COGS 260, Spring 2018: Assignment 1

April 6, 2018

Due: April 15, 2018 11:59 PM PDT
Late policy: Every 10% of the total received points will be deducted for every extra day past due.

Instructions

1. You will use Python and OpenCV to complete this assignment.
2. Download the resources Assignment1.zip. It contains the data and the python code which will be required to complete this assignment. The data is 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 fill all 3 ipython reports describing about the experiments you run and the corresponding results. 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 if any.

1 Basic Image Operations [15]

1.1 Image Read/Write [4]

Read any image from the dataset in the resource folder (data/img) in color, display it in RGB using pyplot and write it in the correct color and Grayscale.

1.2 Image Smoothing [6]

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

1.3 Denoising [5]

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 [25]

2.1 Histogram [5]

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?

2.2 Global Histogram Equalization [10]

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

2.3 Adaptive Histogram Equalization (CLAHE) [10]

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 [60]

You will choose any three edge detectors, Sobel Operator, Canny [2], gPb [3], BEL [4], Sketch Token [5], or Structured Forests [6] (Reading materials/codes can be found under references) and test them on at least 4 of the images present in the resource folder (data/img). For the evaluation, use the python script provided (Instructions to run the code are present in the third ipython file). Report the accuracy obtained (using the evaluate method) for all the edge detectors.

Were you able to improve on the results based on what you have learned in class? Please report the implementations and the results of any improvements you have tried on all 3 of the selected method.

References

[1] P. Arbelaez, C. Fowlkes, and D. Martin, "The berkeley segmentation dataset and benchmark," 2007. [Online]. Available: http://www.eecs.berkeley.edu/Research/Projects/CS/vision/bsds

[2] J. Canny, "A computational approach to edge detection," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. PAMI-8, no. 6, pp. 679–698, Nov. 1986.

[3] P. Arbeláez, M. Maire, C. Fowlkes, and J. Malik, "Contour detection and hierarchical image segmentation," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 33, no. 5, pp. 898–916, May 2011. [Online]. Available: (MATLAB) https://www2.eecs.berkeley.edu/Research/Projects/CS/vision/grouping /resources.html

[4] P. Dollar, Z. Tu, and S. Belongie, "Supervised learning of edges and object boundaries," vol. 2, pp. 1964–1971, 2006. [Online]. Available: (MATLAB) http://pages.ucsd.edu/ ztu/Download.htm

[5] J. J. Lim, C. L. Zitnick, and P. Dollár, "Sketch tokens: A learned mid-level representation for contour and object detection," *Computer Vision and Pattern Recognition*, pp. 3158–3165, 2013. [Online]. Available: (MATLAB) https://github.com/gitlim/SketchTokens

[6] P. Dollár and C. L. Zitnick, "Structured forests for fast edge detection," *International Conference on Computer Vision*, pp. 1841–1848, Dec. 2013. [Online]. Available: https://github.com/ArtanisCV/StructuredForests