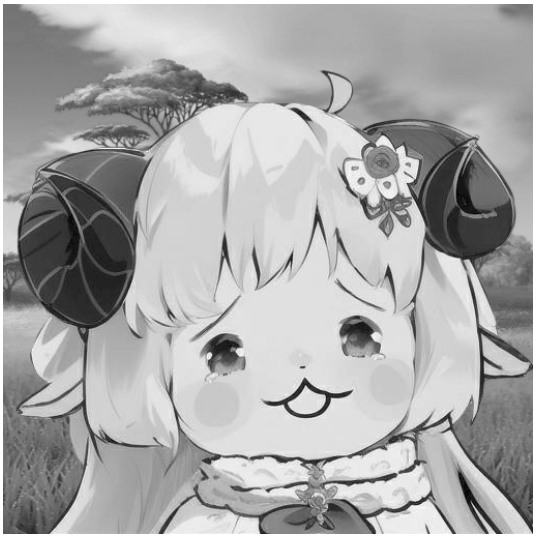
HOMEWORK ASSIGNMENT 2

Edge Detection and Geometrical Modification

Due Date: 11:59 p.m. on Mar. 28, 2023
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

The sheep in sample1.png does not know how to perform edge detection algorithms, please help her 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) (`20 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.

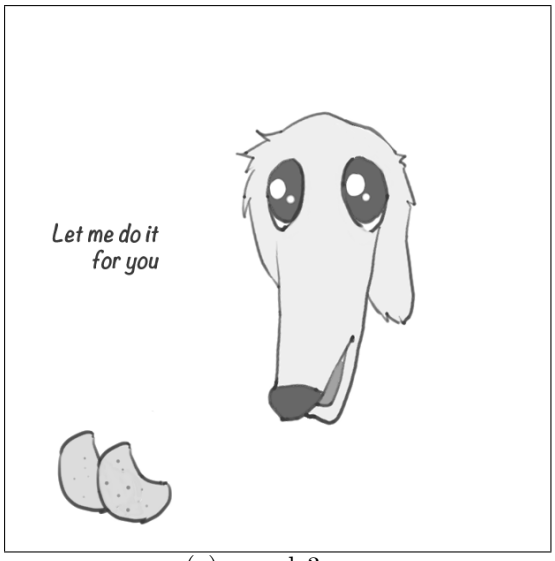
(e) (`Bonus`) Perform Canny edge detection on **result5.png** and output the edge map as **result6.png**. Then apply the Hough transform to **result6.png** and output the Hough space as **result7.png**. What lines can you detect by this method?

Problem 2: GEOMETRICAL MODIFICATION

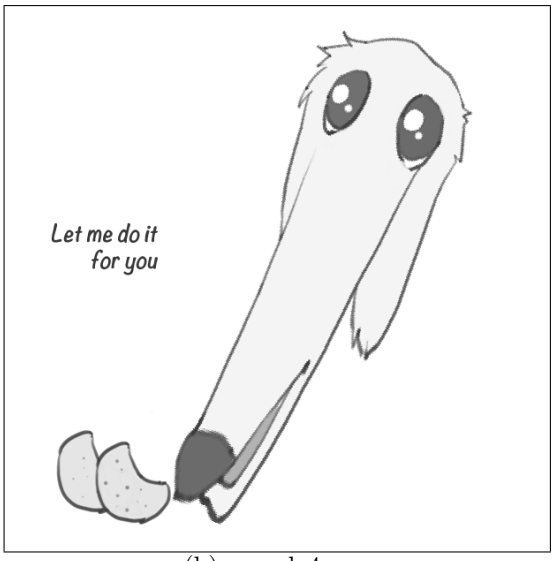
Please design several geometrical modification algorithms to meet the following requirements. **Your results may not be exactly the same as the sample images. Just try to create the effects as closely as possible.**

(a) (`25 pt`) The Borzoi wants to help you to get the potato chips. Please design an algorithm to make **sample3.png** become **sample4.png**. Output the result as **result8.png** with the same dimension as **sample3.png**. Please describe your method and implementation details clearly. (hint: you may perform rotation, scaling, translation, etc.)

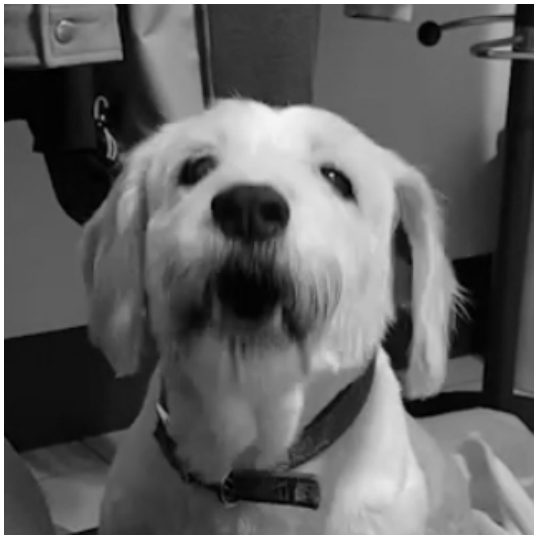
(b) (`25 pt`) I made my own Popcat picture, although there's no cat in it. By observing the effect shown in **sample6.png**, please design an algorithm to make **sample5.png** look like it as much as possible and save the output as **result9.png**. Please describe the details of your method and also provide some discussions on the designed method, the result, and the difference between **result9.png** and **sample6.png**, etc.



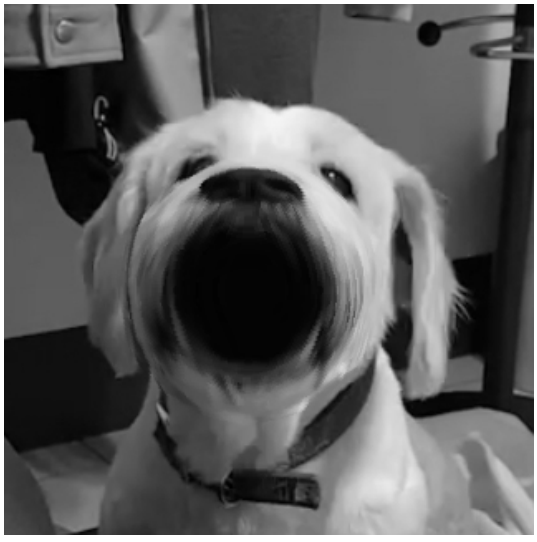
(a) sample3.png



(b) sample4.png



(c) sample5.png



(d) sample6.png

Figure 2: Images for geometrical modification.

Appendix

Problem 1: EDGE DETECTION

sample1.png:	512×512	gray-scale
sample2.png:	600×800	gray-sacle

Problem 2: GEOMETRICAL MODIFICATION

sample3.png:	600×600	gray-scale
sample4.png:	600×600	gray-scale
sample5.png:	320×320	gray-scale
sample6.png:	320×320	gray-scale