Machine Learning for Image Processing

Programming Assignment-1

Objective: The objective of this programming assignment is to provide hands-on practice to students on contrast stretching, histogram equalization, Adaptive Histogram Equalization (AHE), and Clipped AHE for image enhancement.

Note: Report results on all the given images for each problem. Write your own Python function for computing the histogram of a given input image and use it in the following problems instead of the built-in histogram function. Submit a report of the results along with your code.

1. **Contrast Stretching:** Write your own Python function to perform contrast stretching of an image. Apply it on all four images. Clearly specify your inferences from these results.

2. **Histogram Equalization (HE):** Write your own Python function to perform global histogram equalization of an image. Apply it on all four images. Clearly specify your inferences from these results.

3. **Adaptive Histogram Equalization (AHE):** Write your own Python function to perform sliding window adaptive (local) histogram equalization. For each of the four images, play with varying window sizes, and only present results for that window size that looks visually better. Also, make sure to mention the respective window sizes. Clearly specify your inferences from these results.

   Procedure for sliding window AHE algorithm:

   a) Define a square window of appropriate size whose centre moves from pixel to pixel.
   b) Compute local histogram for each window, and apply histogram equalization for the central pixel.
   c) The pixels at the borders can remain the same and thus no image padding is required.

4. **Clipped AHE:** Use Python built-in functions to perform clipped AHE for all four images. Experiment with all parameters of the function, and present the visually best results for each image along with the details of the respective parameters. Clearly specify your inferences from these results.