

HOMework ASSIGNMENT 2

Edge Detection and Geometrical Modification

Due Date: 11:59 pm on Mar. 23, 2022

Please read the **submission guideline** carefully before getting started. All images in this homework are in PNG format and can be downloaded from our NTU COOL website. Details of all files offered are listed in the appendix. You are **NOT** allowed to use other functions except I/O, plotting and basic functions.

Problem 1: EDGE DETECTION

In this problem, please perform several edge detection algorithms to accomplish the following tasks.



(a) sample1.png



(b) sample2.png

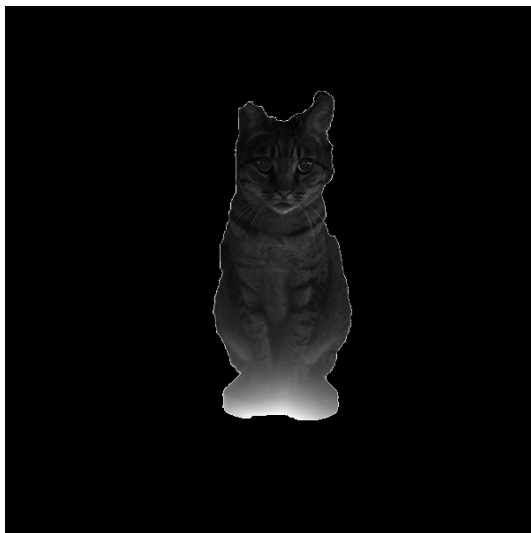
Figure 1: Images for edge detection.

- (a) (10 pt) Apply Sobel edge detection to **sample1.png**. Output the gradient image and its corresponding edge map as **result1.png** and **result2.png**, respectively. Please also describe how you select the threshold and how it affects the result.
- (b) (10 pt) Perform Canny edge detection on **sample1.png** and output the edge map as **result3.png**. Please also describe how you select the parameters and how they affect the result.
- (c) (10 pt) Use the Laplacian of Gaussian edge detection to generate the edge map of **sample1.png** and output it as **result4.png**. Compare **result2.png**, **result3.png** and **result4.png** and discuss on these three results.
- (d) (10 pt) Perform edge crispening on **sample2.png** and output the result as **result5.png**. What difference can you observe from **sample2.png** and **result5.png**? Please specify the parameters you choose and discuss how they affect the result.
- (e) (Bonus) Apply the Hough transform to **result3.png** and output the Hough space as **result6.png**. What lines can you detect by this method?

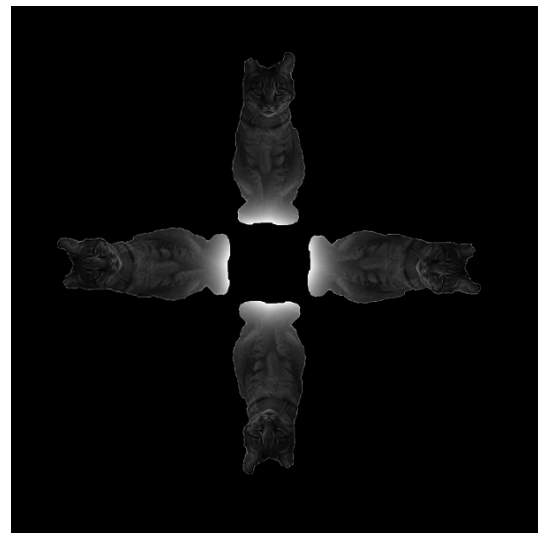
Problem 2: GEOMETRICAL MODIFICATION

Please design several geometrical modification algorithms to meet the following requirements. **Your results may not be exactly the same as the sample images. Just try to create the effects as closely as possible.**

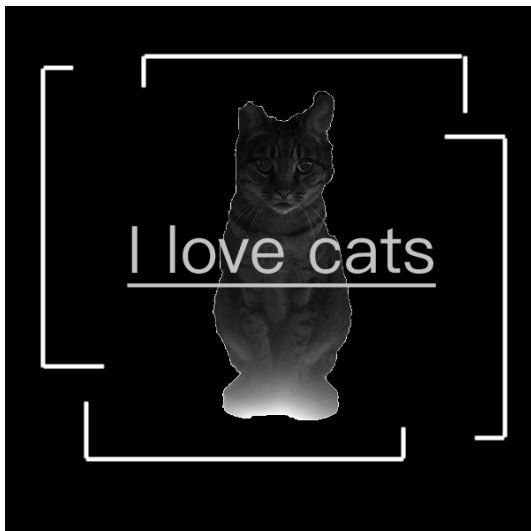
- (10 pt) Please design a method to improve **sample3.png**. Describe your method in detail and specify all the parameters.
- (25 pt) The cat needs friends! Please design an algorithm to help her find new friends by making **sample3.png** become **sample4.png**. Output the result as **result7.png** with the same dimension as **sample3.png**. Please describe your method and implementation details clearly. (hint: you may perform rotation, scaling, translation, etc.)
- (25 pt) Legend says that cats are a kind of liquid. Let's perform some magic tricks on the lovely cat to confirm this rumor. By observing the wave shown in **sample6.png**, please design an algorithm to make **sample5.png** look like it as much as possible and save the output as **result8.png**. Please describe the details of your method and also provide some discussions on the designed method, the result, and the difference between **result8.png** and **sample6.png**, etc.



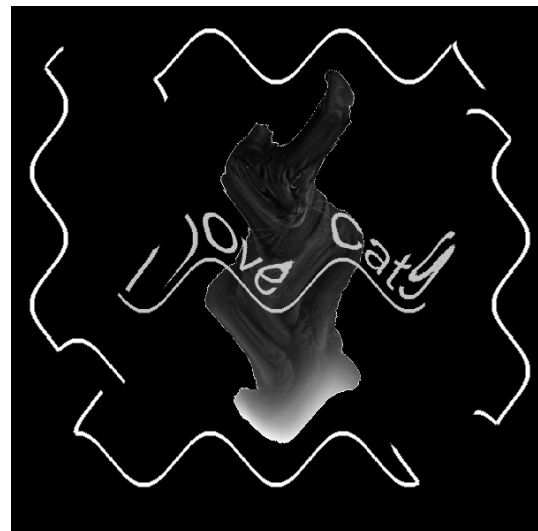
(a) sample3.png



(b) sample4.png



(c) sample5.png



(d) sample6.png

Figure 2: Images for geometrical modification.

Appendix

Problem 1: EDGE DETECTION

sample1.png: 600×800 gray-scale

sample2.png: 600×800 gray-scale

Problem 2: GEOMETRICAL MODIFICATION

sample3.png: 600×600 gray-scale

sample5.png: 600×600 gray-scale