Image Augmentation Using Morphological Operators: A Review

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***Abstract*- The aim of image Augmentation is to improve the interpretability or perception of information in images for human viewers, or to provide `better' input for other automated image processing techniques. The aim is to improve the visual appearance of an image, or to provide a "better transform representation for future automated image processing". This paper is about a review of histogram techniques for image contrast enhancement. Many images like text images and even real life photographs suffer from poor contrast and noise.**

***Keywords*- grayscale Image augmentation, Image enhancement, Frequency based enhancement.**

I. INTRODUCTION

The image acquired from natural environment with high active ranges includes both dark and bright regions. Due to exceed in dynamic range of human eyes sensing, those image are difficult to recognize by human eyes. Image Augmentation is a common approach to improve the quality of those images in terms of human visual discernment. Enhancement techniques can be divided into two categories namely:

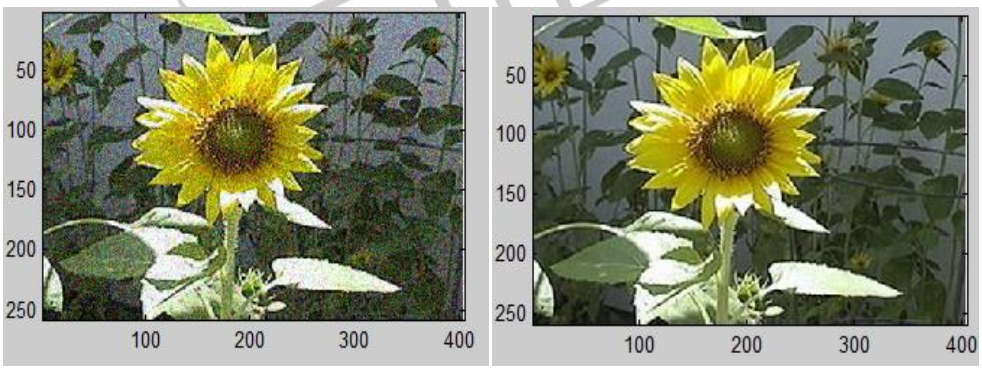
- Spatial domain methods
- Transform domain methods

Spatial domain technique enhances an image by directly dealing with the intensity value in an image. These methods include histogram equalization. These methods have been also applied to color image enhancement in the R-G-B space.
Transform Enhancement techniques such as Gaussian filtering which applies operation on the intensity of the image, and therefore high intensity content such as edges and other subtle information can easily be enhanced.Image augmentation simply

means, transforming an image *f* into image *g* using *T*. (Where T is the transformation. The values of pixels in images f and g are denoted by r and s, respectively. As said, the pixel values r and s are related by the expression

$$s = T(r)$$

Where T is a transformation that maps a pixel value r into a pixel value s.



Input Image **Output image**

Fig.1: Showing the effect of Image Enhancement

II. MORPHOLOGY

The field of mathematical morphology contributes a wide range of operators to image processing, all based around a few simple mathematical ideas from set theory. The operators are particularly useful for the examination of binary images and common usages include edge detection, noise removal, image augmentation and image segmentation.

The two most basic operations in mathematical morphology are erosion and dilation. Both of these operators take two pieces of data as input: an image to be eroded or dilated, and a structuring element (also known as a kernel). The two pieces of input data are each treated as representing sets of coordinates in a way that is slightly different for binary and grayscale images.

For a binary image, white pixels are normally considered to represent foreground regions, while black pixels denote background. (Note that in some implementations this principle is reversed, and so it is very important to set up input images with the correct polarity for the realization being used).
For a grayscale image, the intensity value is taken to represent height above a base plane, so that the grayscale image represents a surface in three-dimensional Euclidean space. Figure.2 shows such a surface.

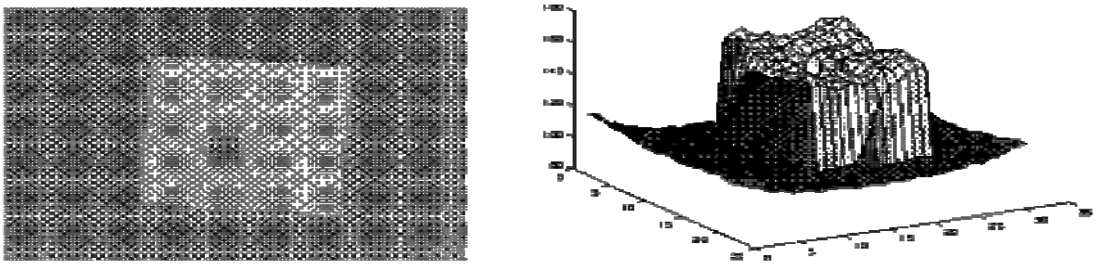


Fig.2: Showing Gray scale intensity Graph

III. HISTOGRAMS

- A graphical representation is similar to a bar chart, that organizes a group of data points into user-specified ranges. The histogram condenses a data series into an easily interpreted visual by taking many data points and grouping them into logical ranges or bins.
- A Histogram is a graphical display of data using bars of different heights.
- The horizontal axis of the graph represents the color variations, while the vertical axis represents the number of pixels in that particular color.

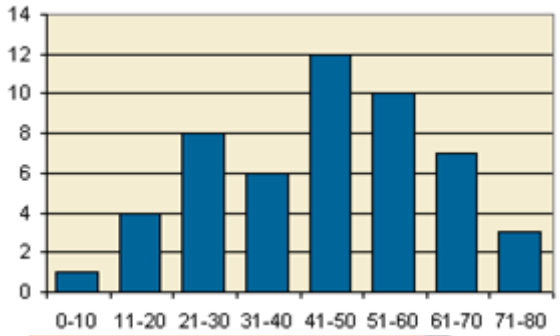


Fig.3: Showing Basic Representation of a histogram

- The histogram compresses a data series into an easily interpreted visual by taking many data points and grouping them into logical ranges.
- It plots the number of pixels for each tonal value.

IV. GAUSSIAN FILTERING

It is a widely used effect in graphics software, typically to reduce image noise and reduce detail. The Gaussian Smoothing Operator performs a weighted average of surrounding pixels based on the Gaussian distribution. It is used to remove Gaussian noise. The operator generates a template of values that are then applied to groups of pixels in the image. These values are defined by 2D Gaussian Equation:

Sigma defines the amount of blurring or Noise:

$$\frac{1}{2\pi\sigma^2}\exp\{-\frac{x^2+y^2}{2\sigma^2}\}$$

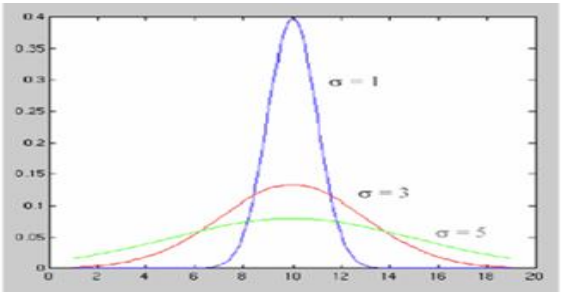


Fig.4: Showing Variation in noise with respect to value of sigma.

How Gaussian Noise Affects any Capture Image

Real world signals usually contain deviations from the ideal signal that would be produced by our model of the signal production process. Such deviations are referred to as *noise*. It is not part of the ideal signal and may be caused by a wide range of sources, *e.g.* variations in the detector sensitivity, environmental variations, the isolated nature of radiation, transmission or quantization errors, *etc.* The characteristics of noise depend on its source, as does the operator which best reduces its effects. Many image processing packages contain operators to synthetically add noise to an image. Intentionally corrupting an image with noise allows us to test the resistance of an image processing operator to noise and assess the performance of various noise filters.

Fig.5: Showing Comparison Between two Images before and after analyzing Gaussian noise.

V. CONCLUSION AND FUTURE SCOPE

Most of the techniques are useful for altering the gray level values of individual pixels and hence the overall contrast of the entire image. But they usually enhance the whole image in a uniform manner which in most of the cases produces undesirable results. There are various techniques available which produce highly evenhanded and visually pleasing results for a diversity of images with different qualities of contrast and edge information and it will produce adequate results.

The future scope will be the development of Morphological Field for effective image augmentation using Bilateral Operators and Gaussian Filtering with the help of Histograms. Under the guidance of same Operators the blurring of text will also be removed. Use of Morphological operators is one of the Efficient Techniques used to enhance Colored as well as grey Images.

VI. REFERENCES

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