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An Enhanced Approach to improve the contrast of Images having bad light by Detecting and Extracting their Background

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ABSTRACT

The application of mathematical morphology to image processing and analysis has initiated a new approach for solving a number of problems in the image enhancement field. So, we have used morphological operators to detect and extract the background of images. Various operators used are erosion, dilation, opening and closing. After the background is extracted, contrast of bad lightning image is improved by the application of operators based on Weber's law notion. The operators used are block analysis and opening by reconstruction. In this paper, we will present the result of images on applying these operators.

Keywords: *Morphological operators, block analysis, opening by reconstruction, contrast.*

I. INTRODUCTION

In this paper, firstly we give introduction about various morphological operators and then we apply them on a bad light image and extract the background of that image and then improve contrast of that image. Image enhancement is a useful technique in image processing that permits the improvement of the visual appearance of the image or provides a transformed image that enables other image processing tasks (image segmentation, for example).Methods in image enhancement are generally classified into spatial methods and frequency domain ones. The present work is focused on the spatial methods, and in particular, to the use of morphological image transformations. Mathematical morphology approach is based on set theoretic concepts of shape. In morphology objects present in an image are treated as sets. Quite often a recorded image suffers from a common degradation like poor contrast. The range of intensity i.e. the difference between the highest and lowest intensity values in an image gives a measure of its contrast. The first work dealing with contrast theory was carried out by Meyer and Serra.

II. BASIC CONCEPTS

Morphological operators

The identification of objects within an image can be a very difficult task. One way to simplify the problem is to change the grayscale image into a binary image, in which each pixel is restricted to a value of either 0 or 1. The techniques used on these binary images go by such names as: blob analysis, connectivity analysis, and morphological image processing (from the Greek word *morph*, meaning shape or form). The foundation of morphological processing is in the mathematically rigorous field of set theory; however, this level of sophistication is seldom needed. Morphological operators often take a binary image and a structuring element as input and combine them using a set operator (intersection, union, inclusion, complement). They process objects in the input image based on characteristics of its shape, which are encoded in the structuring element. Usually, the structuring element is sized 3×3 and has its origin at the center pixel. It is shifted over the image and at each pixel of the image its elements are compared with the set of the underlying pixels. If the two sets of elements match the condition

defined by the set operator (*e.g.* if the set of pixels in the structuring element is a subset of the underlying image pixels), the pixel underneath the origin of the structuring element is set to a pre-defined value (0 or 1 for binary images).

A morphological operator is therefore defined by its structuring element and the applied set operator. For the basic morphological operators the structuring element contains only foreground pixels (*i.e.* ones) and `don't care's'. These operators, which are all a combination of erosion and dilation, are often used to select or suppress features of a certain shape, *e.g.* removing noise from images or selecting objects with a particular direction.

In erosion, every object pixel that is touching a background pixel is changed into a background pixel. In dilation, every background pixel that is touching an object pixel is changed into an object pixel. Erosion makes the objects smaller, and can break a single object into multiple objects.

Dilation makes the objects larger, and can merge multiple objects into one. As shown in (d), opening is defined as an erosion followed by a dilation. Figure (e) shows the opposite operation of closing, defined as a dilation followed by an erosion.

As illustrated by these examples, opening removes small islands and thin filaments of object pixels. Likewise, closing removes islands and thin filaments of background pixels.

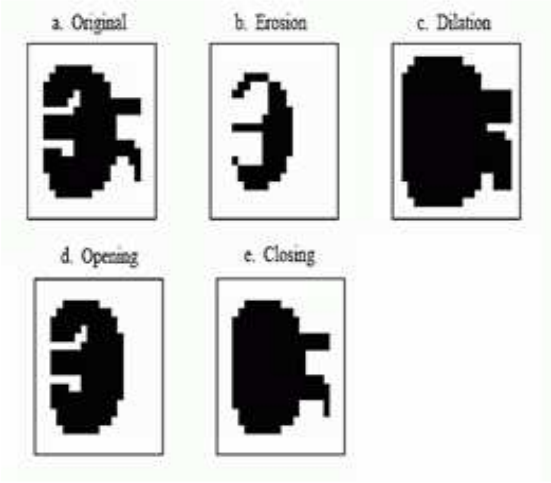


Fig 1 Morphological operations four basic morphological operations are used in the processing of binary image: erosion, dilation, opening and closing.Fig (a) shows an example binary image. Fig (b) to (e) shows the result of applying these operations to the image in (a).

Contrast enhancement operators

The two methodologies we used to enhance the contrast of images is based on Weber's law notion and are:- Block analysis method and opening by reconstruction method.

In block analysis method, each block is the sub image of the original image. The maximum and minimum intensity values are denoted as Mi and mi. For each analyzed block, maximum (Mi) and minimum (mi) values are used to determine the background measures. Ti is used to select the background parameters. Background parameters line between clear (f >Ti) and dark (f <=Ti) intensity levels. and dark intensity levels. Once Ti is calculated, this value is used to select the background parameter associated with the analyzed block.

In MM, there is other class of transformations that allows the filtering of the image without generating new components; these transformations are called transformations by reconstruction. The normal morphological opening is an erosion followed by a dilation. The erosion "shrinks" an image according to the shape of the structuring element, removing objects that are smaller than the shape. Then the dilation step "regrows" the remaining objects by the same shape. The dilation step in the opening operation restored the vertical strokes, but the other strokes of the characters are missing. How can we get the entire characters containing vertical strokes. The answer is to use morphological reconstruction. For binary images, reconstruction starts from a set of starting pixels (or "seed" pixels) and then grows in flood-fill fashion to include complete connected components. To get ready to use reconstruction, first define a "marker" image. This is the image containing the starting or seed locations.

III. CONTRAST ENHANCEMENT PROCESS

The contrast enhancement process consists of different steps:-

- Image Acquisition
- Applying Morphological operators
- Detecting and extracting the background

- Applying contrast enhancement operators:- block analysis and opening by reconstruction
- Applying image enhancement techniques like image sharpening etc.
- Final image

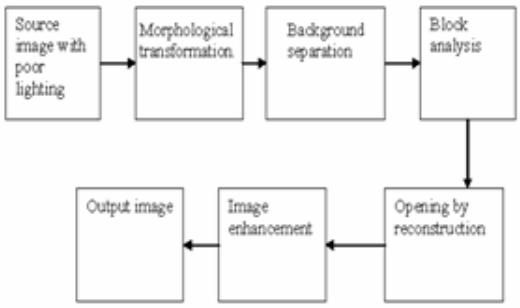


Fig 2 Proposed methodology to compute the problem

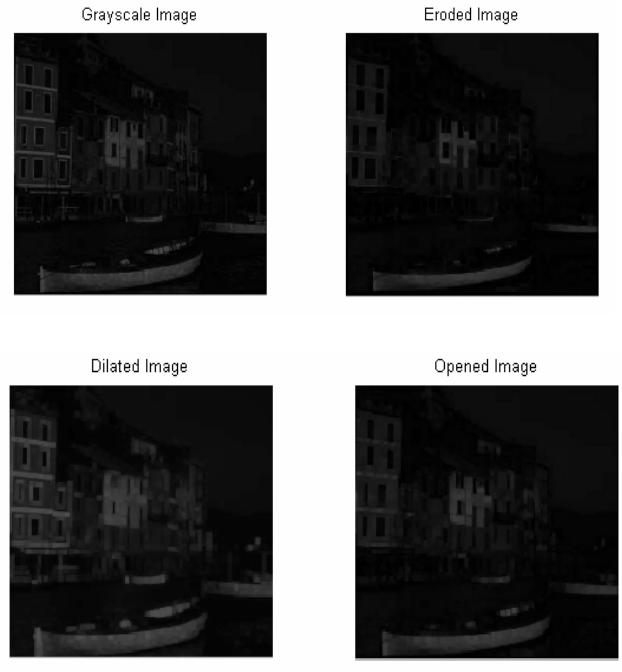
IV. IMPLEMENTATION RESULTS OF VARIOUS STEPS

Result of Step1

In this step, we acquire image which has poor lightning or dull, from a specified place.

Result of Step 2

In this step, firstly we convert image into grayscale image and then apply various morphological operations on the image such as erosion, dilation, opening and closing to see the exact location of foreground image.



Result of Step 3

Then in this step we separate the background from the image.

Result of Step 4

Then in the next step, we segment the image into sub-images. As the source image is difficult to deal with in a general view. Thus we decompose it into simpler ways in this processing stage. The decomposed sub-images are processed by a morphological filter to emphasize the character region and suppress the small islands of noises.

Result of Step 5

Finally the sub-images are united to obtain the resulting image. Then, we enhance the image by various functions like image sharpening etc. By doing this, finally our image will be of good contrast and free from bad lightning.

V. COMPARISON OF IMAGES

Then, we will compare the contrast of both images by Histogram Equalization process. During the histogram equalization process, grey level intensities are reordered within the image to obtain an uniform distributed histogram.

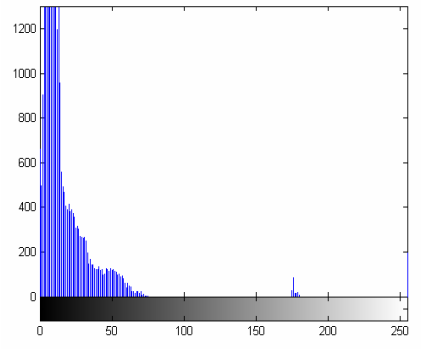


Fig 3 : Histogram of original image

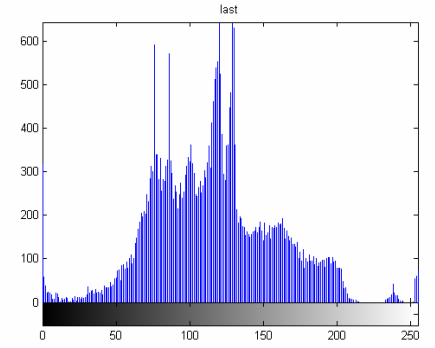


Fig 4: Histogram of improved image

VI. CONCLUSION

The proposed methodology in this paper is used to detect the image background and to enhance the contrast in grey level images with bad lighting. In this paper, firstly we give introduction about basic concepts used in this methodology like Morphological operators, contrast enhancement operators. Then we provide various steps to perform the methodology. Then, we provide implementation results of steps involved in proposed methodology. And finally, we provide the comparison between two images i.e. original image and contrast improved image by the help of Histogram equalization process.

There is a disadvantage of contrast enhancement transformations i.e. they can only be used satisfactorily in images with poor lighting; in a future work this problem will be considered.

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