat img) {
    Mat binary = Mat::zeros(img.size(), CV_8UC1);
    for (int i = 0; i < img.rows; i++) {
        for (int j = 0; j < img.cols; j++) {
            uchar n = img.at<uchar>(i, j);
            if (n == 1) {
                binary.at<uchar>(i, j) = 255;
            }
            else {
                binary.at<uchar>(i, j) = 0;
            }
        }
    }
    return binary;
}
```

將圖片轉成二值化沿用了上次 HW1 寫出來的灰階轉換、二值化轉換函式，但為了方便計算，將數值將二值化轉換函式的數值從 255 改成了 1，後面輸出 binary image 時用了 BinaryReConstruct 函式再將數值轉為 255 來做圖片輸出。

2. 4-connected.

```
Mat FourlabelConnect(Mat img, int threshold) {
    Mat binary = ConvertToBinary(img, threshold);
    Mat label=Mat::zeros(binary.size(),CV_32SC1);
    binary.convertTo(label, CV_32SC1);
    int counter = 1;
    int propCount = 0;
    int temp = 1;
    for (int i = 1; i < binary.rows - 2; i++) {
        int* data = label.ptr<int>(i);
        for (int j = 1; j < binary.cols - 2; j++) {
            if (data[j] == 1) {
                std::stack<std::pair<int, int>> neighbor;
                neighbor.push(std::pair<int, int>(i, j));
                ++counter;
                while (!neighbor.empty()) {
                    std::pair<int, int> cur = neighbor.top();
                    int curX = cur.first;
                    int curY = cur.second;
                    label.at<int>(curX, curY) = counter;

                    neighbor.pop();
                    if (curY != 0) {
                        if (label.at<int>(curX, curY - 1) == 1) {
                            neighbor.push(std::pair<int, int>(curX, curY - 1));
                            temp++;
                        }
                    }
                    if (curY != binary.cols - 1) {
                        if (label.at<int>(curX, curY + 1) == 1) {
                            neighbor.push(std::pair<int, int>(curX, curY + 1));
                            temp++;
                        }
                    }
                    if(curX!=0){
                        if (label.at<int>(curX-1, curY) == 1) {;
                            neighbor.push(std::pair<int, int>(curX - 1, curY));
                            temp++;
                        }
                    }
                    if (curX != binary.rows - 1) {
                        if (label.at<int>(curX+1, curY) == 1) {
                            neighbor.push(std::pair<int, int>(curX + 1, curY));
                            temp++;
                        }
                    }
                }
                if (temp >= 100) {
                    propCount++;
                }
                temp = 0;
            }
        }
    }

    Mat colorLabel;
    std::vector<Vec3b> colors;
    for (int i = 0; i < label.rows * label.cols; i++) {
        colors.push_back(Vec3b(rand() % 256, rand() % 256, rand() % 256));
    }
    colorLabel = Mat::zeros(label.size(), CV_8UC3);
    for (int i = 0; i < colorLabel.rows; i++) {
        for (int j = 0; j < colorLabel.cols; j++) {
            int labelValue = label.at<int>(i, j);
            if (labelValue > 0) {
                colorLabel.at<Vec3b>(i, j) = colors[labelValue - 1];
            }
        }
    }
    int num = counter - 1;
    printf("count：%d\n", propCount);
    return colorLabel;
}
```

在4連通中，我使用了seed-filling演算法。用迴圈去跑每個pixel，如果該pixel是1且沒被標記過將這點儲存到一個stack中並給予個新的標籤,然後跑4連通的鄰近pixel並將鄰近的pixel是一的儲存到stack中直到該區域所有的1都被跑完。最後用亂數產生一個顏色映射表，將label中的值都替換成新的顏色。

3. 8-connected.

```
Mat EightlabelConnect(Mat img, int threshold) {
    Mat binary = ConvertToBinary(img, threshold);
    Mat label = Mat::zeros(binary.size(), CV_32SC1);
    binary.convertTo(label, CV_32SC1);
    int counter = 1;
    int propCount = 0;
    int temp=1;
    for (int i = 1; i < binary.rows - 2; i++) {
        int* data = label.ptr<int>(i);
        for (int j = 1; j < binary.cols - 2; j++) {
            if (data[j] == 1) {
                std::stack<std::pair<int, int>> neighbor;
                neighbor.push(std::pair<int, int>(i, j));
                ++counter;
                while (!neighbor.empty()) {
                    std::pair<int, int> cur = neighbor.top();
                    int curX = cur.first;
                    int curY = cur.second;
                    label.at<int>(curX, curY) = counter;
                    neighbor.pop();
                    for (int x = -1; x <= 1; x++) {
                        for (int y = -1; y <= 1; y++) {
                            if (x == 0 && y == 0) {
                                continue;
                            }
                            int x2 = curX + x;
                            int y2 = curY + y;
                            if (x2 >= 0 && x2 < binary.rows && y2 >= 0 && y2 <
binary.cols) {
                                if (label.at<int>(x2, y2) == 1) {
                                    neighbor.push(std::pair<int, int>(x2, y2));
                                    temp++;
                                }
                            }
                        }
                    }
                }
                if (temp >= 100) {
                    propCount++;
                }
                temp = 0;
            }
        }
    }

    Mat colorLabel;
    std::vector<Vec3b> colors;
    for (int i = 0; i < label.rows * label.cols; i++) {
        colors.push_back(Vec3b(rand() % 256, rand() % 256, rand() % 256));
    }
    colorLabel = Mat::zeros(label.size(), CV_8UC3);
    for (int i = 0; i < colorLabel.rows; i++) {
        for (int j = 0; j < colorLabel.cols; j++) {
            int labelValue = label.at<int>(i, j);
            if (labelValue > 0) {
                colorLabel.at<Vec3b>(i, j) = colors[labelValue - 1];
            }
        }
    }
    int num = counter - 1;
    printf("count：%d\n", propCount);
    return colorLabel;
}
```

在 8 連通中，我一樣使用了 seed-filling 演算法。唯一的差別是在偵測鄰近 pixel 時變成偵測鄰近 8 格。所以我用了多兩層的迴圈來去跑附近(x±1, y±1)的範圍。然而再計算有幾個物件時，由於轉換成二值化影像後還是會有一些小雜訊在，所以我只追蹤了大於 100pixel 的物件，剛好 seed-filling 演算法很好計算這個。

4. Output

轉換成二值化使用的 threshold 值：

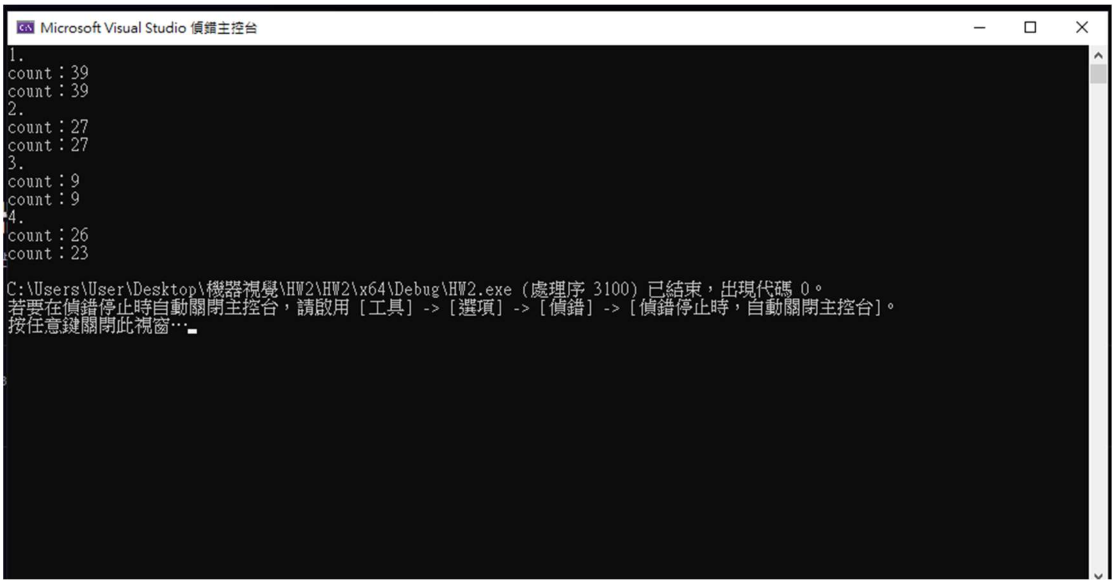
1.png 100

2. png 232

3. png 90

4. png 230

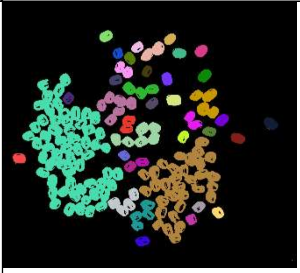
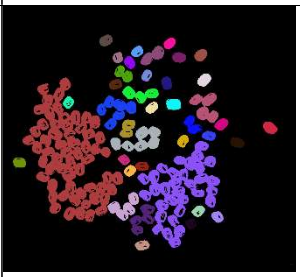
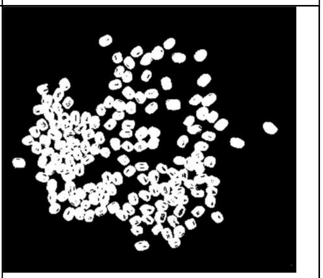
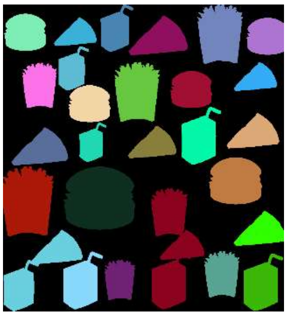
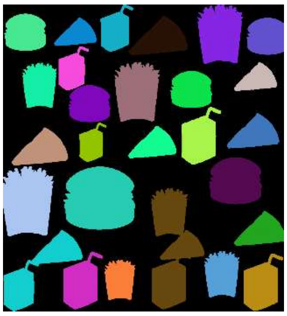
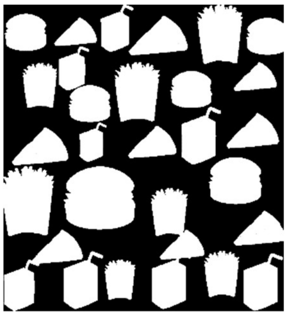
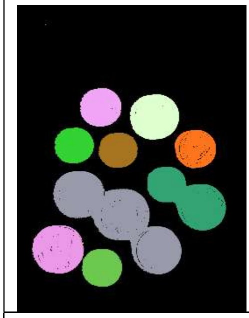
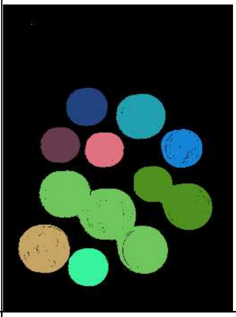
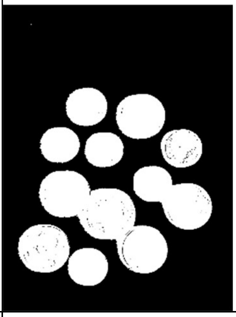
數量輸出：

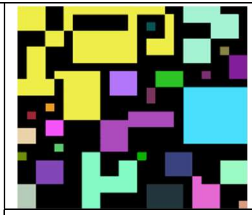
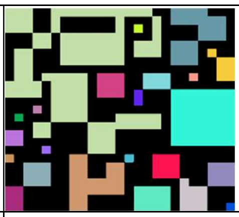
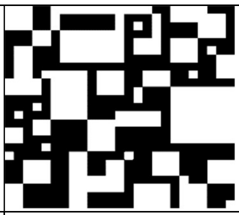


```
1.
count：39
count：39
2.
count：27
count：27
3.
count：9
count：9
4.
count：26
count：23

C:\Users\User\Desktop\機器視覺\HW2\HW2\x64\Debug\HW2.exe (處理序 3100) 已結束，出現代碼 0。
若要在偵錯停止時自動關閉主控台，請啟用 [工具] -> [選項] -> [偵錯] -> [偵錯停止時，自動關閉主控台]。
按任意鍵關閉此視窗…
```

圖片輸出：

	4-connect	8-connect	Binary
1.png			
	總數：39	總數：39	
2.png			
	總數：27	總數：27	
3.png			
	總數：9	總數：9	

4.png			
	總數：26	總數：23	