DMET 1002 – Advanced Media Lab

Lab 1 Preparation

Image Pre-processing Review

1. Objective

This experiment aims at reviewing simple image pre-processing steps previously taught in the Computer Vision class that are needed to extract an object from an image.

2. Pre-requisites

- Basics of Geometric Transformation and Median Filtering.

- MATLAB programming knowledge.

3. References

- Computer Vision lectures of Winter 2018.

4. Theoretical Background

In this experiment, you will be implementing some of the simple algorithms that were given in the Computer Vision class last semester using MATLAB. The following pre-processing steps will be applied to the given image:

1 – Geometric Transformation

2 – Median Filtering

3 – Converting Colored Image to Gray-scale

We review in the following sections each of these algorithms.

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4.1 Geometric Transformation

- Changes in scale, shifts and rotations of images are done by geometric transformation which consists of two stages:
    - Pixel Coordinate Transformation
    - Brightness Interpolation
- Pixel coordinate transformation takes the form

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = T \times \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} a_0 \\ b_0 \end{bmatrix}$$

where (x, y) is the original position before transformation while (x', y') is the position after transformation, T is the transformation matrix while (a_0, b_0) represents translation.

- One example of a transformation that you will apply in this experiment is flipping to convert, for example, the left image given below to the right image.

Original Image

Flipped Image

- The following transformation can flip an image both horizontally and vertically:

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \times \begin{bmatrix} x \\ y \end{bmatrix}$$

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4.2 Median Filtering

- In a set of ordered values, the median is the central value
- When applied to a noisy image, the color of the central pixel of a square neighborhood is replaced with the median color of the neighborhood
- It works very well with salt and pepper noise as shown below

Noisy Image

Filtered Image

4.3 Converting Colored Image to Gray-scale Image

- To convert an RGB image to a gray-scale image, the following transformation could be used

$$I_{gray}(p) = 0.3I_R(p) + 0.59I_G(p) + 0.11I_B(p)$$

where I_R, I_G and I_B are the red, green and blue components of pixel p, respectively.

Colored Image

Gray-scale Image