# CV Assignment 2: Image Enhancement and Image Restoration

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## 1 Introduction

In this assignment, you need to generate a dataset and use at least five methods to achieve image enhancement and two methods to achieve image restoration. Then, you need to use one evaluation measure to compare the average performances of different image enhancement methods and image restoration methods. The whole framework of the implementation for this assignment is shown in Figure 1. It may serve as a reference for your assignment.

The details of this assignment are given in the following sections.

## 2 Image Dataset

To get started with the assignment, you need to download the dataset from the attachment. This dataset contains 15 clear images and 8 blurred kernel images. You need to convolute the 15 clear images with 8 blurred kernel images to get 120 blurred images (If you convolute one clear image with one blurred kernel image, you will get one blurred image). The generated 120 blurred images and 15 clear images compose our dataset. This

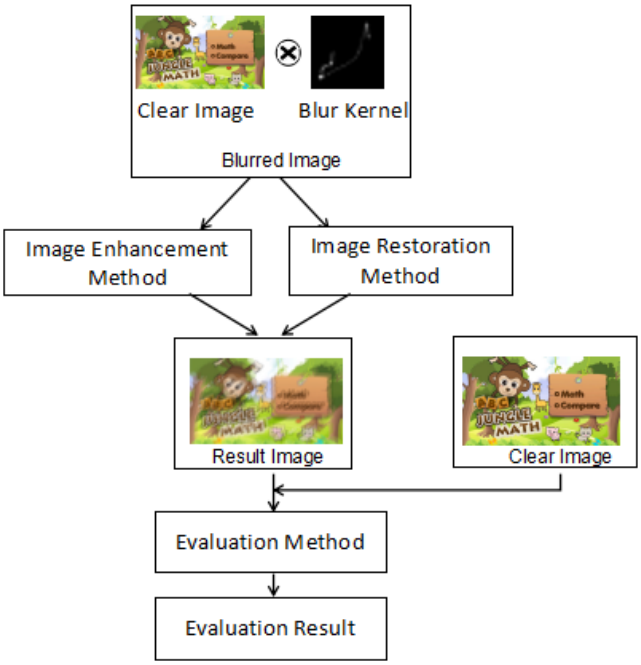


Figure 1: The framework of this assignment

dataset should be used for all of the following methods. You need to use **all these 135 images** in your adopted methods.

# 3 Image Enhancement Methods

This section includes two subsections. In the first subsection, three methods are provided to improve image contrast. All these three methods must be adopted in your experiments. In the second subsection, we provide four methods to do image smoothing filtering. You need to choose at least two methods to achieve image smoothing filtering.

## 3.1 Image Contrast Improving

Use all of the following three histogram equalization methods and draw histograms of all origin images and processed images respectively:

- Histogram Equalization (HE)
- Adaptive Histogram Equalization (AHE)
- Contrast Limited Adaptive Histgram Equalization (CLAHE)

### 3.2 Image Smoothing Filtering

Before using the following methods, you need to add Gaussian noise and Salt & Pepper noise to each image respectively. The $\sigma^2$ value of Gaussian noise is 0.1 and 0.2. And the noise density of Salt & Pepper noise is 10% and 20%. Compare each method's smoothing filtering effects with different noises and different noise levels. Then choose at least two methods from following four methods to do image filtering on these images which have been added noises:

- Mean Filtering
- Median Filtering
- Bilateral Filtering
- Wavelet Transform

## 4 Image Restoration Methods

In this section, you need to adopt the following two methods to do image restoration.

- $L_0$ Sparse Representation [1]
- $L_0$-Regularized [2]

[1] L.Xu and J.Jia. Unnatural $L_0$ Sparse Representation for Natural Image Deblurring. In CVPR, pages 1107-1114, 2013.

[2] J. Pan and Z.Hu. Deblurring Text Images via $L_0$-Regularized Intensity and Gradient Prior. In CVPR, pages 2901-2908, 2014

## 5 Evaluation

In this section, you need to evalutate your methods by using the following evaluation index.

- Peak Signal to Noise Ratio (PSNR)

In short, with this evaluation index, you can compare the effectiveness of each image enhancement method or image restoration method.

## 6 Submission

Finally, you need to submit following work:

1. Your code.
2. A report with your results and simple explanation.

Zip all your files and submit your assignment to ouceecv@163.com with the subject: YourName_Assignment2.zip. The name of your zip file should be the same as the email subject.