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Machine Problem 1

Introduction:

The goal of this project was to apply Connected Component Labelling to identify, count, and label independent regions of a binary image.

Algorithm:

1. Iterate through each pixel in the binary image and access each pixel's value
2. Check if the neighboring pixels have been assigned labels
3. If no neighboring pixels have been labelled yet, create a new label and assign it to the current pixel. This is now considered a new region
4. If the pixel borders a single labelled region, the current pixel is added to the region and assigned the same label
5. Finally, if the current pixel borders multiple regions, the current pixel is added to the region with the lowest label value. Then, the other neighboring regions are relabeled with the same minimum label. This effectively combines the multiple bordering regions into a single region.
6. Apply the size filter. This checks the number of pixels with each label in the image. If the number of pixels with a given label is too small, that label is removed and pixels with the label are relabeled as zero/black.
7. Return an output array with labels assigned to each pixel.

Results:

This algorithm was very successful. Below are the output images generated by my code. Separate regions are marked with different colors. From these output images, it is clear that the algorithm is able to distinguish and label the different regions in each image.

6 regions in image face.bmp:



6 regions in image face_old.bmp:



4 regions in image gun.bmp:



1 region in image test.bmp:



I also created the following test image to test my size filter. Below is the input image and the output image with the small regions filtered out. The code successfully identifies the 6 remaining large regions.

