Xiaowei Yuan

ECE 332

06 October 2022

MP 2 Report

INTRODUCTION

In this MP, I focused on implementing 5 functions : Erosion, Dilation, Opening, Closing and Boundary. I used three pictures to test: palm, gun and pika(my own testcase). Each of them have different results and it's interesting to see the change due to different SE.

CONTENTS

Erosion:

In the erosion, I used two SE for testing: 2*2 and 3*3.

And I first go over each pixel of the original image, to see if the pixel is white (marked), set a flag to 1 if this pixel is marked. And then I put a SE as a mask on that pixel, go over every pixel of SE to see if all pixel of SE mask is white(marked), if so, this pixel is still white(marked), if not, this pixel will be changed to black(unmarked), which means its erased.

Here is what I got use SE 2*2 and 3*3 on gun and palm.

gun_erosion_22 gun_erosion_33 palm_erosion_22 palm_erosion_33

You can see the white(marked) part become less when we increase the area of SE.

One interesting thing is that when I apply the same code on my own testcase: pikachu. It seems like dilation because the background of pikachu is white while the lines are in black. So everything here is getting opposite results, which makes the image even fatter.

pika_erosion_22

pika_opening_33

Dilation:

Just like what I did in erosion, I choose two other size of SE in dilation: 4*4 and 6*6.

I first go over each pixel of the image to see if it's white(marked). If it's white(marked), I only need to put a SE mask there and set every pixel inside SE to be white. If not, then keep it as original. The difference between this one and erosion is that dilation does not need any flags.

Below is what I got for test cases:

gun_dilation_44

gun_dilation_66

palm_dilation_44

palm_dilation_66

Same principle applies, due to the opposite color of background and marks, the pikachu seems thinner, just like it goes through erosion.

pika_dilation_66

Opening:

In the opening function, I used a SE of 3*3, first apply erosion, then apply dilation on the original image, the output image looks unconnected and fragile.

gun_opening_33

palm_opening_33

pika_opening_33

Closing:

In the closing function, I used a SE of 3*3, first apply dilation, then apply erosion on the original image, the output image looks better than the original and opening image.

gun_closing_33

palm_closing_33

pika_closing_33

Boundary:

In the boundary function, I used two methods to do so. The first one is following the professor's lecture, apply erosion on an image to see the difference between original image and erosion

image. I used a SE of 3*3. The output image seems unconnected because there's still holes inside the image which have been eroded.


gun_boundary_33


palm_boundary_33


pika_boundary_33

In addition to getting a better boundary, I apply an update on the function. I applied a dilation as a pretrain on the original image, which aims to fill the holes, and then do the boundary just like I've mentioned before. The output boundary seems better.


updated_gun_boundary_33


updated_palm_boundary_33


updated_pika_boundary_33

RESULT ANALYSIS

During all the functions, dilation and erosion are the most important functions which support other functions. And SE affects a lot while training. If SE is too large, the image's getting too big(dilation) or just disappears(erosion). But if it's too small, it does not make changes to our original image. And Opening and Closing lead to totally different outputs. Boundary function is not always effective to use. If the image has some holes, we need to first fill these holes and then do a boundary function.

Also my own test case gives us an idea: if the color of background and lines are totally opposite to the given image, then dilation function and erosion function can be exchanged to meet the requirements.