COGS 260: Assignment 1

Instructions

1. You may use any tool: Python, Matlab or OpenCV, to complete this assignment.
2. Download the resources Project1.zip. It contains the data and a python code which will be required to complete this assignment. The data is a subset of BSD300 dataset [1].
3. Reference materials and some useful codes can be found at the end of the document.
4. You are supposed to write a report describing about the experiments you run and the corresponding results. You are encouraged to follow a standard rule of paper writing, e.g. CVPR, format which includes abstract, introduction, description of the methods, experimental results, and conclusions. Grading of your report will be based on standard metrics: (1) the quality of the writing, (2) your unique insights and ideas, (3) thoroughness of the experiments, (4) conclusive results, (5) references, and (6) how professional the writing is.

1 Basic Image Operations

1.(a) Image Read/Write

Read any image from the dataset in the resource folder (data/img) and write it in RGB and Grayscale.

1.(b) Image Smoothing

Take any 3 images from the dataset in the resource folder (data/img) and perform Average smoothing and Gaussian smoothing. Try with atleast 3 different filter sizes. Report the results. What do you observe?

1.(c) Denoising

For this question use the images present in (data/snp) folder. The images in this dataset contains salt and pepper noise which can effectively be removed using **Median Filtering**. Denoise all the images in the dataset and report your results. Also report the filter size that you have used.

2 Image Enhancement

2.(a) Histogram

Take any 3 images from the dataset in the resource folder (data/img) and show their histogram for R, G and B color intensity values. For each image, histograms for R, G and B has to be in the same plot. What can you say about the spread of the color intensities for these images?

2.(b) Global Histogram Equalization

Perform Global Histogram Equalization on the images used in the previous part. Report the original and enhanced images and their corresponding histogram.

2.(c) Adaptive Histogram Equalization (CLAHE)

Again take the images used in the previous part. This time perform Contrast Limited Adaptive Histogram Equalization with Contrast Limiting. Report the results similar to the previous part. Also report the hyperparameters used. Did you find any difference between the two techniques?

3 Edge Detection

You will choose any three edge detectors, Sobel Operator, Canny, gPb, BEL, Sketch Token, or Structured Forests (Reading materials/codes can be found under references) and test them on all the images present in the resource folder (data/img). For the evaluation, use the python script present in the resource (Instructions to run the code are present in the readme.txt file present inside the Code folder). Report the accuracy obtained (using the python script) for all the edge detectors.

References

[1] The Berkeley Segmentation Dataset and Benchmark, `https://www.eecs.berkeley.edu/Research/Projects/CS/vision/bsds/`.

[2] Canny: J. Canny. "A computational approach to edge detection". PAMI, 8(6):679698, November 1986.

[3] BEL: P. Dollr, Z. Tu, and S. Belongie. "Supervised learning of edges and object boundaries". In CVPR, 2006. Download Program.

[4] gPb: P. Arbelaez, M. Maire, C. Fowlkes, and J. Malik. "Contour detection and hierarchical image segmentation". PAMI, 33, 2011. `http://www.eecs.berkeley.edu/Research/Projects/CS/vision/grouping/resources.html` with Precompiled Matlab code.

[5] Sketch Token: J. Lim, C. Zitnick and P. Dollr, "Sketch Tokens: A Learned Mid-level Representation for Contour and Object Detection". CVPR 2013. Matlab code.

[6] Structured Forests: P. Dollr and C. Zitnick. "Structured Forests for Fast Edge Detection". ICCV 2013. Structured Edge Detection Toolbox.